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INTERRAD

International Association of Radiolarian Paleontologists

A Research Group of the International Paleontological Association

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INTERRAD is an international non-profit organization for researchers interested in all aspects of radiolarian taxonomy, palaeobiology, morphology, biostratigraphy, biology, ecology and paleoecology. INTERRAD is a Research Group of the International Paleontological Association (IPA). Since 1978 members of INTERRAD meet every three years to present papers and exchange ideas and materials.

INTERRAD MEMBERSHIP: The international Association of Radiolarian Paleontologists is open to any one interested on receipt of subscription. The actual fee is US $ 15 per year. Membership queries and subscription are sent to the Treasurer. Changes of address can be sent to the Secretary.

BIBLIOGRAPHIES: The bibliographies are produced by the Secretary. Any suggestion, reprints of articles and details of omission should be sent to him directly. Please send reprints of any radiolarian article to the Secretary this facilitate the edition of forthcoming bibliographies.

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Editor: *Giuseppe Cortese*

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EDITOR'S NOTE

Giuseppe Cortese

Welcome to a new issue of Radiolaria ! While it contains as much radiolarian information as you may wish, unfortunately infos from a couple working groups did not make it in print, mostly due to both the intervening holiday season and/or travelling chairmen. I wanted however to get the newsletter out, in order to provide good enough coverage of the coming Interrad meeting... and before it is too late to submit abstracts and register for it. Warm thanks to all those who provided material, information and references for this issue.

PRESIDENT'S LETTER

Chris Hollis

Tena koutou katoa (Greetings to you all),

You have barely two months to submit your abstract and register for InterRad 11, the first international radiolarian conference ever to be held in the Southern Hemisphere and hopefully the last international conference I'll endeavour to convene! I can now confirm what you may have heard from Peter, Paula and others – it's a big job.

But, rest assured of two things: (i) it's coming together and (ii) the NZ dollar is significantly lower than it was this time last year. If you're thinking of choosing a time when the exchange rate is favourable – now is good.

When you visit the web site you will note our sponsors' page is filling up nicely. It has been very heartening to receive generous support from my own institution, *Institute of Geological and Nuclear Sciences*, our venue hosts, *Te Papa Tongarewa*, the *Royal Society of New Zealand* and *Ministry of Research Science and Technology*, through the *International Conference Fund*, the *National Institute of Water and Atmospheric Research (NIWA)*, the *Wellington City Council*, *Webster Drilling and Exploration* and *Carl Zeiss Australasia*. We hope that some more sponsors will come on board shortly.

Really all we need now is YOU! Please register as soon as possible so we can confirm the symposia programmes and excursion details.

One further enticement for you, excursion-wise, is the addition of a significant new dimension to excursion 1A – the Auckland-Wellington tour via the Rotorua-Taupo geothermal area. Local experts will guide participants through the spectacular morphology changes that track biologically-mediated phase transitions within siliceous sinter deposits in the alkali-chloride and acid-sulphate thermal areas of Waiotapu and other sites in the Rotorua-Taupo area. For some details on current studies see:

Lynne, B.Y.; Campbell, K.A. 2004: Morphologic and mineralogic transitions from opal-A to opal-CT in low-temperature siliceous sinter diagenesis, Taupo Volcanic Zone, New Zealand. *Journal of sedimentary research 74(4)*: 561-579.

Rodgers, K.A.; Browne, P.R.L.; et al. 2004: Silica phases in sinters and residues from geothermal fields of New Zealand. *Earth-science reviews 66(1/2)*: 1-61.

Updated information on this and other excursions and other conference information is given on the website: **http://www.gns.cri.nz/interrad**

If you have trouble accessing this website or completing the online registration, I can email or post you the conference details and registration form.

Ka kite ana (see you soon),
Chris Hollis, convenor InterRad 11

RECENT AND CENOZOIC WORKING GROUP

Annika Sanfilippo

During the past year the Combined Late Cretaceous-early Paleogene, Cenozoic and Recent Working Group had no specific working group projects nor meetings to report on. References with abstracts to the published papers resulting from work by this energetic group are compiled in the general Bibliography section at the end of this newsletter.

Despite the Triassic flavour to next year's InterRad conference in New Zealand, the two non-Triassic symposia, the Nigrini Symposium and and the Biosilica Symposium, have a strong focus on themes relevant to Cenozoic workers: paleoclimate, paleoproductivity, paleoceanography, advances in biostratigraphy, radiolarian biology and evolution. Northland and Marlborough excursions provide an opportunity for Cenozoic workers to examine the only radiolarian-rich Cenozoic sedimentary sections known from the Southern Hemisphere: including Cretaceous-Tertiary, Paleocene-Eocene and Eocene-Oligocene boundary sequences.

News from Working Group Members and from other colleagues

Demetrio Boltovskoy keeps busy on a little project together with Stan Kling, Kozo Takahashi and Kjell Bjorklund, which involves compiling of all the distributional (species specific) Recent rad data, including sediment traps, sediments and plankton samples. The authors are about to finish the first phase of the project - the compilation itself, and will start "cleaning" the data shortly. Below a more detailed description of their effort....

WoRaDD (World Radiolarian Distributional Database)

PI's: Demetrio Boltovskoy, Kjell Bjorklund, Stanley Kling and Kozo Takahashi.

Despite the fact that the first radiolarian studies date as far back as the middle of the 19th century, so far there is not a single species for which the world wide distribution in the plankton has been mapped. This situation, common to many marine plankton groups, is chiefly due to the lack of interest in undertaking the complicated and time-consuming task of compiling the abundant distributional information that appeared over the years in individual publications. Absence of this larger, unifying picture not only retards advancement of the knowledge in the field of radiolarian biogeography s.s., but also hinders development of other areas, including assessment of mismatches in the plankton and the sediments, interpretation of sedimentation modes and rates, application of microfossil remains for paleoecologic purposes, etc.

This project will compile all the existing (published and unpublished) information on radiolarian (Polycystina) distribution from plankton and sediment trap samples, and from surface sediment materials. The compiled information will be critically "cleaned" and analyzed with the aid of objective numerical and GIS techniques in order to derive global distributional patterns of both species and cell numbers.

The project comprises the following phases:

Identification and location of the sources of information (publications, web-based databases, internal institutional reports, MSc and PhD theses, etc.). We expect to have identified and located over 95% of the useful data available. So far we have completed entry of the yields of 1118 plankton samples, 492 sediment trap samples, and 2240 surface sediment samples.

Data acquisition and entry. Some of the latest databases are available in electronic format, but most earlier information is available in hardcopy format only.

Critical evaluation of the data and "cleaning" of the database. This is a crucial aspect of the work, as taxonomic inconsistencies plague the radiolarian literature. We will assess synonyms and merge records accordingly.

Analysis of patterns, including production of maps and subsequent assessment of recurrent species groups indicative of discrete biogeographic regions. For water-column data we will consider depth, sampling gear and season as variables. Multivariate techniques (cluster and factor or principal component analysis) will be applied to delineate sample and spe- species groupings, followed by nodal

analyses in order to define underlying relationships.

We anticipate to tackle the following questions:

How many extant radiolarian species are there?

How well do radiolarian distribution patterns match water-mass patterns?

How do radiolarian patterns compare with those proposed for other shelled and non-shelled plankton? What do similarities and differences tell us?

How do radiolarian patterns compare with those derived from functional attributes of the ecosystems (such as mixed layer depth, insolation and photic depth, seasonality, etc.).

What are the species diversity vs. latitude relationships in radiolarian assemblages? Are these trends alike in plankton and sediments or are they different? Are there regional variations in pattern or trend?

How cosmopolitan are radiolarian species? How do these ranges compare with those of other protists and multicellular plankton? How do these comparisons stand in the light of recent claims that morphologically simpler organisms have wider distribution ranges?

Among the questions more specific to radiolarian biological, ecological and paleoecological studies we anticipate focusing on the following:

What is the imprint of chlorophyll fields on radiolarian distribution? Are there any firm relationships useful for paleoproductivity and paleoupwelling studies?

How congruent are distributional patterns in the plankton and in the sediments? Are there regional or latitudinal trends in the differences? What are the implications of these results for paleoecologic analyses based on the transfer-function technique?

Cold-water species are thought to preserve better in the sediments because their shells are more solution-resistant; do the patterns support this notion?

Biogenic opal seems to preserve better in the eupelagic province than in the hemipelagic one. Is this a result of surface production or a result of pore-water diagenesis resulting in selective species dissolution?

Vertical distribution patterns have often been associated with latitude, how widespread and robust are these relationships?

Ehrenberg Collection and Literature

People interested in using original descriptions of radiolarians by Ehrenberg now have some additional resources to make use of. In addition to the drawings and downloadable collection database announced previously (in the 2003 newsletter), the Berlin Museum's

ftp site (note new address: http://download.naturkundemuseum-berlin.de/Ehrenberg/) now has full scanned copies of both of Ehrenberg's major monographs - the Infusionsthierchen and the Mikrogeologie. For those who need to access Ehrenberg's individual publications, most are available at the German Academy of Sciences' website. The current URL (which seems to vary a bit in detail with time) is:
http://bibliothek.bbaw.de/bibliothek-digital/digitalequellen/schriften

Here you will find scanned copies of all papers published in the Monatsbericht and Abhandlung journals. Lastly, the Ehrenberg Collection Database, until now only available by download, should, by the time this newsletter appears, also be available in online form (see below) and include a visual browser for the drawings archive as well.

Go to the main Museum webpage and choose 'databases' in the Quick Index.

Ehrenberg collection database online

Now available at http://onlinedb.naturkundemuseum-berlin.de/v1/default.asp

With the help of Dirk Striebing of the IT department of the Berlin Museum of Natural History, the Ehrenberg Collection database, originally developed by Dave Lazarus and compiled by Anne Jobst, is now available online at a website. Here you can search for information on any word or words. The initial version of the database is restricted to information on the drawings in the collection, but will soon include information on the microscope preparations and samples as well. Drawings located can be downloaded directly from this site.

A complete relational version of the database (requires local installation on a computer) can be obtained on request from Dave Lazarus, the collection curator.

Note - the Ehrenberg collection is also of interest to taxonomists working on other micro-organism groups, so tell your non-radiolarian colleagues!

Databasing Radiolarian Occurrence Data

The Paleobiology Database (http://paleodb.org) has founded a new micropaleontology working group in February 2005. At the first meeting in Santa Barbara, chaired by David Lazarus, two research projects were launched, both involving diversity analyses of marine microplankton based on comprehensive databases.

1. Diversity history and relation to environment, general ecology and biologic characteristics for Neogene plankton groups (NeoDivO-Neogene Diversity of Organisms). The goals of this project are to document the diversity history of Neogene plankton groups and to examine possible factors - environmental and biologic - that may have influenced the diversities of the fossil groups studied.

2. Plankton **E**volution during the **J**urassic-**E**arly **C**retaceous **T**ransition (EJECT). The Callovian-Barremian time interval will be analysed for diversity trends in major plankton groups (radiolarians, calcareous nannoplankton, dinoflagellates). The project focuses on the magnitude and timing of evolutionary turnover in these groups. Plankton events will be compared for the respective groups and to diversity dynamics in the nekton (ammonoids) and benthos (level-bottom and reefs).

Both projects differ from similar previous enterprises in (1) that diversity patterns will be computed using actual occurrence data, rather than a monographic approach and (2)

that diversity trends are assessed by sophisticated subsampling techniques, which even out heterogeneities of the fossil record. The first project will mostly utilize DSDP/ODP data as already available at the Chronos website (Neptune Database, http://www.chronos.org). Project two focuses on onshore data, which are currently being entered into the Paleobiology Database. Do see what is already there, go to the public webpage, click fossil collection records and select "micropaleontology" from the pulldown under research group.

http://paleodb.org/cgi-bin/bridge.pl?user=Guest&action=displaySearchColls&type=view

As you can see when typing "Radiolaria" in the search form (taxon name), substantial data are already present for our beloved group of organisms (333 collections, more than 10,000 taxonomic occurrences). Participants in both projects are currently J. Alroy, P. Bown, T. Danelian, V. Davydov, P. Diver, Z. Finkel, W. Kiessling, D. Lazarus, J. Lees, W. Wise, and J. Young. The micropaleontology working group is open to new members. Details on how to join are available at:

http://paleodb.org/cgi-bin/bridge.pl?user=Guest&action=displayPage&page=join_us.

Micropaleontology Reference Centers (MRCs)

The status of the MRCs in IODP is still being negotiated. At the recent (July 2005) STP meeting a detailed written report on the MRCs past work and proposed future, presented by the new MRC lead curator - David Lazarus - was positively received. It is hoped that the upcoming October SPC meeting will formally approve the MRC concept in IODP. In the meantime, work continues on preparing radiolarian (and other) slides. There is now an updated MRC page at the Berlin Museum's website, and a downloadable list of all samples and slides in the MRC collections at:
http://download.naturkundemuseum-berlin.de/Ehrenberg/MRC%20db,%20lists/

Ages are given for (almost) all samples. The list is in tab-text format, so can be easily imported and searched in a spreadsheet program. Also at this ftp site is a set of maps showing the distribution of MRC radiolarian samples. There are currently ca. 5,000 rad slides in the MRC collections.

MRC rad slides can be loaned out for short intervals for research purposes to qualified investigators. Please contact the MRC nearest you for more info. The MRC home page is at: http://iodp.tamu.edu/curation/mrc.html.

Update Interrad X Special Volume (Eclogae Geologicae Helvetiae)

The intention of the editor, as well as the wish of the radiolarist community, is to have this volume published before the next Interrad meeting in March 2006. As of end September 2005, the following seven papers are with the Eclogae editor ready to print:

Wonganan & Caridroit - Middle to Late Permian radiolarian faunas from chert blocks in Pai are, northwestern Thailand.

Feng et al. - A new genus of Entactiniidae (Radiolaria) from the Late Permian of south China

Hollis - Radiolarian faunal turnover through the Paleocene-Eocene transition, Mead Stream, New Zealand

De Wever et al. - The plankton turnover at the Permo-Triassic boundary, emphasis on radiolarians

Marquez et al. - Upper Permian to Lower Jurassic radiolarian assemblages of Busuanga and surrounding islands , Palawan, Philippines

Bandini et al. - Upper Cretaceous radiolarians from Karnezeika

Wang & Luo - Influence of the F-F event for radiolarian fauna

Another four papers have been reviewed, but either they have not been sent to the authors for revision, or the authors did not send back the revised version.

Cretaceous-Tertiary transition and Southern Ocean Eocene

Dave Lazarus and Chris Hollis are slowly progressing on two projects: an analysis of radiolarian faunal turnover through the Cretaceous-Tertiary transition in order to understand the causes of the overall morphological differences between Cenozoic and Mesozoic radiolarians, and an analysis of the Eocene origins and expansion of the Antarctic radiolarian fauna as they relate to progressive cooling of the Southern Ocean (see Lazarus et al. 2004). The first of these projects will include a review of Helen Foreman's Cima Hill borehole material, which Chris is undertaking in collaboration with Annika Sanfilippo.

Indian Ocean rads under scrutiny

John Rogers (doing his Ph.D. under the supervision of Professor Patrick De Deckker of the Department of Earth and Marine Sciences at the Australian National University) is currently fine tuning his surface sediment database for the eastern Indian Ocean. The resulting dataset, comprising over one hundred surface sediment samples, will allow him to apply the observed good correlation to modern environmental parameters to the reconstruction of past climatic conditions.

Review paper available in PDF form

Those of you who did not get, but would still like a pdf copy of the recent short radiolarian research review paper by Lazarus can contact him directly for it (david.lazarus@rz.hu-berlin.de).

RadWorld progresses further

Jean Pierre Caulet continues to enter data to the RadWorld database. All of Haeckel 1887, Rüst 1885, 1892 and 1898, Parona, Pantanelli, Stöhr have been entered. Currently Popofsky, Bütschli, Vinassa, Lipman and some other authors are being entered.

RADIOLARIA.ORG UPDATE

Jane Dolven

To date Radiolaria.org contains information (pictures, descriptions, synonyms and references) of approx. 417 species within the periods of Holocene (Recent), Miocene and Paleocene, and more species are scheduled to be added in the near future. Richard Benson has done a tremendous job and finished adding all the species from his 1966-thesis on Recent radiolarians found in the Gulf of California. A revised taxonomy and several new photographs have been added in cooperation with Kjell Bjørklund. Data on radiolarians from the Sea of Japan and the Arctic Ocean is in the process of being submitted by Takuya Itaki and Kjell Bjørklund/Svetlana Kruglikova, respectively. The Nordic Seas radiolarian section (compiled by Jane Dolven) is almost completed, and data on Recent Southern Ocean radiolarians is up next. David Lazarus and his student helper Sara Correia-Carreira have during the last year made substantial contributions to the Miocene, with main focus on species from the Antarctic area.

In the Archive section three new plate-collections have been made available: 1) Afanasieva's (2000) atlas of Paleozoic Radiolarians (140 plates); 2) Takahashi's (1981/1991) images of Recent radiolarians from the Pacific and the Atlantic (63 plates); and 3) Petrushevskaya's (1971) drawings of Nassellarians (145 figures). Valuable help with the scanning of plates and the digitization of captions has been provided by Marina Afanasieva, Kozo Takahashi, Seiji Tanaka, Mona Holte, Gordon Damitz, Sara Correia-Carreira and Kristine Dolven.

The "InterRad" pages have recently been updated. These pages now provide information from Chris Hollis about the next international radiolarian conference (InterRad XI) that will be held in New Zealand (March 2006). The InterRad pages also give general info about the International Radiolarian Association, the Radfolks e-mail list and former radiolarian conferences.

The "radiolarian art"-pages now contain (in addition to pictures of Bjerke's radiolarian clay models and West's radiolarian quilt) images of three radiolarian models made in transparent plastics by the German artist Dagmar Borgwart.

Radiolaria.org welcomes you to add information to the database and a manual (in pdf) on "How to contribute species information to Radiolaria.org" has been added under "About Radiolaria.org". If you are searching for something within Radiolaria.org, we encourage you to use the search-engine (www.radiolaria.org/search.htm) where you can choose between searching for a species, synonym, reference, description or in the archive (containing plates).

We have updated and expanded the password protected "Radpeople" section on Radiolaria.org. These pages, aimed for radiolarists only, now include a list with the contact information of radiolarian researchers from all around the world. This list is maintained by Giuseppe Cortese, and any updates/changes can be sent to him directly at <gcortese@awi-bremerhaven.de>. In addition to the "Contact info" you will at "Radpeople" find a section called "Downloads" containing special publications that for different rea-

sons are not open to the public. We have also decided to move the Radiolaria Newsletters into "Radpeople" in order to prevent spam-bots from picking up e-mail addresses (and other contact info) from these pdf-files. As before, the "Radpeople" section can only be accessed after you have logged in with a password. The password is being distributed via the Radfolks e-mail list, or can be obtained by contacting Jane Dolven <jane@radiolaria.org>. Here you will also find a copy (in pdf's) of the English translation made by Roden and Riedel of Petrushevskaya's (1971) "Radiolarians of the World Ocean" which Annika Sanfilippo and Kathy Rutledge, Service Coordinator, UCSD SIO Library Interlibrary Loan & Document Delivery Service so kindly has made available.

If you like to add or update your contact information on "Radpeople", share a "Mystery Rad" or "News", or have any other contributions to or comments about Radiolaria.org, please use my e-mail address above. We are looking forward to hear from you!

ADDRESS CHANGES

Giuseppe Cortese

A comprehensive list of radiolarists' addresses and contact information was published in the previous issue (#22) of Radiolaria. You can find it on the www.radiolaria.org Website too, under the „Radpeople" section (password available either through „Radfolks", or by contacting Jane Dolven jane@radiolaria.org).

Several entries in the online list are probably not up to date, so please send a e-mail to Giuseppe Cortese (gcortese@awi-bremerhaven.de) for changes in your own data, or to correct the information regarding any colleagues. As is the case with issues related to our newsletter, the quality and usefulness of this list depends on your feedback... Only in this way can this list become complete, up to date, and useful to the whole of our community.

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RADIOLARIAN BIBLIOGRAPHY 2001-2005

Giuseppe Cortese

This list was supposed to include the update from the years 2004-2005. However, many other references from previous years came up to light and, as a matter of fact, the list now includes almost 300 references, mostly covering the 2001-2005 period. As usual, the featured papers had the word radiolarian either in the title, in the abstract, or in the keywords. Thanks to all of those who sent their references: it is mostly thanks to your effort that this list can be "half-complete", so keep on sending your references (and their abstract...) as you publish new papers.

AFANASIEVA, M. S., AMON, E. O., AGARKOV, Y. V. & BOLTOVSKOY, D. S. 2005. Radiolarians in the geological record. *Paleontological Journal* **39** (3, Suppl. S.), 135-392.

This study is dedicated to the comprehensive description of radiolarians, the discussion of their morphology, problems of classification, and their important role in the history of the Earth's biosphere. This study contributes to the solution of the fundamental problems of the evolutionary morphology of radiolarians related to the study of the morphogenesis of their skeletons at various structural levels through geological time, aiming at the creation of a morphological basis for the phylogeny and classification of the phylum Radiolaria. The book describes three stages of the history of 200-year old radiolariology. The biology and morphology of radiolarians are discussed. The study deals with the successive stages of the ontogeny of radiolarians and the main patterns of skeletal morphogenesis: appearance and growth of skeletal elements, biomineralization, and secondary transformation of skeletons. A new classification of the phylum Radiolaria, uniting two superclasses Phaeodaria and Polycystina is proposed. The superclass Polycystina is composed of six classes: Aculearia, Sphaerellaria, Spumellaria, Stauraxonaria, Nassellaria, and Collodaria. Patterns in the appearance/disappearance and distribution in time of higher taxa of Polycystina are discussed, and critical levels in the evolution of radiolarians at the major stages of the Phanerozoic are revealed. Four phases and nine stages in the evolution of radiolarians are recognized. The statistical analysis of the biodiversity of radiolarians in the Phanerozoic is conducted based on the informational system "RADBASE" containing the information on 1721 genera of radiolarians and their synonyms. Problems of the biology, ecology, and taphonomy of radiolarians are discussed. It is shown that the biomass of polycystine radiolarians is greatest at depths of 50--400 m. The conclusion is made that radiolarians cannot be regarded as indicators of exclusively oceanic deep-water conditions. In the geological past, the maximum density and diversity of the population of radiolarians was observed in the coastal regions or zones of aulacogenes and active tectonic faults. The study is expected to be of use to a broad range of readers in paleontology, biostratigraphy, paleoecology, and as a textbook for the university courses. It contains 67 figures, 11 tables, 33 plates, and an appendix. The list of references includes 464 names.

AFANASIEVA, M. S., AGARKOV, Y. V. & AMON, E. O. 2005a. Evolution stages of radiolarians (Polycystina) in Phanerozoic. *Paleontological Journal* **39** (6).

The general tendencies in evolutionary radiolarians (Polycystina) in Phanerozoic are considered. It is established four phases and nine stages of radiolarian development. There were significant changes of structure and number various taxa, and also change of leading groups at each stage of radiolarian evolution. It is established, that in Early Paleozoic (Cambrian-Silurian) has appeared 180 radiolarian species with average rate of speciation 1,1 species/million years, and in Late Paleozoic (Devonian-Permian) it is known 487 species appeared with average rate 2,9 species/million of years. Mesozoic is characterized by the highest number of radiolarian species (3328 species) and by the maximal average rate of species formation 18,8 species/million years. Cenozoic (without the data about recent radiolarians) differs sharp reduction of total of species number up to 922 species and reduction of average rate of speciation up to 12,8 species/million years. Transition from a cold Paleozoic climate to a warm Mesozoic one was marked by extraordinary extinction of 95,5 % of genera and 98,9 % of species of Paleozoic radiolarians. Transition from a warm Mesozoic climate to cold Cenozoic one was accompanied so significant extinction of 96,6% of genera and 99,4 % of species of Mesozoic radiolarians. Absence of explosion of a radiolarian biodiversity in Holocene is shown.

AFANASIEVA, M. S., AMON, E. O. & BOLTOVSKOY, D. 2005b. Radiolarian ecology and biogeography: New vision of the problem. Part 1. Ecology and Taphonomy. *Lithosphere* **3**.

Analysis of published data on the distribution of Recent radiolarians in various climatic and oceanographic zones indicates that their tapho- and orictocoenoses are chiefly originated by biocoenoses which inhabited the upper water layers (0-300 m). Several aspects of radiolarian biology, ecology and taphonomy are discussed and the conclusion is reached that members of this group cannot be regarded as inequivocal indicators of oceanic deep-water conditions.

AFANASIEVA, M. S., AMON, E. O. & CHUVASHOV, B. I. 2005c. Radiolarian ecology and biogeography: New vision of the problem. Part 2. Abiotic factors, radiolarian paleobiogeography, marine paleolandscape environments in geologic past. *Lithosphere* **5**.

The new data on distribution radiolarians of Late Devonian, Carboniferous, Early Permian, and Late Cretaceous ages in paleobasins of Ural and adjacent territories of Russian and Western-Siberian platforms are analyzed. It is established, that in the geological past paleobasins with the maximal density of populations and high taxonomic diversity of radiolarians were located near to a continental land, or in zones of aulacogen and active tectonic breaks. It is shown, that radiolarian bioefficiency is supervised by leading abiotic factors: currents, upwelling, the El Nino effects, hydrosulphuric pollution, rift zones and deep breaks, supply silica and other minerals in sea water.

AFANASIEVA, M. S., AMON, E. O. & VISHNEVSKAYA, V. S. 2004a. Main events in history of classification of Radiolarians. 1. Origin and development of radiolariology during 19th and the middle 20th centuries (1806-1979). *Bulletin MOIP, Series Geology* **79** (1), 48-64.

First stage in radiolarian researches (1806-1887) includes W. Tilesius von Tilenau's first mention of the recent living unicells with silicon skeleton. The first their classification was given by Ch. Ehrenberg and recent name for this group of Protista as "Radiolaria" was given by J. Müller. In the end of this stage the fundamental monograph of E. Haeckel was published. The evolution of radiolarian classification during middle of 20th century is linked with names of Russian (D. Chedia, A. Habakov, A. Strelkov, R. Lipman) and foreign scientists (G. Deflandre, A. Campbell, A. Hollande, M. Enjumet, W. Riedel).

AFANASIEVA, M. S., AMON, E. O. & VISHNEVSKAYA, V. S. 2004b. Main events in history of classification of Radiolarians. 2. Progress of radiolariology in the end of 20th and beginning of 21st centuries. *Bulletin MOIP, Series Geology* **79** (3), 26-52.

The general tendencies in development of radiolariology during the last quarter of 20th and beginning of 21st centuries (1980-2003) are described. Classifications of Radiolaria proposed by H. Kozur and H. Mostler; P. Dumitrica; M.G. Petrushevskaya; B.B. Nazarov; S.V. Tochilina; D. Boltovskoy; N.Yu. Bragin, V.S. Vishnevskaya, A.I. Zhamoida and L.I. Kazintsova; E.O. Amon and M.S. Afanasieva; P. De Wever, P. Dumitrica, J.P. Caulet, C. Nigrini and M. Caridroit are analyzed.

AITA, Y. & TAKETANI, Y. 2001. Report of age diagnostic microfossils from some Neogene marine sediments in Fukushima Prefecture. *Research Report of Fukushima Museum* **36**, 1-53.

AITCHISON, J. C., DAVIS, A. M., ABRAJEVITCH, A. V., ALI, J. R., BADENGZHU, L. J., LU O, H., MCDERMID, I. R. C. & ZIABREV, S. V. 2004. Stratigraphic and sedimentological constraints on the age and tectonic evolution of the Neotethyan ophiolites along the Yarlung Tsangpo suture zone, Tibet. *In:* (DILEK, Y. & ROBINSON, P. T. eds). *Ophiolites in Earth History* **218**. 147-163. The Geological Society of London Special Publication, London.

AMON, E. O., VASIL'EVA, O. N. & ZHELEZKO, V. I. 2003. Stratigraphy of the Talitsa Horizon (Paleocene) in the Central Trans-Urals. *Stratigraphy and geological Correlation* **11** (3), 278-292.

Data on a series of boreholes drilled in the central trans-Urals are used to characterize the Paleocene marine deposits of the Talitsa Horizon, which are widespread all over the trans-Urals and in West Siberia. Presented paleogeographic considerations are based on distribution patterns of various fossils (foraminifers, radiolarians, dinocysts, and Selachii teeth) and on lithologic characteristics of their host deposits. Presented in addition are brief descriptions of underlying Maastrichtian (Gan'kino Formation) and overlying Thanetian (Serov Formation) deposits. The character and position of the Cretaceous–Paleogene boundary that is placed at the Talitsa Horizon base are described. Regional zonation of foraminifers and dinocysts is substantiated, and problems of regional and interregional correlations are briefly discussed.

ANMA, R., KAWAKAMI, S. & YAMAMOTO, Y. 2002. Structural profile of the Nankai accretionary prism and *Calyptogena* colonies along the Shionomisaki submarine canyon: results of "SHINKAI" 6K#522 and #579 dives. *JAMSTEC Journal of Deep Sea Research* **20**, 59-75.

AVOUAC, J. P., DE WEVER, P. & TAPPONNIER, P. 2002. La mosaïque asiatique (introduction). *In:* (CNRS-MNHN eds). *Himalaya – Tibet. Le choc des continents*. 8-9.

BABAZADEH, S. A. & DE WEVER, P. 2004a. Early Cretaceous radiolarian assemblages from radiolarites in the Sistan Suture (eastern Iran). *Geodiversitas* **26** (2), 185-206.

A well preserved Cretaceous radiolarian fauna was recovered from the Sistan Suture zone (eastern Iran). This radiolarian fauna was obtained from the red argillaceous cherts and green-grey cherts that distributed in the ophiolite unit. It is regarded as representative of the Early Cretaceous assemblage in the oceanic basin created by the opening of the two blocks (Afghan and Lut) during the Cretaceous time. During the Early Cretaceous, an extensive sedimentation of radiolarian-rich facies occurred in this region. Two radiolarian assemblages are determined: Assemblage I (composed of about 15 species which represent the early Aptian), and Assemblage II (characterized by the occurrence of about 32 species). The cryptothoracic Nassellaria correspond to *Holocryptocanium barbui* Dumitrica, 1970, *Dorypyle communis* (Squinabol, 1903), etc. The cryptocephalic Nasselaria is only confined to *Diacanthocapsa* cf. *ovoidea* Dumitrica, 1970. The spumellarian genera are *Dactyliodiscus* cf. *lenticulatus* (Jud, 1994), *Pseudoaulophacus* sp., etc. The study of the radiolarites provides new data for dating the primary opening between two blocks. It is proposed that the oceanic opening of the two blocks occurred prior to the early Aptian.

BABAZADEH, S. A. & DE WEVER, P. 2004b. Radiolarian Cretaceous age of Soulabest radiolarites in ophiolite suite of eastern Iran. *Bulletin de la Société géologique de France, Série VIII* **175** (2), 121-129.

The ophiolite-flysch range (accretionary prism) of the Sistan suture zone from eastern Iran includes several intensely deformed tectonic units, some of which consist of volcaniclastic rocks, volcanic rocks, siliceous pelagic sediments (cherts and radiolarites) and calcareous rocks (deep marine, platform), whereas others are represented by terrigenous turbidites. The Soulabest radiolarites are located in the Ratuk complex of the Tirrul's subdivision [Tirrul et al., 1983], or in the ophiolite suite of the Gazik province. The local biostratigraphy of this region is based on two faunal assemblages. Faunal assemblage I is dated early Aptian, faunal assemblage II is attributed to middle-late Albian. The most abundant fauna is found in the middle-late Albian. The timing of the oceanic opening in eastern Iran remained questionable until now. The study of the radiolarites of the Soulabest area provides new data for dating the primary opening between two microcontinents: the Lut and Afghan blocks. It is proposed that the oceanic opening of the two blocks occurred prior to the early Aptian. In previous reports, the age of opening was attributed to Upper Cretaceous. All reported Radiolaria are found in red radiolarites and green-red argillaceous cherts. This formation is unconformably overlain by Maastrichtian conglomerates. It indicates that the closure of the basin occurred in Maastrichtian age.

BAIOUMY, H. M. & ABU EL-HASSAN, M. M. 2004. Formation of Upper Cretaceous bedded and nodular cherts in Egypt. *Neues Jahrbuch Fur Geologie Und Palaontologie-Abhandlungen* **233** (2), 233-253.

In addition to phosphorites, the Upper Cretaceous Duwi Formation contains abundant cherts that occur as lenses or beds. The cherts are dull, brittle, very dense rocks, black to dark brown in color, and massive to weakly laminated. They are composed of fine-grained, microcrystalline quartz with minor amounts of clays, organic matter and iron oxides. Neither radiolaria nor sponges spicules were observed in the studied cherts. Cherts are formed due to diagenesis of pre-existing biogenic silica. Silica was supplied along with phosphorus by upwelling currents prevailing during the Late Campanian in Egypt and the North African continental margin. Absence of biogenic relics can be attributed to the complete dissolution of these relics during diagenesis. Low MnO/TiO2 values, plot of Al2O3 against Fe2O3 normalized to SiO2, and plot of Al2O3/(Al2O3 + Fe2O3) against Fe2O3/TiO2 indicate the formation of the Duwi cherts in an oxic continental margin environment.

BAK, M. 2004. Radiolarian biostratigraphy of the Upper Cenomanian-Lower Turonian deposits in the Subsilesian Nappe (Outer Western Carpathians). *Geologica carpathica* **55** (3), 239-250.

The Upper Cenomanian-Lower Turonian flysch deposits of the Subsilesian Unit of the Outer Western Carpathians include a characteristic interval of green and black, siliceous shales with manganese concretions, benthonites and tuff, with abundant radiolarian fauna. Thirty two species of Radiolaria have been identified. Spherical cryptothoracic and cryptocephalic Nassellaria dominate in the assemblage. Two radiolarian species: *Alievium superbum* and *Crucella cachensis* have been proposed as biomarkers for setting the Cenomanian–Turonian boundary interval in the deposits of the Subsilesian series of the Polish Outer Carpathians.

BAK, K., BARSKI, M. & BAK, M. 2005a. High resolution microfossil, microfacies and palynofacies studies as the only method in recognition of the Jurassic and Cretaceous "black shales" in a strongly

tectonised section of the Czorsztyn Succession, Pieniny Klippen Belt, Poland. *Studia Geologica Polonica* **124**, 171-198.

Combined stratigraphic studies based on foraminifers, radiolarians and palynomorphs together with microfacies and palynofacies characteristics allowed us to separate the Lower Turonian sediments corresponding to the Cenomanian/Turonian boundary event from the Lower-Middle Jurassic black facies in a strongly tectonised section of the Czorsztyn Succession in the Pieniny Klippen Belt, Poland. The studied section, located at Trawne creek, includes tectonised incompetent series of black marly facies and pink, cherry-red marls and marly limestones. The Cenomanian/Turonian boundary event related deposits (ca. 0.5 m thick) belong to the upper part of the Altana Shale Bed of the Jaworki Formation with uncertain transition to the pelagic pink and cherry-red marly limestones and marls. Both facies represent the *Helvetoglobotruncana helvetica* planktoni foraminiferal Zone (Lower–Middle Turonian). The other black facies in the studied section include dark-grey marly shales with dark-grey calcareous mudstone (ca. 1.5 m of total thickness). Most likely they belong to the Skrzypny Shale Formation. This is documented by the filament-radiolarian microfacies, dinocyst and radiolarian stratigraphic data. The Early Bajocian age was determined only for one thin package of dark-grey shale. Other packages of black facies include long-ranging dinocyst taxa of Late Pliensbachian–Early Bathonian age. Following the earlier stratigraphic data for the Skrzypny Shale Formation (Middle Aalenian–Early Bajocian), based on ammonite fauna, it may be suggested that a part of these black facies might represent the underlying lithostratigraphic unit, the Krempachy Marl Formation, or its transition to the Skrzypny Shale Formation. Pelagic cherry-red marls and marly limestones which in most cases are in tectonic contact with the black facies are here also strongly tectonised. They represent different, non-continuous stratigraphic horizons of the Lower–Middle Turonian and the Lower Campanian.

BAK, M., BAK, K. & CIUREJ, A. 2005b. Mid-Cretaceous spicule-rich turbidites in the Silesian Nappe of the Polish Outer Carpathians: radiolarian and foraminiferal biostratigraphy. *Geological Quarterly* **49** (3), 275-290.

Spicule-rich turbidites are widespread in mid-Cretaceous deep-water flysch of the Subsilesian and Silesian units in the Polish Outer Carpathians. The spicule-rich material with admixture of numerous radiolarian and foraminiferal particles was supplied, together with siliciclastic material, from shallow environments, mostly from the northern margin of the Carpathian Basin. We present new data on the age of these deposits in the Silesian Nappe, where they are distinguished as the Mikuszowice Cherts. This unit is composed of medium- and thick-bedded siliciclastic to calcareous turbidites including bluish cherts in their middle and upper parts and of thin non-calcareous hemipelagic shales. Radiolaria and Foraminifera from hemipelagic sediments and spicule-rich turbidites were studied by the authors. Samples were collected from two continuous sections in the Barnasiówka Range (Beskid Wyspowy Mts) that included the Mikuszowice Cherts (31 m thick) and their transition to the surrounding units. The age of the Mikuszowice Cherts was determined taking into account the following radiolarian datum events: 1) the occurrence of *Praeconocaryomma lipmanae* in the whole unit, 2) the FO of *Hemicryptocapsa tuberosa* in the upper part of the unit, 3) the FO of *Amphipyndax stocki* close to the upper boundary of the unit, 4) the FO of *Hemicryptocapsa prepolyhedra* in the lowermost part of the overlying Barnasiówka Radiolarian Shale Formation. These datum events appear successively in the Western Tethys successions within the *Rotalipora cushmani* planktonic foraminiferal Zone, which corresponds to the Middle and Upper Cenomanian (without its uppermost part). The foraminiferal assemblages, in which such taxa as *Rotalipora* cf. *cushmani*, *R.* cf. *greenhornensis*, whiteinellids and *Uvigerinammina praejankoi* successively appear, confirm the Middle–Late Cenomanian age of the spicule-rich turbidites in the Silesian Nappe.

BAK, M. & BARWICZ-PISKORZ, W. 2005. Stratigraphical and ecological significance of Early Eocene radiolarians from the Subsilesian Series, Polish Flysch Carpathians. *Annales Societatis Geologorum Poloniae* **75**.

Variegated shales in the Early Eocene hemipelagic deposits of the Subsilesian series, Polish part of the Western Carpathians, have yielded rich siliceous microfossils comprising abundant radiolarians and rare diatoms. Forty-three radiolarian taxa have been recognised. One new radiolarian species, *Amphisphaera subsilesianensis* n. sp. was described. The assemblage represents the *Phormocyrtis striata striata* radiolarian Zone of the tropical oceans. The deposits investigated have also yielded abundant agglutinated foraminifera which correlate with the lower Eocene *Saccamminoides carpathicus* foraminiferal Zone. The radiolarian assemblage comprises a low content of taxa characterising cool, oligotrophic water masses which also occur in the upper Paleocene deposits of the Subsilesian series. Most part of the assemblage is represented by abundant radiolarian species characteristic of tropical domain, which may indicate the incursion of warm water masses into the Subsilesian Basin during the Early Eocene Climatic Optimum Period.

BARTOLINI, A. 2003. Cretaceous radiolarian biochronology and carbon isotope stratigraphy of ODP Site 1149 (Northwestern Pacific, Nadezhda Basin). *In:* (LUDDEN, J. N., PLANK, T. & ESCUTIA, C. eds). *Proceedings of the Ocean Drilling Program, Scientific Results* **185**. 1-17.

In the Nadezhda Basin (northwestern Pacific), the contact between oceanic crust basalt and its sedimentary cover was recovered at Site 1149 during Leg 185. The bottom sedimentary section (Unit IV) is characterized by interbedded radiolarian chert and radiolarian nannofossil chalk/marl. This peculiar lithology for the western Pacific has allowed an approach of integrated stratigraphy between radiolarians and carbon isotope data. The upper Valanginian $d^{13}C$ positive excursion, correlatable to magnetic Chron M11, was individuated. Biochemostratigraphy constrains the calibration of the positive magnetic lineation at Site 1149 as Chron M12r. Moreover, these data confirm the upper Valanginian $d^{13}C$ positive excursion as a global event, probably linked to high primary productivity.

BAZZUCCHI, P., BERTINELLI, A., CIARAPICA, G., MARCUCCI, M., PASSERI, L., RIGO, M. & ROGHI, G. 2005. The Late Triassic-Jurassic stratigraphic succession of Pignola (Lagonegro-Molise Basin, Southern Apennines, Italy). *Bollettino Della Societa Geologica Italiana* **124** (1), 143-153.

The stratigraphic succession of Pignola belongs to the Lagonegro-Molise Basin (Ionian Tethys). Two different sections, cropping out along the road connecting Pignola to Abriola (Potenza prov.) were analyzed: Mt. Crocetta and Chiatamone section. The Mt. Crocetta section is made up of cherty limestones, dolostones and marls (upper part of the Calcari con Selce fm). On the base of conodont and radiolarian assemblages, this section is referred to the Upper Norian-Rhaetian interval. Rhaetian radiolarians are found in this section for the first time. The Chiatamone section is constituted of cherts, radiolarites, shales and often silicified calcarenites (Scisti Silicei fm). On the basis of radiolarian contents, the lower portion of the section is referred to middle Bathonian to late Bathonian-early Callovian and the upper part is referred to Kimmeridgian-Tithonian.

BECCALETTO, L., BARTOLINI, A.-C., MARTINI, R., HOCHULI, P. A. & KOZUR, H. 2005. Biostratigraphic data from the Cetmi Melange, northwest Turkey:

Palaeogeographic and tectonic implications. *Palaeogeography, Palaeoclimatology, Palaeoecology* **221** (3-4), 215-244.

The Cetmi accretionary melange is cropping out in the Biga Peninsula of northwest Turkey. It is characterised by an isolated position, relatively far from the accretion complexes of the nearest suture zones, which raises the question of its lateral correlations. A detailed biostratigraphic investigation of the limestone and radiolarite blocks and the matrix of the Cetmi melange allowed to propose a solution for this palaeogeographic problem.Scarce red nodular limestones in the Han Bulog facies represent the oldest lithology in the melange. Their Late Scythian-Ladinian age is based on *Chiosella gondolleloides*, the co-occurrence of *Gladigondolella* sp. and *Nicoraella* cf. *kockeli*, and *Paragondolella fuelopi*. Light grey limestone blocks are a characteristic feature of the Cetmi melange. They occur in two distinct facies. Facies A consists of packstone to grainstone, and is characterised by unsorted and poorly washed pelbiosparites. Facies B consists of wackestone to packstone, and is characterised by poorly washed biopelmicrites to biopelsparites. The foraminiferal assemblage of Facies A, containing *Triasina hantkeni*, is of Late Norian to Rhaetian age. The foraminiferal assemblage of Facies B never contains *T. hantkeni*, and is characteristic of a Late Triassic (Carnian? to Norian-Rhaetian) age. Radiolarian cherts are widely distributed in the Cetmi melange. They record fully pelagic sedimentation from the Upper Bajocian to the Aptian. The matrix of the Cetmi melange consists of brown to black shales, sometimes silty or siliceous, intercalated with dark grey greywackes. Palynomorphs of one sample of brownish silty shale yielded an Early to Middle Albian age, based on the co-occurrence of several dinoflagellate cysts. The age of the matrix, representing the youngest lithology within the melange, and of the unconformable overlaying section (latest Albian-Cenomanian) indicate that the melange-forming process stopped between the Early Albian and the latest Albian-Cenomanian. At a regional scale, the Cetmi melange has little in common with the melanges from the Izmir-Ankara and Intra-Pontide sutures of northwestern Turkey precluding a direct correlation. On the other hand, the Cetmi melange shares several characteristics with the melange-like units of the eastern Rhodope Zone (Bulgaria and Greece), like a major Cenomanian transgression, the reworking of Triassic limestones and Middle Jurassic-Lower Cretaceous radiolarians, and the absence of Jurassic-Cretaceous passive margin lithologies. The occurrence of Rhodopian units on the Biga Peninsula suggests that the studied units represent an isolated fragment of the Rhodope Zone in NW Turkey.

BECCARO, P. 2004a. *Monotrabs goricanae* n.sp.: a new species of Jurassic Tritrabidae (spumellarian Radiolaria). *Micropaleontology* **50** (1), 81-87.

Monotrabs goricanae n. sp. is a new species belonging to the Tritrabidae family (Spumellaria, Radiolaria). Monotrabs goricanae n. sp. has been discovered in the Middle Jurassic pelagic successions from northwestern Sicily (Favignana Island) and the Southern Alps (Cava Vianini and Coston delle Vette) (Italy). *Monotrabs goricanae* n. sp. is characterized by having one ray with a tritrabid structure, a bulbous distal part with two stout lateral opposite spines, and a proximal part always incomplete. The external longitudinal beams are nodose and separated by grooves with two rows of rounded pores. Remains of very small spines occur sometimes on the external edge of the bulbous portion and on the external longitudinal beams. *Monotrabs goricanae* n. sp. is a good stratigraphical marker for the Middle Jurassic time.

BECCARO, P. 2004b. Upper Jurassic radiolarians from Inici Mt. area (North-western Sicily, Italy): Biochronology and calibration by ammonites. *Rivista Italiana di Paleontologia e Stratigrafia* **110** (1), 289-301.

This research is devoted to the biostratigraphic analysis of radiolarian assemblage of the Upper Jurassic intermediate siliceous member of the Rosso Ainmonitico Formation in the Inici Mountain area (North-western Sicily, Italy). The aims of this paper are to give the first description of the tadiolarian associations, to establish a direct,in biochronostratigraphy by means of radiolarians, and to calibrate radiolarian zones by ammonite zones. During Late Jurassic time, Inici Mt. area was part of a submerged pelagic plateau characterized by the deposition of Rosso Ammonitico condensed facies (Rosso Ammonitico Inferiore -RAI- and Rosso Ammonitico Superiore -RAS-) and basinal facies (Rosso Ammonitico Medio -RAM-). Four stratigraphical sections of RAM have been studied: Fornazzo Strada, Fornazzo Cava, Castello Inici and Balada di Baida. In all sections RAM consists of siliceous nodular limestone alternating with marly limestone, and contains moderately preserved radiolarians. Biostratigraphic correlation has been made using the Unitary Associations (UAs) method: 11 UAs have been identified and grouped in 5 biozones (Unitary Associations Zones: UAZs) whose age is calibrated by ammonites found in the same successions and/or in the under- and overlying formations. Ammonite assemblages assign the top of RAI to mid Oxfordian and the top of RAM to upper Kimmeridgian. The ranges of *Eucyrtidiellum unumaense* (Yao) s.l. and *Williriedellum* (?) *marcucciae* Cortese have been extended with respect to those stated in Baumgartner et al. 1995a. Syringocapsidae family is extraordinarily abundant and new morphogroups are presented here: *Podobursa* sp. A, *Podobursa* sp. B, *Syringocapsa* sp. A, *Syringocapsa* sp. B. Other new morphogroups are: *Fultacapsa sphaerica* (Ozvoldova) ssp. A, *Loopus* sp. A, transitional forms between *Emiluvia orea* Baumgartner and *Emiluvia ultima* Baumgartner & Dumitrica, transitional forms between *Tetratrabs bulbosa* Baumgartner and *Tetratrabs zealis* (Ozvoldova).

BERNOULLI, D., GASPERINI, L., BONATTI, E. & STILLE, P. 2004. Dolomite formation in Pelagic limestone and diatomite, Romanche Fracture Zone, equatorial Atlantic. *Journal of Sedimentary Research* **74** (6), 924-932.

Two dredge samples from the Romanche Fracture Zone in the equatorial Atlantic document dolomite formation in pelagic sediments in a deep-sea environment. The samples come from a highly deformed sedimentary succession, the Romanche Sedimentary Sequence, constituting the transverse ridge accompanying the transverse valley of the fracture zone to the north. These sediments were folded and uplifted to or near the seaffoor prior to the growth of an early Miocene carbonate platform which unconformably overlies them. Dolomitized pelagic limestones of Early Cretaceous age preserve solution molds and unaltered tests of radiolaria (opal-A) and ghosts of calcareous nannoplankton in a dolomicritic groundmass. Carbon isotope data indicate a normal marine source of carbon, and oxygen isotope compositions are consistent with precipitation from cool, marine pore waters at or near the sediment-water interface. The Sr-87/Sr-86 ratio suggests dolomitization at around 25 Ma, presumably when the sediments were exhumed to or near to the seafloor. In contrast, a dolomite-cemented diatomite of presumably late Eocene age shows no relics of a carbonate precursor. Dolomite crystals grew freely in the originally highly porous rock, cementing it into a tight fabric. The absence of compaction suggests that cementation by dolomite took place soon after deposition and before significant burial of the sediment. Carbon and oxygen isotope compositions of this dolomite suggest that its formation also occurred from cool, marine waters. The Sr-87/Sr-86 ratio shows the value of seawater around 35 Ma. Under the assumption that dolomite cementation was by seawater, it occurred shortly after deposition at or near the seafloor.

BERTINELLI, A., CHIARI, M. & MARCUCCI, M. 2005a. Late Triassic radiolarians of the cherty dolostones of Mt. Marrone (Molise Basin), Central Apennines, Italy. *Boll. Soc. Geol. It.* **124**, 155-159.

The stratigraphic succession of Mt. Marrone (Central Apennines) is constituted, from bottom to top, by: thin-bedded cherty dolostones; massive and nodular dolostones; partially dolomitized nodular

limestones; green, red, black shales and radiolarian cherts, with calcirudites and thin silicified calcarenites. Radiolarian faunas of middle late Carnian to early Norian age have been extracted from the lower portion of the cherty dolostones of the Mt. Marrone succession. The age has been determined on the base of the presence of *Capnodoce* sp. and *Xiphotheca rugosa* Bragin. This succession represents the oldest part of the exposed deposits of the Molise Basin, which is thus shown to have existed since the Late Triassic at least.

BERTINELLI, A., CIARAPICA, G., DE ZANCHE, V., MARCUCCI, M., MIETTO, P., PASSERI, L., RIGO, M. & ROGHI, G. 2005b. Stratigraphic evolution of the Triassic-Jurassic Sasso di Castalda succession (Lagonegro Basin, Southern Apennines, Italy). *Bollettino della Società geologica italiana* **124** (1), 161-175.

BERTINELLI, A., CIARAPICA, G. & PASSERI, L. 2005c. Late Triassic-Jurassic basinal successions in Molise and northern Basilicata: the northernmost witness of the Ionian Ocean. *Bollettino Della Societa Geologica Italiana* **124** (1), 177-188.

Molise and northern Lagonegro successions (Central and Southern Apennines) are described and compared in order to depict their sedimentary evolution and their paleogeographic relationships. The Molise Mesozoic facies were studied in the Mt. Marrone section (Abruzzi National Park), Pesche section (Isernia) and in the Matese area. Mt. Marrone contains pelagic facies (cherty dolostones) since the late Carnian-early Norian at least, and Early Cretaceous radiolarian cherts. Evidence of Late Triassic-Early Jurassic synsedimentary tectonics was found in the western Matese carbonate platform. The northern and proximal Lagonegro successions were studied in two stratigraphic sections: Mt. Pierno (for the lower part) and S. Fele. The Mt. Pierno section is identical to the Mt. Marrone one, being formed by cherry dolostones of the same Late Triassic age. The S. Fele section contains Middle and Late Jurassic radiolarian cherts with a large amount of calcarenites. The comparison between the Lagonegro and Molise successions suggests: a) palaeogeographic identity between the Molise and Lagonegro units during the Late Triassic (cherty limestones in the distal Lagonegro facies and cherry dolostones in the proximal Lagonegro facies and in the Molise facies); b) progressive deepening below the CCD from the distal facies to the proximal ones during the Jurassic; c) occurrence of synsedimentary tectonics during the Late Triassic-Early Jurassic after the Early and Middle Triassic phases that originated the Lagonegro-Molise basin.

BERTINELLI, A., NANNARONE, C., PASSERI, L. & VENTURI, F. 2004. Hettangian ammonites and radiolarians in the Mt. Camicia (Gran Sasso, Central Apennines). *Rivista Italiana di Paleontologia e Stratigrafia* **110** (1), 87-95.

The Vallone di Vradda stratigraphic section is situated in the eastern part of the Gran Sasso range and shows the transition from Late Triassic euxinic facies to Early Liassic open pelagic facies. This paper describes Middle and Late Hettangian ammonite and radiolarian assemblages found in the upper part of the succession. The existence of an anoxic event below the Middle Hettangian beds is noted. Assemblages of small-sized Middle Hettangian ammonites suggest some taxonomic innovation within the early *Lytoceratina*: gen. n. (Pleuroacanthitidae) and *Analytoceras* n. sp. indet. Radiolarians found together with ammonites improve the knowledge of Hettangian radiolarian assemblages of the western Tethys.

BIAN, Q. T., LI, D. H., POSPELOV, I., YIN, L. M., LI, H. S., ZHAO, D. S., CHANG, C. F., LUO, X. Q., GAO, S. L., ASTRAKHANTSEV, O. & CHAMOV, N. 2004. Age, geochemistry and tectonic setting of Buqingshan ophiolites, North Qinghai-Tibet Plateau, China. *Journal of Asian Earth Sciences* **23** (4), 577-596.

The Buqingshan ophiolite complex is a sector of the A'nyemaqen ophiolite belt in the East Kunlun southern marginal suture zone in the northern part of the Qinghai-Tibet Plateau. The WNW-trending ophiolite complex consists of metaperidotite, gabbro, diabase, pillow basalt, massive basalt and pelagic sedimentary rocks including radiolarian chert. We have determined that Early Paleozoic and Early Carboniferous-Early Permian ophiolites are present in this ophiolite complex that were previously thought of Permian-Middle Triassic age. A zircon U-Pb age of 467.2 +/- 0.9 Ma for gabbro, and a Rb-Sr isochron age of 481 +/- 130 Ma for diabase and gabbro have been obtained from the Early Paleozoic ophiolite slice, and Middle-Late Ordovician acritarchs have been found in the melange matrix that envelopes the sliver. We interpret the first two ages to represent the formation age of the ophiolite. Granodiorite-tonalite plutons with a zircon U-Pb age of 402 +/- 24 Ma intrude the slice. Early Carboniferous-Early Permian radiolarians have been discovered in cherts and argillaceous cherts in the second ophiolite slice. Geochemistry indicates that metaperidotites in the first slice represent a depleted ocean lithosphere mantle. Most mafic rocks in the Early Paleozoic ophiolite are of N-MORB type with small amount of T-MORB, and they resulted from the magma from the depleted oceanic lithosphere mantle with little crustal contamination. The basalts in the Early Carboniferous-Early Permian ophiolite have similar characteristics to the mafic rocks and also show DUPAL anomaly and a mixed source of DMM and EM II. The original formation environments of the two-stage ophiolites are both mid-ocean ridges. These lines of evidence suggest that a mature Early Paleozoic Kunlun-Qilian-Qinling ocean basin and a mature Paleotethyan ocean basin once existed in the study area.

BLECHSCHMIDT, I., DUMITRICA, P., MATTER, A., KRYSTYN, L. & PETERS, T. 2004. Stratigraphic architecture of the northern Oman continental margin; Mesozoic Hamrat Duru Group, Hawasina Complex, Oman. *GeoArabia (Manama)* **9** (2), 81-132.

The Triassic to Late Cretaceous deep-marine sediments of the Hamrat Duru Group, Oman Mountains, represent a subunit of the Hawasina nappe-complex which was deposited in a deep marine basin. During the Late Cretaceous SSW-directed obduction of the Semail Ophiolite, the Hawasina complex was emplaced onto the autochthonous cover of the Arabian basement, while the original configuration of the basin was destroyed. New lithostratigraphic results and high-resolution radiolarian and conodont biostratigraphy lead to a revised stratigraphic scheme of the Hamrat Duru Group which conforms with the standard stratigraphical nomenclature. The Hamrat Duru Group is divided into six formations: (1) The Early Triassic (Olenekian) to Late Triassic (Upper Norian) Zulla Formation (Limestone and Shale Member, Sandstone and Shale Member, Radiolarian Chert Member and Halobia Limestone Member); (2) The Late Triassic (late Norian to Rhaetian) Al Ayn Formation; (3) The Early Jurassic (late Pliensbachian) to Middle Jurassic (early Callovian) Guwayza Formation (Tawi Sadh Member and Oolitic Limestone Member); (4) Middle Jurassic (Callovian) to Late Cretaceous (Cenomanian?) Sid'r Formation (Lower Member, Upper Member); (5) Late Cretaceous (Cenomanian? to Santonian?) Nayid Formation; and (6) Late Jurassic (early Callovian) to Early (Late?) Cretaceous Wahrah Formation. Most of the lithostratigraphic units (formations and members) show isochronous boundaries between the different outcrop areas. The stratigraphic architecture of the Hamrat Duru Group megasequence is controlled by alternating siliciclastic and carbonate sedimentation possibly related to the second-order sea-level variations. The sediments accumulated on the continental rise of the Arabian margin mostly by submarine sediment-gravity flows and hemipelagic to pelagic rainout. A close relationship of the evolution of the Arabian Platform and the adjoining slope and basinal environments is evident. Changes in carbonate supply,

oceanographic circulation and/or variations in silica productivity resulted in two distinct phases of radiolarian sedimentation. The first phase corresponds to the Triassic late Anisian-early Norian time interval; the second started in the Early Jurassic late pliensbachian and lasted, with some interruptions, up to the Late Cretaceous Coniacian. The litho- and biostratigraphic similarities between the Mesozoic Hamrat Duru Basin of the northern/central Oman Mountains and the Mesozoic Batain Basin of northeastern Oman are seen as related to Neo-Tethys-wide palaeoceanographic changes and suggest a strong interdependence of the two basins with the evolution of the Arabian Platform.

BLOME, C. D. & SANFILIPPO, A. 2003. Special issue - INTERRAD IX - International Association of Radiolarian Paleontologists - Preface. *Marine Micropaleontology* **49** (3), 185-186.

BORTOLOTTI, V., CARRAS, N., CHIARI, M., FAZZUOLI, M., PHOTIADES, A. & PRINCIPI, G. 2004a. Sedimentary evolution of the Upper Jurassic Zyghosti platform, Kozani, northern Greece. *Proceedings, Earth System 2004 - Istanbul 8-10 September 2004*, 705-712.

A Jurassic and Cretaceous calcareous succession crops out along the Zyghosti Rema, Kozani area (Northern Greece). The substratum consists of the ophiolitic succession of the Vourinos Massif including serpentinites tectonically overlain by basalts with thin lenses of radiolarian cherts of middle Bathonian age at the top. The contact with the overlying Jurassic limestones is presently tectonic, but could have been primary (sedimentary). Eight informal lithostratigraphic units, of Jurassic and of Cretaceous age, have been distinguished within the Mesozoic limestones. Their sedimentary features allow to recognise the following sequence of events: 1) development of a carbonate platform in the Middle and Late Jurassic; 2) its thrusting on the ophiolites from either a continental margin or from a nearby oceanic basement and its emersion starting in the latest Jurassic, with erosion and deposition of laterites; 3) marine transgression on the Jurassic platform and on the ophiolites during the late Early Cretaceous, and 4) extensional tectonism and platform demise starting in the Cenomanian, with sedimentation of gravity flows and turbidity currents deposits from the Cenomanian to the Campanian-?Maastrichtian.

BORTOLOTTI, V., CHIARI, M., FAZZUOLI, M., MARCUCCI, M. & PRINCIPI, G. 2004b. Records of Mesozoic oceans and persisting pericontinental pelagic basins in the perimediterranean orogen. *Proceedings, Earth System 2004 - Istanbul 8-10 September 2004*, 713-720.

The old oceanic basins are directly documented by the occurrence of ophiolites including both MOR and, indirectly, IAT basalts. In the peri-Mediterranean orogens, Mesozoic ophiolites whose ages cluster into three different groups, are present: a- Middle-Upper Triassic (Ladinian-Carnian) MORB-type in the Dinarides-Hellenides-Pontides and Caucasic (Eastem Tethys) belt; b- Middle-Upper Jurassic, both MORB and IAT-type, in the same belt, and only MORB in the Central Atlantic, and Betic - Alpine-Apenninic (Western Tethys) belt; c- Upper Cretaceous IAT-type in the Skarpathos - Taurides - Zagros-Oman orogenic belt. In the Middle Triassic the Adria margin was fragmented in a complex system of platforms and persistent basins, with alkali-acidic volcanism connected with extension in the basins. These basins were trending roughly parallel to the incipient Eastern Tethys Ocean (the Vardar – Pontic ocean), which could represent the westward propagation of the Palaeotethys and to the future Western Tethys (Ligurian Ocean). The Triassic-Cretaceous evolution of the Adria Plate - Tethys system, is schematically summarized.

BORTOLOTTI, V., CHIARI, M., KODRA, A., MARCUCCI, M., MUSTAFA, F., PRINCIPI, G. & SACCANI, E. 2004c. New evidences for Triassic morb magmatism in the northern Mirdita Zone Ophiolites (Albania). *Ofioliti* **29** (2), 243-246.

BORTOLOTTI, V., CHIARI, M., MARCUCCI, M., MARRONI, M., PANDOLFI, L., PRINCIPI, G. & SACCANI, E. 2004d. Comparison among the Albanian and Greek ophiolites: In search of constraints for the evolution of the Mesozoic Tethys Ocean. *Ofioliti* **29** (1), 19-35.

In this paper the stratigraphical, structural, geochemical and petrological features of the Mirdita (Albania) and Pindos, Vourinos, Koziakas, Othrys and Argolis (Greece) ophiolitic nappes are summarised and then compared. These ophiolitic nappes occur as a 700 km long belt running from Albania to Greece. These ophiolitic nappes are located between the west-verging imbricate stack of thrust sheets derived from the Adria plate continental margin to the west and the Pelagonian zone to the cast. Each ophiolitic nappe is represented by several end-members represented by the sub-ophiolite melange, the ophiolite sequence(s) with their sedimentary oceanic cover and the supra-ophiolite deposits. The latter can be divided in syn- and post-emplacement deposits, the first ones are recognised only in Albania. All the described ophiolite sequences are characterised at their base by a well-developed metamorphic sole that represents a further end-member of the ophiolitic nappe. The comparison among the features of all the end-members recognised in the studied ophiolitic nappes allows providing further constraints for the geodynamic reconstructions of the Mesozoic Tethyan oceanic basin located eastwards of the Adria plate.

BORTOLOTTI, V., MARRONI, M., NICOLAE, I., PANDOLFI, L., PRINCIPI, G. & SACCANI, E. 2004e. An update of the Jurassic ophiolites and associated calc-alkaline rocks in the South Apuseni Mountains (western Romania). *Ofioliti* **29** (1), 5-18.

This paper presents a synthesis of the researches so far carried out by the authors on the Jurassic magmatic sequences of South Apuseni Mountains. The Apuseni Mountains represent an alpine orogenic belt located in the hinterland of the Southern Carpathians. The Apuseni Mountains include a pile of basement nappes affected by Hercynian metamorphism (Bihor, Biharia, Baia de Aries, Codru nappe complexes). These nappes are overlain by an imbricated stack of tectonic units mainly consisting of Late Cretaceous elastic deposits that are, in turn, topped by the Mures nappe. This nappe includes a Middle Jurassic ophiolite sequence covered by Upper Jurassic calc-alkaline volcanics. The ophiolite sequence consists of a gabbroic complex overlain by a sheeted dike complex and a volcanic sequence including massive and pillow-lavas. Cherts associated to pillow-lava basalts have provided Callovian to Oxfordian radiolarian associations. According to the geological and geochemical evidences, we propose that the ophiolite sequence preserved in the Southern Apuseni Mountains is representative of an oceanic lithosphere formed in a mid-ocean ridge setting. The calc-alkaline series is mostly characterized by volcanic rocks including: basalts, basaltic andesites, andesites, dacites and rhyolites showing geochemical features typical of an intra-oceanic arc setting, and is thought to be related to Late Jurassic convergence between Eurasia and Adria plate. The calc-alkaline series is in turn overlain by Late Jurassic shallow-water limestones showing a gradual transition to Cretaceous carbonate deposits. The geological and geochichemical features are consistent with a possible linkage of the Apuseni Mountains ophiolites with northern continuation of the Vardar oceanic domain of the Hellenic-Dinaric belt. The present-day location in the hinterland of the Carpathian area achieved in the Late Paleogene - Early Neogene time span, when the escape tectonics produced a large-scale displacement of blocks originated from the northernmost edge of the Adria plate.

BRAGIN, N. Y. 2005. Radiolarian evolution and diversity dynamics in the Late Permian through to the Early Mesozoic. *Paleontological Journal* **39** (2), 117-132.

Available data on the distribution of radiolarian genera in the Upper Permian through to the Lower Jurassic are summarized, and their diversity dynamics, including the rates of appearance and extinction of genera and the general rate of diversification, are estimated. The results show a major extinction of Paleozoic taxa in the Late Permian, low taxonomic diversity in the Early Triassic, rapid diversification in the early Middle Triassic, stasis in the Ladinian and Late Triassic, and a new major extinction at the Triassic-Jurassic boundary. This confirms previous assumptions that the Triassic Period was a unique stage in radiolarian evolution limited by two great extinction events.

BRAGINA, L. G. 2004. Cenomanian-Turonian radiolarians of northern Turkey and the Crimean Mountains. *Paleontological Journal* **38** (4), 325-456.

BRAGINA, L. G. & N.YU., B. 2004. Radiolarians from Upper Cretaceous Deposits, the Novodeviche Section (Samara Oblast, Volga River Middle Courses). *Stratigraphy and geological Correlation* **12** (3), 286-296.

Radiolarians from the Novodevich'e section, Samara oblast, are described. Two subdivisions of the section correspond to the 6.5-m-thick member of clay and chalk with Turonian–Coniacian benthic foraminifers and to the other member of intercalated opoka and clay beds, which are 6.8 m thick in total and yield benthic foraminifers of the upper Coniacian–Santonian in association with radiolarians. Of 41 radiolarian species,which have been identified, the most typical are *Cromyodruppa concentrica* Lipman, *Crucella aster* (Lipman), *C. cachensis* Pessagno, *C. latum* (Lipman), *Orbiculiforma monticelloensis* Pessagno, *O. quadrata* Pessagno, *Paronaella santonica* (Lipman), *P. tumida* (Lipman), *Patulibracchium ingens* (Lipman), *Pentinastrum subbotinae* Lipman, *Praeconocaryomma lipmanae* Pessagno, *P. universa* Pessagno, *Pseudoaulophacus lenticulatus* (White), *Triactoma compressa* (Squinabol), *Amphipyndax stocki* (Campbell et Clark), *Dictyomitra multicostata* Zittel, and *Xitus asymbatos* (Foreman). The late Coniacian–Santonian age of radiolarian assemblage is inferred based on coexisting radiolarians and on correlation with radiolarians characteristic of the Zagorsk Formation of the Moscow syneclise. As compared to radiolarian assemblages of the Moscow syneclise, which are taxonomically diverse and include many taxa known from California and bottom sediments of tropical oceanic regions, and to concurrent assemblages of the Urals and West Siberia, which are depleted in thermophilic species, the Late Cretaceous radiolarians from the Volga River middle courses are of a transitional taxonomic composition. It is plausible to conclude therefore that thermophilic taxa migrated into the East European sea from the west, whereas cryophilic forms characteristic of the West Siberian basin arrived from the east and northeast. Species originally identified by Lipman (1952) are revised and described anew.

CARRAS, N., FAZZUOLI, M. & PHOTIADES, A. 2004. Transition from carbonate platform to pelagic deposition (Mid Jurassic-Late Cretaceous), Vourinos Massif, northern Greece. *Rivista Italiana di Paleontologia e Stratigrafia* **110** (1), 345-355.

A Jurassic-Cretaceous carbonate succession crops out along the Zyghosti Rema, Kozani (Northern Greece). The substratum consists of the ophiolitic succession of the Vourinos Massif (Pelagonian Domain): serpentinites tectonically overlain by basalts, with thin lenses of radiolarian cheris of middle Bathonian age. The contact with the overlying Jurassic limestones is tectonic. Eight informal units have been distinguished within the Mesozoic limestones, from the base upwards. (A) bioclastic, intraclastic and oolitic packstone (Callovian-Oxfordian). (B) bioclastic packstone and coral boundstone (Oxfordian). (C) bioclastic and oncoidal wackestone with Clypeina jurassica (Oxfordian-Upper Kimmeric gian). (D) (Upper Kimmeridgian- Portlandian): oncoidal packstone and rudstone (facies D1); intraclastic and bioclastic grainstone and packstone (facies D2); neptunian dykes with intraclastic and bioclastic wackestone and packstone filling (facies D3); neptunian dykes with Fe-Mn rich laterite filling and with pink silty filling of early Late Cretaceous age. An unconformity surface, due to emersion and erosion of the platform during the latest Jurassic-Early Cretaceous, is overlain by (E) intraclastic, bioclastic packstone and grainstone (Cenomanian). (F) massive body of debrites with coral, echinoderm, algae and rudist large clasts (facies F1) (Cenomanian); turbiditic beds of bioclastic, intraclashin bedded tic and lithoclastic rudstone and grainstone (facies F2). (G) t bioclastic mudstone and wackestone with planktonic foraminifers and radiolarians, alternating with turbiditic beds of bioclastic, intraclastic packstone and rudstone and with conglomeratic levels and slumped beds of the previous turbidites (upper Santonian-lower Campanian). (H): bioclastic packstone with planktonic foraminifers (facies H1) (lower Campanian - ?Maastricht an); amalgamated turbiditic beds of bioclastic wackestone and packstone with planktonic foraminifers (facies H2); turbiditic beds of bioclasvic packstone and rudstone (facies H3). These features allow to recognise the following sequence of events: 1) development of a carbonate platform in the Middle and Late Jurassic; 2) its overthrusting onto the ophiolites and its emersion starting from latest Jurassic time, with erosion and deposition of laterites; 3) marine transgression on the Jurassic platform and on the ophiolites during the early Late Cretaceous, and 4) extensional tectonism and platform demise starting in the Cenomanian, with sedimentation of gravity flows and turbidity currents deposits from the Cenomanian to the Campanian-?Maastrichtian.

CARTER, E. S. & HORI, R. S. 2005. Global correlation of the radiolarian faunal change across the Triassic–Jurassic boundary. *Can. J. Earth Sci.* **42**, 777–790.

Precise comparison of the change in radiolarian faunas 3.5 m above a U–Pb zircon dated 199.6 ± 0.3 Ma tuff and approximately coincident with a negative $d^{13}C$ anomaly in the Queen Charlotte Islands, B.C. (Canada) with Inuyama (Japan) sequences indicates that major global changes occurred across the Triassic–Jurassic (T–J) boundary. Nearly 20 genera and over 130 Rhaetian species disappeared at the end of the Triassic. The index genera *Betraccium* and *Risella* disappear and the final appearance of *Globolaxtorum tozeri*, *Livarella valida*, and *Pseudohagiastrum giganteum* sp. nov. are also diagnostic for the end of the Triassic. The low-diversity Hettangian survival fauna immediately above the boundary is composed mainly of small, primitive spumellarians with spongy or irregularly latticed meshwork and rod-like spines, and new genera *Charlottea*, *Udalia*, and *Parahsuum* s.l. first appear in the lowest Hettangian in both localities. Irrespective of different sedimentation rates and sedimentary environments, such as shelf to upper slope (Queen Charlotte Islands) and deep sea below carbonate compensation depth (CCD; Inuyama), radiolarians show a similar turnover pattern at the T–J boundary.

CHANG, K. H., SUZUKI, K., PARK, S. O., ISHIDA, K. & UNO, K. 2003. Recent advances in the cretaceous stratigraphy of Korea. *Journal of Asian Earth Sciences* **21** (8), 937-948.

A subrounded, accidental, zircon grain from a rhyolite sample of the Oknyobong Formation has shown an U-Pb CHIME isochron age, 187 Ma, implying its derivation from a Jurassic felsic igneous rock. Such a lower limit of the geologic age of the Oknyobong Formation, combined with its pre-Kyongsang upper limit, constrains that the Oknyobong Formation belongs to the Jasong Synthem (Late Jurassic-early Early Cretaceous) typified in North Korea. The Jacryonggang Movement terminated the deposition of the Jasong Synthem and caused a shift of the depocenter from

North Korea to the Kyongsang Basin, Southeast Korea. The Cretaceous-Paleocene Kyongsang Supergroup of the Kyongsang Basin is the stratotype of the Kyongsang Synthem, an unconformity-bounded unit in the Korean Peninsula. The unconformity at the base of the Yuchon Volcanic Group is a local expression of the interregionally recognizable mid-Albian tectonism; it subdivides the Kyongsang Synthem into the Lower Kyongsang Subsynthem (Barremian-Early Albian) and the Upper Kyongsang Subsynthem (Late Albian-Paleocene). The latter is unconformably overlain by Eocene and younger strata. The Late Permian to Early Jurassic radiolarian fossils from the chert pebbles of the Kumidong and the Kisadong conglomerates of the Aptian-Early Albian Hayang Group of the Kyongsang Basin are equivalent with those of the cherts that constitute the Jurassic accretionary prisms in Japan, the provenance of the chert pebbles in the Kyongsang Basin. Bimodal volcanisms throughout the history of the Kyongsang Basin is exemplified by the felsic Kusandong Tuff erupted abruptly and briefly in the Late Aptian when semi-coeval volcanisms were of intermediate and mafic compositions. The mean paleomagnetic direction shown by the Kusandong Tuff is in good agreement with the Early Cretaceous directions known from North China, South China and Siberia Blocks.

CHENG, Z. B., SHI, X. F., TAN, Z. Y., WU, Y. H., WANG, K. S. & JU, X. H. 2004. Study of Radiolaria in the surface sediments from the area east of Taiwan Island. *Acta Oceanologica Sinica* **23** (3), 463-472.

The species and characteristics of Radiolaria in the surface sediments were systematcally investigated in the sea east of Taiwan Island. One hundred and seventy-eight species of Radiolaria (including 21 unidentified species) have been identified in the surface sediments, and they belong to 2 orders, 34 families and 101 genera. Among them there are 19 families, 70 genera, 134 species of Spumellaria and 15 families, 31 genera, 44 species of Nassellaria. Of the 178 species of Radiolaria, the individual number of Spumellaria amounts to 88.1% of the total individual number, and that of Nassellaria amounts to 11.9% of the total individual number. It is shown that most of the dominant species belong to the tropical and subtropical dominant species and are brought into the area mainly by the Kuroshio, and some affecting factors including the submarine topography, submarine sediments, upwelling current east of Taiwan Island and carbonate dissolution play a secondary role in forming the Radiolaria distributions.

CHIARI, M., BALDANZA, A. & PARISI, G. 2004a. Integrated stratigraphy (radiolarians and calcareous nannofossils) of the Jurassic siliceous sediments from Monte Kumeta (Western Sicily, Italy). *Rivista italiana di Paleontologia e Stratigrafia* **110** (1), 129-140.

Integrated analyses of Calcareous Nannofossils and Radiolarians were carried out in the Monte Kumeta (Sicily) to better define the age of the siliceous sediments (Membro Radiolaritico Intermedio = MRI), which results to be early-middle Bathonian to early Kimmeridgian. The base of this unit shows variable ages in the different sites along the Kumeta palaeoescarpment. Particularly, the ages of the distal sections range from early-middle Bathonian to early Kimmeridgian, whereas the proximal sections show ages from late Oxfordian to early Kimmeridgian. This fact suggests the presence of heteropy between the Membro Radiolaritico Intermedio and the Rosso Ammonitico Inferiore. Moreover, several gaps occur in the MRI and they are restricted to late Bathonian - early Callovian and to late Oxfordian, testifying the times of major tectonic activity along the palaeoescarpment.

CHIARI, M., MARCUCCI, M. & PRELA, M. 2004b. Radiolarian assemblages from the Jurassic cherts of Albania: new data. *Ofioliti* **29** (2), 95-105.

We examined Radiolarian assemblages of Jurassic age in four sections of cherts from the sedimentary cover of the Mirdita ophiolites (Kalur Cherts) and in two sections of chert levels intercalated in carbonate successions of the Mesozoic Albanide continental margin. In the Kalur Cherts the ages of the radiolarian assemblages range from latest Bajocian-early Bathonian (UAZ. 5), to middle Bathonian - middle Callovian-early Oxfordian (UAZ. 6-8). In the sections from the carbonate successions the ages range from middle Bathonian (UAZ. 6), to late Bathonian-early Callovian - middle Callovian-early Oxfordian (UAZ. 7-8).

CORDEY, F., BOUGHDIRI, M. & SALLOUHI, H. 2005. First direct age determination from the Jurassic radiolarian-bearing siliceous series (Jedidi Formation) of northwestern Tunisia. *Comptes Rendus Geoscience* **337** (8), 777-785.

Our study presents preliminary biostratigraphic results from the Jurassic siliceous series of northwestern Tunisia. For the first time, radiolarians are extracted from the Jedidi formation and provide a direct age determination. They are the first radiolarian fauna documented from Tunisia. Two age assignments are comprised within the following intervals: (1) Late Bathonian-Early Callovian, (2) Late Bathonian-Early Oxfordian. These ages are compatible with recent stratigraphic synthesis proposed for the Jurassic series of Tunisia. The data suggest the correlation of the Jedidi formation with siliceous series of Middle-Late Jurassic age from the external zone of the Maghrebides belt rather than with true oceanic units from the Maghrebian flyschs or the internal zones of western Tethys.

CORTESE, G., DOLVEN, J. K., BJØRKLUND, K. R. & MALMGREN, B. A. 2005. Late Pleistocene – Holocene radiolarian paleotemperatures in the Norwegian Sea based on artificial neural networks. *Palaeogeography,Palaeoclimatology,Palaeoecology* **224**, 311-332.

Artificial Neural Networks (ANN) were trained by using an extensive radiolarian census dataset from the Nordic (Greenland, Norwegian, and Iceland) Seas. The regressions between observed and predicted Summer Sea Temperature (SST) indicate that lower error margins and better correlation coefficients are obtained for 100 m (SST100) compared to 10 m (SST10) water depth, and by using a subset of species instead of all species. The trained ANNs were subsequently applied to radiolarian data from two Norwegian Sea cores, HM 79-4 and MD95-2011, for reconstructions of SSTs through the last 15,000 years. The reconstructed SST is quite high during the Bølling–Allerød, when it reaches values only found later during the warmest phase of the Holocene. The climatic transitions in and out of the Younger Dryas are very rapid and involve a change in SST100 of 6.2 and 6.8 °C, taking place over 440 and 140 years, respectively. SST100 remains at a maximum during the early Holocene, and this Radiolarian Holocene Optimum Temperature Interval (RHOTI) predates the commonly recognized middle Holocene Climatic Optimum (HCO). During the 8.2 ka event, SST100 decreases by ca. 3 °C, and this episode marks the establishment of a cooling trend, roughly spanning the middle Holocene (until ca. 4.2 ka). Successively, since then and through the late Holocene, SST100 follows instead a statistically significant warming trend. The general patterns of the reconstructed SSTs agree quite well with previously obtained results based on application of Imbrie and Kipp Transfer Functions (IKTF) to the same two cores for SST0. A statistically significant cyclic component of our SST record (period of 278 years) has been recognized. This is close to the de Vries or Suess cycle, linked to solar variability, and documented in a variety of other high-resolution Holocene records.

DANELIAN, T., LE CALLONNEC, L., ERBACHER, J., MOSHER, D. C., MALONE, M. J., BERTI, D., BICE, K. L., BOSTOCK, H., BRUMSACK, H. E., FORSTER, A., HEIDERSDORF, F., HENDERIKS, J., JANECEK, T. J., JUNIUM, C., MACLEOD, K., MEYERS, P. A.,

MUTTERLOSE, J. H., NISHI, H., NORRIS, R. D., OGG, J. G., O'REGAN, M. A., REA, B., SEXTON, P., STURT-FREDRICKS, H., SUGANUMA, Y., THUROW, J. W., WILSON, P. A., WISE, S. W. & GLATZ, C. 2005. Preliminary results on Cretaceous-Tertiary tropical Atlantic pelagic sedimentation (Demerara Rise, ODP Leg 207). *Comptes Rendus Geoscience* **337** (6), 609-616.

Five sites located on a bathymetric transect of the distal Demerara Rise were studied by ODP Leg 207. Albian sediments of essentially terrigenous nature (clay, siltstone, sandstone) are the oldest drilled stratigraphic levels and form apparently the top of the synrift sequence. They are overlain by Cenomanian to Santonian finely laminated black shales, rich in organic matter of marine origin, which accumulated on a thermally subsiding ramp. Early Campanian hiatuses are thought to be the result of final disjunction of Demerara Rise (South America) from Africa and the onset of deep water communication between the two Atlantic basins (south and central). The overlying Uppermost Cretaceous-Oligocene chalk includes rich and diversified calcareous plankton assemblages, as well as two radiolarian-rich intervals (Late Campanian and Middle Eocene). A complex erosional surface developed during the Late Oligocene-Early Miocene. Sedimentation was impeded since then on the intermediate and deep sites of Demerara Rise, possibly due to the action of deep submarine currents.

DE WEVER, P. 2002a. Introduction. *In:* (VUIBERT-MNHN eds). *Le temps mesuré par les sciences, l'homme à l'échelle géologique*. 7-13.

DE WEVER, P. 2002b. *Le temps mesuré par les sciences, l'homme à l'échelle géologique*. Vuibert-MNHN. 130 pp.

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DE WEVER, P. 2004a. Temps de la Terre, temps de l'Homme. *Découverte* **315**, 12-21.

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DE WEVER, P. 2005a. La géologie : Acquis et Questions vus par la Société Géol. de Fr. *Revue OCIM (in press)*.

DE WEVER, P. 2005b. Regards humanistes sur le temps de la Terre. *In:* (C.T.H.S. eds). *Le Temps*.

DE WEVER, P., CORNEE, A., REYNAUD, J.-Y., VENNIN, E., ROBIN, C., GUILLOCHEAU, F. & ROUBY, D. 2002a. Des stratotypes au Bassin de Paris : deux siècles de stratigraphie. *In:* (NATHAN-MNHN eds). *Alcide d'Orbigny, du Nouveau Monde… au passé du monde*. 89-99.

DE WEVER, P., GUILLOCHEAU, F., REYNAUD, J.-Y., VENNIN, E., ROBIN, C., CORNEE, A. & ROUBY, D. 2002b. Deux siècles de stratigraphie dans le bassin de Paris. *C.R. Palevol.* **1**, 399-414.

DE WEVER, P., GUIRAUD, M. & CORNEE, A. 2004. *Des collections en sciences de la Terre, pour quoi faire?* 165 pp.

DE WEVER, P., JAUPART, C., BOUDON, G., KOMOROWSKI, J.-C., BARDINTZEFF, J.-M., LÉNAT, J.-F., LEYRIT, H., GUIRAUD, M., PAROLI, G. & SAUTTER, V. 2003. *Le volcanisme, cause de mort & source de vie*. Vuibert/MNHN. 344 pp.

DE WEVER, P. & REYNAUD, J.-Y. 2003. Gosselet et la notion de temps en géologie. *Ann. Soc. Géol. du Nord* **t.10 (2e sér.)**, 87-96.

DIESTER-HAASS, L. & ZACHOS, J. 2003. The Eocene-Oligocene transition in the Equatorial Atlantic (ODP Site 925); paleoproductivity increase and positive $d^{13}C$ excursion. *In:* (PROTHERO, D. R., IVANY, L. C. & NESBITT, E. A. eds). *From greenhouse to icehouse; the marine Eocene-Oligocene transition*. 397-416. Columbia University Press, New York.

DUMITRICA, P. 2004. New Mesozoic and early Cenozoic spicular Nassellaria and Nassellaria-like Radiolaria. *Revue de Micropaleontologie* **47** (4), 193-224.

This paper continues a former study (Rev. Espanola Micropaleontol. 14 (1982b) 401), where the author described spicular nassellarian and entactinarian Radiolaria found in the Middle Triassic samples available at that time. Based on the study of new samples bearing well preserved radiolarians collected during the 20 years that followed the former publication, samples coming from Triassic, Jurassic, Cretaceous, and Paleogene deposits, the author found that spicular Nassellaria are extremely rare in the post-Fassanian radiolarian faunas. Their fossil record is punctuated, their occurrences being separated by very long gaps. And even so, when they occur their number is usually reduced to one, two, or several specimens of a single species. Spicular Nassellaria are rare or very rare in the upper Spathian and Anisian,

frequent in the upper Anisian-lower Ladinian, practically absent in the upper Ladinian and the whole upper Triassic and pre-Toarcian Lower Jurassic, rare in lower Toarcian, very rare in the Bajocian, rare in the lower Tithonian. No specimens were recorded in the other stages of the middle and upper Jurassic and in the whole Cretaceous, except for one in the Coniacian. In the Paleogene only five species belonging to four genera have been recorded in the upper Paleocene-middle Eocene. In the Neogene the only genus known so far is *Neosemantis* that occurs sporadically since the lower Miocene. A wider diversity is recorded in the living plankton or Recent sediments that comprise all genera and species described in the literature before 1970. It is suggested that this scarcity reflects their real scarcity in the tropical or subtropical seas of the past, but this scarcity was probably magnified by selective preservation. The idea of origination of spicular Nassellaria once or several times from shell-bearing Nassellaria by the reduction of shell during some environmental crises of the Mesozoic and Cenozoic or by hybridization is rejected because the group is rather unitary in its spicular structure and it shows a certain evolution from taxa with massive spines to taxa with three-bladed spines. Nassellarian-like spicular Radiolaria range within the boundaries of the Triassic; they seem to have disappeared by the end of the Norian.In order to give a complete inventory of these radiolarians all taxa known in the Mesozoic and lower Cenozoic are described, discussed, or just mentioned. They comprise 44 species of which 20 are new, 14 genera of which six are new (*Palaeosemantis*, *Molzaxis*, *Daniplagia*, *Verticiplagia*, *Jeanpierria* and *Nandartia*), three subfamilies of which one (Zaldacriinae) is new, and two families (Plagiacanthidae and Archaeosemantidae).

DUMITRICA, P. & DUMITRICA-JUD, R. 2005. *Hexasaturnalis nakasekoi* nov. sp., a Jurassic saturnalid radiolarian species frequently confounded with *Hexasaturnalis suboblongus* (Yao). *Revue de Micropaleontologie* **48** (2), doi:10.1016/j.revmic.2005.03.001.

Detailed morphological study of the ring of the Jurassic saturnalid radiolarian species frequently cited in the literature as *Hexasaturnalis suboblongus* (Yao) has proven that it contains two well-defined species: *H. suboblongus* (Yao), practically ranging within the boundaries of the Bajocian, and *Hexasaturnalis nakasekoi* nov. sp., ranging within the Bathonian–Kimmeridgian interval. The two species seem to be important stratigraphically because the transition from the former to the latter took place at or around the Bajocian/Bathonian boundary. The phyletic lineage *Hexasaturnalis hexagonus* (Yao) ? *H. inuyamaensis* (Yao) ? *H. suboblongus* (Yao) ? *H. nakasekoi* nov. sp. ? *H. minor* (Baumgartner) ? *Dicerosaturnalis angustus* (Baumgartner) ? *D. dicranacanthos* (Squinabol) is proposed.

DUMITRICA, P. & HOLLIS, C. J. 2004. Maastrichtian Challengeriidae (phaeodarian radiolaria) from deep sea sediments of SW Pacific. *Revue de Micropaléontologie* **47** (3), 127-134.

The paper reports three species of fossil phaeodarian Radiolaria of the family Challengeriidae, of which two (*Protocystis pacifica* and *Challengeron takahashii*) are new and one is determined at generic level. They have been found in a Maastrichtian sample from Site 275 of the Deep Sea Drilling Project located on Campbell Plateau, near New Zealand. Together with the two species of the same family recently described by Bragina [Paleontol. J. 37 (2003) 8] from the upper Cenomanian of Sakhalin Island, and three other species found by Takahashi [Tenth Meeting of the International Association of Radiolarian Palaeontologists, Abstracts and Programme, Lausanne (2003) 107] from the upper Campanian to lower Maastrichtian of central Japan, they represent the only Cretaceous phaeodarian species so far known. The family Challengeriidae, to which most of these species belong, seems to contain the most resistant phaeodarians to fossilization. These species prove that the skeleton structure of Cretaceous Challengeriidae is similar to Recent ones and that the difference between them is only at species level.

EGGER, H., HOMAYOUN, M., HUBER, H., ROGL, F. & SCHMITZ, B. 2005. Early Eocene climatic, volcanic, and biotic events in the northwestern Tethyan Untersberg section, Austria. *Palaeogeography,Palaeoclimatology,Palaeoecology* **217** (3-4), 243-264.

The 40 in thick Untersberg section (Salzburg, Austria) of the Northern Calcareous Alps comprises the Palaeocene-Eocene transition and spans the upper part of calcareous nannoplankton zone NP9 and the lower part of zone NP10 (subzone NP10a). These zones are equivalent to planktonic foraminifera zone P5 and the lower part of zone P6 (sub-zone P6a). The succession was deposited in a lower bathyal slope environment at a palaeodepth of about 2000 in. Within the dominantly marlstone succession, a 5.5-m-thick intercalation of red and green claystone and marly claystone represents the global negative carbon isotope excursion (CIE) which is used to recognize the Palaeocene-Eocene boundary. The CIE was associated with a shallowing of the calcite compensation depth by at least 1 km. Throughout the section, clay mineral assemblages are dominated by smectite, indicating a seasonal climate with alternating wet and dry conditions. A 49% increase in detrital quartz and feldspar within the CIE-interval suggests enhanced continental run-off This was probably the result of the establishment of a monsoonal setting, in which vegetation was sparse, while periodic high rainfall caused pronounced sediment transport. The increased terrestrially derived input is associated with abundant radiolarian casts indicating high primary productivity. This suggests that seasonal nutrient pulses resulting from intensified precipitation during the wet season have caused high surface-water fertility. The benthic foraminifera faunas of the samples rich in siliceous plankton are strongly dominated by *Glomospira* spp., *Nuttalides truempyii*, *Abyssamina poagi*, *Anomalinoides praeacutus*, *Anomalinoides nobilis*, and *Oridorsalis* spp. We assume that the *Glomospira-Nuttalides* fauna consists of opportunistic species which quickly react to seasonally varying amounts of food. The calcareous nannoplankton assemblage of the CIE-interval is characterized by the first occurrences of the genus *Rhomboaster* and of *Discoaster araneus* and *Discoaster mahmoudii*, whereas *Scapholithus apertus* become extinct at the Palaeocene-Eocene boundary. Within nannoplankton sub-zone NP10a, a series of primarily basaltic ashes give evidence for a major episode of explosive volcanism which can be correlated with the positive ash-series of the Fur-Formation in northern Denmark. The wide dispersal distance of the tephras implies Plinian-scale eruptions and multiple ejections of large volumes of pyroclastic material.

EHIRO, M., NOGI, D., MORI, K., KAWASHIMA, G., SUZUKI, N. & YOSHIHARA, K. 2001. Discovery of scleractinian corals from the limestone conglomerate in the Kuzumaki-Kamaishi Belt, Northern Kitakami Massif, northeast Japan and its significance. *Journal of the Geological Society of Japan* **107** (8), 531-534.

FENG, Q., GU, S., JIANG, M. & JIN, Y. 2004a. Two new radiolarian genera from the uppermost Permian of southern China. *Revue de Micropaléontologie* **47** (3), 135-143.

Two new genera (*Sinosphaera* and *Trigonosphaera*), including two new species and another left in open nomenclature, are described from the Changxingian (upper Permian) of southern Guangxi, southern China. They are characterized by a single spherical, subspherical or rounded triangular cortical shell composed of two spongy layers and the likely absence of both a medullary shell and internal spicule. They are tentatively grouped within the family Xiphostylidae Haeckel, 1881 and are considered as the most primitive representatives of this family.

FENG, Q. & LIANG, B. 2003. Ladinian radiolarian fauna from West Sichuan, China. *Revue de Micropaléontologie* **46** (4), 217-227.

A poorly preserved, but diversified radiolarian fauna was recovered from thin-bedded cherts occurring in the southeast of Daofu, Sichuan Province, southwestern China. Twenty-two radiolarian species belonging to 10 genera are identified and three new species (*Paroertlispongus daofuensis* n. sp., *Falcispongus heinzi* n. sp., *Falcispongus pauliani* n. sp.) are described. *Falcispongus heinzi* represents a transitional species between genera *Oertlispongus inaequispinosus* Dumitrica, Kozur and Mostler and *Falcispongus* Dumitrica. The fauna is divided into two assemblages, namely *Muelleritortis cochleata* and *Oertlispongus inaequispinosus* assemblages, which can be well correlated with the Ladinian radiolarian zones from Europe. The fauna indicates that basaltic rocks occurring in the Xianshuihe Belt were formed mainly during the Middle Triassic. Our results thus extend the previously known geological age of the Xianshuihe Belt to the Middle and Late Triassic interval.

FENG, Q. L., CHONGLAKMANI, C., HELMCKE, D. & INGAVAT-HELMCKE, R. 2004b. Long-lived Paleotethyan pelagic remnant inside Shan-Thai Block: Evidence from radiolarian biostratigraphy. *Science in China Series D-Earth Sciences* **47** (12), 1113-1119.

Newly identified radiolarians from ribbon chert in the Mae Hong Son-Mae Sariang area, northwestern Thailand covered Early Carboniferous, Late Permian, and Middle-Late Triassic in age, which indicate that there was a pelagic basin during the Late Paleozoic and Triassic in this region together with the published radiolarian biostratigraphic data. This basin is joined with the Chiang Dao and Changning-Menglian oceanic basins, which represent the main oceanic basin of Paleotethyan Archipelago Ocean. The main oceanic basin was situated in the traditional "Shan-Thai Block". Therefore, "the Shan-Thai Block" was not a single block during that stage, but composed of the Paleotethyan Ocean and two continental terranes that affiliated to Gondwana and Cathysian domains respectively.

FRISCH, W. & GAWLICK, H.-J. 2003. The nappe structure of the central Northern Calcareous Alps and its disintegration during Miocene tectonic extrusion - a contribution to understanding the orogeneic evolution of the Eastern Alps. *International Journal of Earth Sciences* **92**, 712-727.

FUNAKAWA, S. & NISHI, H. 2005. Late middle Eocene to late Oligocene radiolarian biostratigraphy in the Southern Ocean (Maud Rise, ODP leg 113, site 689). *Marine Micropaleontology* **54** (3-4), 213-247.

We propose a new biostratigraphic scheme comprising the *Eucyrtidium spinosum*, *Eucyrtidium antiquum* (new), *Lychnocanoma conica* (emended), *Clinorhabdus robusta* (emended) and *Stylosphaera radiosa* (emended) Zones, in ascending order, in Eocene to Oligocene sediments drilled on Maud Rise in Southern Atlantic Ocean (Site 689, Ocean Drilling Program Leg 113). The bases of these zones are defined by the lowermost occurrences of *E. spinosum*, *E. antiquum*, *L. conica*, *C. robusta* and the uppermost occurrence of *Axoprunum irregularis* (?), respectively. From correlation to the magnetostratigraphic data, the *E. spinosum*, *E. antiquum*, *L. conica*, *C. robusta* and *S. radiosa* Zones are assigned to the late middle Eocene through late Eocene (Subchrons C17n2 to C13r), earliest Oligocene (C13n to C11n), late early Oligocene (C11n to C10n2), early late Oligocene (C10n1 to C8r) and latest Oligocene (C8r to C7An), respectively. The four boundary datum levels and supplementary datum levels such as the lowermost occurrences of *A. irregularis* (?), *Dicolocapsa microcephala* and *Lithomelissa challengerae* may be recognized in other ODP sites in the Southern Ocean. The first occurrence of *E. antiquum* approximates the Eocene-Oligocene boundary in Southern Ocean but the last occurrences of many species such as *Periphaena decora*, *D. microcephala* and the *Lithomelissa sphaerocephalis* group are commonly diachronous between high latitude sites. Two new species, *Theocyrtis* (?) *triapenna* and *Spirocyrtis parvaturris*, are described.

GARSIA, M. O., SHERMAN, S. B., MOORE, G. F., GOLL, R. M., POPOVA-GOLL, I. M., NATLAND, J. H. & ACTON, G. 2005. Frequent landslides from Koolau Volcano: Results from ODP Hole 1223. *Journal of Volcanology and Geothermal Research (in press)*.

GAWLICK, H.-J., SCHLANGINWEIT, F., EBLI, O. & SUZUKI, H. 2004. Die Plassen-Formation (Kimmeridgium) des Krahstein (Steirisches Salzkamergut, Östereich) und ihre Unterkagerung: neue Daten zur Fazies, Biostratigraphie und Sedimentologie. *Zentralblatt für Geologie und Paläontologie, Teil 1* **2003** (3/4), 295-334.

GAWLICK, H. J., JANAUSCHEK, W., MISSONI, S., DIERSCHE, V. & ZANKL, H. 2003. Facies, stratigraphy and component analysis of polymict mass-flow deposits in Jurassic cherty sediments (Callovian-Oxfordian) of the Buchsenkopf in the Nationalpark Berchtesgaden and their significance for the tectonic and paleogeographic interpretation of the Berchtesgaden Calcareous Alps (Germany). *Neues Jahrbuch Fur Geologie Und Palaontologie-Abhandlungen* **228** (2), 275-304.

The Buchsenkopf locality with its mass-flow deposits/breccias occuring in cherty sediments is a key point for the tectonical and facies interpretation of the southern Berchtesgaden Calcareous Alps. New investigations on radiolarians of the cherty sediments and component analysis of the mass-flow deposits indicate: 1) Dark-grey to black cherty sediments on basis of the mass-flow deposits can be dated with radiolarians as upper Bathonian to lower Oxfordian (U.A.-Zones 7-8). Therefore these sediments are part of the Strubberg Formation. 2) The cherty matrix of the mass-flow deposits and intercalated sediments are dated by the radiolarian faunas as (middle Callovian to) early (-middle) Oxfordian (U.A.-Zone 8 and younger). Therefore these sediments are part of the Strubberg Formation and not as former postulated of the Tauglboden Formation. 3) The mobilized carbonate sequence of the mass-flow deposits and slides originated from the reef slope area of the Triassic carbonate platform (Gosausee limestone and Durrnberg Formation) and are dated by conodonts, foraminifera and microfacies as lower Norian to Pliensbachian. Components of Dachstein limestone (former interpretation) can not be confirmed. Therefore the Buchsenkopf is the continuation of the Lammer Basin to the west. In the type area components and slides in Gosausee limestone facies are missing. The reconstruction of the Lammer Basin fill is completed in the upper part. The evidence of the Buchsenkopf area for the tectonic interpretation of the Berchtesgaden Alps is discussed.

GERSONDE, R., CROSTA, X., ABELMANN, A. & ARMAND, L. 2005. Sea-surface temperature and sea ice distribution of the Southern Ocean at the EPILOG Last Glacial Maximum--a circum-Antarctic view based on siliceous microfossil records. *Quaternary Science Reviews* **24** (7-9), 869-896.

Based on the quantitative study of diatoms and radiolarians, summer sea-surface temperature (SSST) and sea ice distribution were estimated from 122 sediment core localities in the Atlantic,

Indian and Pacific sectors of the Southern Ocean to reconstruct the last glacial environment at the EPILOG (19.5-16.0 ka or 23 000-19 000 cal yr. B.P.) time-slice. The statistical methods applied include the Imbrie and Kipp Method, the Modern Analog Technique and the General Additive Model. Summer SSTs reveal greater surface-water cooling than reconstructed by CLIMAP (Geol. Soc. Am. Map Chart. Ser. MC-36 (1981) 1), reaching a maximum (4-5 [deg]C) in the present Subantarctic Zone of the Atlantic and Indian sector. The reconstruction of maximum winter sea ice (WSI) extent is in accordance with CLIMAP, showing an expansion of the WSI field by around 100% compared to the present. Although only limited information is available, the data clearly show that CLIMAP strongly overestimated the glacial summer sea ice extent. As a result of the northward expansion of Antarctic cold waters by 5-10[deg] in latitude and a relatively small displacement of the Subtropical Front, thermal gradients were steepened during the last glacial in the northern zone of the Southern Ocean. Such reconstruction may, however, be inapposite for the Pacific sector. The few data available indicate reduced cooling in the southern Pacific and give suggestion for a non-uniform cooling of the glacial Southern Ocean.This study is part of MARGO, a multiproxy approach for the reconstruction of the glacial ocean surface.

GILL, G. A., SANTANTONIO, M. & LATHUILIERE, B. 2004. The depth of pelagic deposits in the Tethyan Jurassic and the use of corals: an example from the Apennines. *Sedimentary Geology* **166** (3-4), 311-334.

Assessing the palaeobathymery of pelagic deposits is rather speculative, as proof through lithology or fossils significant for depth estimates is sparse. This is unfortunate as the bathymetric history of pelagic successions allows to conceive the evolution of continental margins and oceanic basins. Discoveries in coral biology bring an unexpected impact on basin analysis. Evidence strongly suggests that pennular corals, fossil and modern, constitute a zooxanthellate group with an outstanding specialization in colonizing deeper parts of the marine photic zone. This adaptation includes light amplification by autofluorescent pigmented cells, and particular feeding, witnessed by peculiar gastric ducts and skeletal features. Such corals occur in the Umbria-Marche and Sabina Apennines on top of Late Jurassic submarine highs and at basin margins. Values of palaeodepth relative to pelagic deposits are provided by corals and other environmental data. Because depth reconstruction involves classical Tethyan facies, such as Ammonitico Rosso, Aptychus limestone and radiolarian cherts, we must note that these results do not meet with actualistic models relying on carbonate dissolution for estimating depth. Deposits viewed as bathyal to abyssal could also have accumulated within, or just below, the photic zone. Thus, a new insight opens on Mesozoic bathymetries, regarding vast areas (Middle East to Caribbean) and on subjects ranging from platform drowning to regional extension styles.

GLEASON, J. D., MOORE, J., T.C., JOHNSON, T. M., REA, D. K., OWEN, R. M., BLUM, J. D., PARES, J. & HOVAN, S. A. 2004. Age calibration of piston core EW9709-07 (equatorial central Pacific) using fish teeth Sr isotope stratigraphy. *Palaeogeography, Palaeoclimatology, Palaeoecology* **212** (3-4), 355-366.

A high-resolution age-depth profile is presented for a 16-m deep-sea piston core (EW9709-PC07) using three different methods: magnetostratigraphy, fish-teeth strontium isotope stratigraphy, and radiolarian biostratigraphy. Fish teeth are abundant throughout the core, allowing for precise age determinations by Sr isotope stratigraphy. Magnetostratigraphic ages, though not available for this core, were determined by correlation with the drill core record from adjacent ODP Site 1218. Biostratigraphic ages were independently assigned to the lower 12 m of the core, which contains abundant radiolaria. All three methods define an early Miocene age ([not, vert, similar]20 Ma) for the core base. A linear sedimentation rate of [not, vert, similar]2.0 mm/ky was calculated for the lower 10 m of the core, which is dominated by siliceous clays and calcareous ooze. All three methods yield concordant ages over this interval ([not, vert, similar]20 to 15 Ma). Tectonic migration of the PC-07 site away from the equatorial high productivity zone produced a significant decrease in sedimentation rates after 15 Ma, diminishing to just [not, vert, similar]0.30 mm/ky in the uppermost 3 m of the core. Correlated magnetic reversal and fish teeth ages are concordant within this upper red clay interval ([not, vert, similar]10 to 0.0 Ma), which is dominated by eolian dust accumulation; however, within the 15 to 10 Ma interval, fish teeth ages appear to show more scatter, departing from the magnetic ages by as much as 2-3 million years. Age discrepancies in this dominantly siliceous clay interval are most likely due to uncertainties in magnetostratigraphic age correlations. We conclude from this that the eolian dust component in red clay cores can be reliably dated by the fish teeth strontium technique. For otherwise undatable red clay cores from the vast northern Pacific pelagic clay province, this may prove to be the only available method for developing a regional Cenozoic chrono-stratigraphy.

GONCUOGLU, M. C., KUWAHARA, K., TEKIN, U. K. & TURHAN, N. 2004. Upper Permian (Changxingian) radiolarian cherts within the clastic successions of the "Karakaya Complex" in NW Anatolia. *Turkish Journal of Earth Sciences* **13** (2), 201-213.

The arkosic sandstones with olistostromes within the "Karakaya Complex" in NW Anatolia to the south of Geyve include a thin layer of green chert with radiolaria. Based on the composition of Albaillellids, the radiolarian assemblage corresponds to the *Neoalbaillella ornithoformis* assemblage, and its age is assigned to the Changxingian (Late Permian). This is the first finding of synsedimentary radiolarian cherts within the Karakaya units and the indication of latest Permian rifting of the Karakaya basin within the Midian carbonate platform and its pre-Permian basement in the Sakarya Composite Terrane.

GORICAN, S., HALAMIC, J., GRGASOVIC, T. & KOLAR-JURKOVSEK, T. 2005. Stratigraphic evolution of Triassic arc-backarc system northwestern Croatia. *Bulletin De La Societe Géologique De France* **176** (1), 3-22.

Middle Triassic arc-related extensional tectonics in the western Tethys generated a complex pattern of intra-and backarc basins. We studied volcano-sedimentary successions of subsided continental-margin blocks (Mts. Zumberak and Ivanscica) and of dismembered incomplete ophiolite sequences interpreted as remnants of a backarc basin (Mts. Medvednica and Kalnik) in northwestern Croatia. We dated the successions with radiolarians, conodonts, foraminifers, algae, and sponges. The continental margin experienced a phase of accelerated subsidence in the late Anisian that was approximately coincident with the onset of intermediate and acidic volcanism; pelagic sediments with volcaniclastics accumulated atop subsided carbonate platforms. These relatively shallow basins were later infilled completely by prograding platforms in the late Ladinian-Carnian. In the backarc basin, sea-floor spreading initiated near the Anisian-Ladinian boundary and continued into the late Carnian. Pillow basalts were erupted and interlayered with radiolarian cherts and shales. The studied area was a part of a larger Triassic arc-backarc system preserved in the southern Alps, Alpine-Carpathian Belt, Dinarides, and Hellenides. Volcano-sedimentary successions of Mts. Medvednica and Kalnik are relics of the Meliata-Maliak backarc basin. In comparison to other previously dated oceanic remnants of this system, the longest continuous sea-floor spreading is now documented in one restricted tectonic unit.

GORICAN, S. & SMUC, A. 2004. Albian Radiolaria and Cretaceous stratigraphy of Mt. Mangart (western Slovenia). *Razprave 4. razreda SAZU (Ljubljana)* **45** (3), 29-49.

GUEX, J., BARTOLINI, A., ATUDOREI, V. & TAYLOR, D. 2004. High-resolution ammonite and carbon isotope stratigraphy across the Triassic-Jurassic boundary at New York Canyon (Nevada). *Earth and Planetary Science Letters* **225** (1-2), 29-41.

The Triassic-Jurassic boundary is generally considered as one of the major extinctions in the history of Phanerozoic. The high-resolution ammonite correlations and carbon isotope marine record in the New York Canyon area allow to distinguish two negative carbon excursions across this boundary with different paleoenvironmental meanings. The Late Rhaetian negative excursion is related to the extinction and regressive phase. The Early Hettangian delta(13)C(org) negative excursion is associated with a major floristic turnover and major ammonite and radiolarian radiation. The end-Triassic extinction-Early Jurassic recovery is fully compatible with a volcanism-triggered crisis, probably related to the Central Atlantic Magmatic Province. The main environmental stress might have been generated by repeated release of SO2 gas, heavy metals emissions, darkening, and subsequent cooling. This phase was followed by a major long-term CO2 accumulation during the Early Hettangian with development of nutrient-rich marine waters favouring the recovery of productivity and deposition of black shales.

HAAS, J. & TARDY-FILACZ, E. 2004. Facies changes in the Triassic-Jurassic boundary interval in an intraplatform basin succession at Csovar (Transdanubian Range, Hungary). *Sedimentary Geology* **168** (1-2), 19-48.

A continuous, pelagic marine Triassic-Jurassic boundary section is exposed in newly excavated trenches in the surroundings of Csovar, NE of Budapest, Hungary. In the late Triassic, this area was located close to the offshore margin of the Dachstein carbonate platform system that was segmented by intraplatform basins. Based on detailed facies analysis of the Rhaetian-Hettangian platform foreslope-basin succession, a long-term (second order) and superimposed shorter-term (third and fourth order) changes of the relative sea-level could be revealed. After a period of highstand platform progradation in the late Norian, large amounts of larger plant fragments and sporomorphs of continental plants mark a significant sea-level drop in the early Rhaetian, presumably exposing large parts of the platform. A renewed transgression led to the formation of smaller build-ups fringing the higher parts of the previous foreslope. Crinoid meadows may have occupied the slopes, a potential source area of the bioclastic carbonate turbidites. Rising relative sea-level that followed the marked early Rhaetian lowstand is also reflected in the general facies trend from lithoclastic debris-flows and proximal to the very distal turbidites and radiolarian basin facies up to the earliest Hettangian. Meter-scale high frequency (probably fourth order) deepening upward cycles, probably indicating sea-level oscillation, could also be recognized within this interval. At the base of the last Rhaetian cycle, about 10 m below the assumed Tr-J boundary, the amount of bioclasts, including conodonts, drastically decreases (biotic decline). In the radiolarian basin facies characterizing the topmost part of this cycle, a significant negative shift in both the delta(13)C(carb) and delta(13)C(org) and a marked decrease in the organic material (TOC) was recognized that can be interpreted to reflect reduced productivity in connection with the Triassic-Jurassic "boundary event". It is overlain by a lithoclastic horizon, then by laminites where the last conodonts were found. The next significant facies change in the early Hettangian is marked by appearance of redeposited oncoid-grapestone beds suggesting survival of shallow marine carbonate factories in the neighborhood of the basin and the end of the Rhatian to earliest Hettangian sequence (third order). The recurrence of basin facies above this interval indicates a new short-term (third order) transgression and continuation of the long-term (second order) deepening trend in the early Hettangian.

HAIG, D. W. 2005. Foraminiferal evidence for inner neritic deposition of Lower Cretaceous (Upper Aptian) radiolarian-rich black shales on the Western Australian margin. *Journal of Micropalaeontology* **24**, 55-75.

Diverse foraminifera, *Lingula*-like brachiopods and the geological setting indicate that Aptian radiolarian-rich black shales forming the Windalia Radiolarite were deposited at water depths probably less than 40 m in the Southern Carnarvon Basin. Elsewhere in Australia, coeval radiolarian-rich deposits are widespread in other western-margin basins and in vast interior basins. The organic-rich mudstones containing the radiolaria include the foraminiferal Ammobaculites Association, a sparse benthic macrofauna and kerogens of mainly terrestrial plant origin. The deposits suggest that there was substantial high-nutrient freshwater input into the epeiric seas as well as high levels of dissolved silica resulting from marine flooding of a mature silicate-rich landscape bordered on the eastern and western continental margins by large volcanic provinces. The widespread presence of organic-rich muds through the broad, shallow Southern Carnarvon Basin and through the coeval interior basins suggests that regional geomorphology controlled the distribution of eutrophic facies in the Australian Aptian rather than any global expansion of the oceanic oxygen minimum zone. The foraminiferal assemblage from the Windalia Radiolarite consists of calcareous hyaline benthic types (diverse Lagenida as well as abundant *Lingulogavelinella*, *Epistomina* and *Coryphostoma*) and organic-cemented agglutinated species (including common *Ammobaculites humei*, *Haplophragmoides-Recurvoides* spp., and *Verneuilinoides howchini*). Planktonic foraminifera are very rare and present only in the northern, more open part of the basin.

HALAMIC, J., MARCHIG, V. & GORICAN, O. 2005. Jurassic radiolarian cherts in north-western Croatia: geochemistry, material provenance and depositional environment. *Geologica Carpathica* **56** (2), 123-136.

The Middle Jurassic (uppermost Bajocian-lower Bathonian to upper Bathonian-lower Callovian) radiolarian cherts in the Medvednica Mt (NW Croatia) have a high content of SiO2 (average 90.87 %). Most of the silica is of biogenic origin as is indicated by a high Si/Si+Al+Fe+Ca ratio (0.83-0.97). The Al/Al+Fe+Mn ratio (average 0.59) and relatively low contents of Fe and Mn suggest that the sedimentation of the radiolarian cherts was not influenced by hydrothermal volcanisms. The high correlation coefficient between the lithophile elements Ti, K, Al, Th, Zr, Hf and Rb implies that the detrital component in radiolarian cherts for the most part has a terrigenous provenance. The MnO/TiO2 ratio and La-n/Ce-n vs. Al2O3/(Al2O3+Fe2O3) diagram show that the investigated cherts were derived from two different, but not necessarily strongly separated, sedimentation areas: (1) continental shelf and slope or marginal sea, and (2) deep ocean floor, trench or basaltic plateau. According to the proposed sedimentation model the radiolarian cherts in the Medvednica Mt were deposited in a relatively narrow basin. The detrital material was derived from two source areas: (1) from a continent (terrigenous input) and (2) from an accretionary wedge (undifferentiated magmatic arc-like input). During the Late Jurassic-Early Cretaceous the radiolarian cherts were incorporated into the tectonic melange (accretionary prism) along with other fragments: Triassic radiolarian cherts and carbonate rocks; Jurassic shales, siltites and sandstones and basic and ultrabasic magmatic rocks.

HANAGATA, S. & MIWA, M. 2002. Miocene-Pliocene microfossil biostratigraphy and paleoenvironment in the Fukaura district, Aomori Prefecture, northern Japan. *Journal of the Geological Society of Japan* **108** (12), 767-780.

HASHIMOTO, H., KOZAI, T. & ISHIDA, K. 2001. Jurassic and Early Cretaceous radiolarians reworked into the Upper Cretaceous Izumi Group, Izumi

Mountains. *News of Osaka Micropaleontologists, Special Volume* **12**, 271-282.

HASLETT, S. K. 2004. Late Neogene-Quaternary radiolarian biostratigraphy: a brief review. *Journal of Micropalaeontology* **23**, 39-47.

Since the 1950s, it has become apparent that Radiolaria have significant biostratigraphical potential throughout Phanerozoic time, including the Late Neogene and Quaternary. Radiolarian biozonation schemes for this period have been developed, including a Standard Tropical Zonation, which illustrates the pan-oceanic application of radiolarian biostratigraphy to Pliocene-Quaternary sediments. The biostratigraphical resolution obtainable using Radiolaria is equivalent to other microfossil groups, such as planktonic foraminifera. The recognition of abundance events of *Cycladophora davisiana*, and of some other species, are an alternative radiolarian dating technique for the Pliocene-Quaternary, akin to dating sediment using oxygen stable isotope (delta(18)O) records and with similar resolution. A number of studies have used astronomical timescales, derived from orbitally tuning delta(18)O and gamma ray attenuation porosity evaluator (GRAPE) records, to provide ages for radiolarian biodatums. This approach should be adopted as a more accurate alternative to palaeomagnetic chronologies with their inherent flaws. This commentary concludes that Radiolaria are important microfossils and, as a group, continue to offer significant potential as a biostratigraphical tool in future studies of the marine Pliocene-Quaternary.

HAYS, J. D. & MORLEY, J. J. 2003. The Sea of Okhotsk: A window on the ice age ocean. *Deep-Sea Research Part I-Oceanographic Research Papers* **50** (12), 1481-1506.

The modern Sea of Okhotsk and the high-latitude glacial ocean share similar radiolarian faunas suggesting they also share environmental similarities. This sea favors deep- (> 200 m) over shallow-living species as evidenced by collections of sediment traps set at 258 and 1061 m in the central part of the Sea. Of the twelve dominant polycystine radiolarian species, four live above and eight below 258 m. The shallow-living species' productivity maxima coincide with spring and fall phytoplankton blooms while deep-living species' annual production, nearly twice that of the shallow-living species, is concentrated in fall. Previous workers have shown that summer plankton tows collect higher concentrations of polycystine Radiolaria below than above 200 m and that Radiolaria, fish and zooplankton have unusual concentration maxima between 200 and 500 m. The paucity of Radiolaria and other consumers above 200 m coincides with an upper (0-150 m) cold (-1.5degreesC to 1.5degreesC), low salinity layer while higher concentrations below 200m occur within warmer saltier water. This unusual biological structure must produce a lower ratio of shallow (<200m) to deep carbon remineralization than elsewhere in the world ocean. Deep-living radiolarian species, similar to those of the modern Sea of Okhotsk, dominate glacial high-latitude deep-sea sediments. If the hydrographic and biological structures that produced these glacial faunas were like those of the modern Sea of Okhotsk, then glacial high-latitude oceans would have differed from today's in at least two respects. Surface waters were less saline and more stable enhancing the spread of winter sea ice. This stability, combined with a deepening of nutrient regeneration, reduced surface water nutrients contributing to a reduction of atmospheric carbon dioxide.

HE, W. H., FENG, Q. L., GU, S. Z. & JIN, Y. X. 2005. Changxingian (upper Permian) radiolarian fauna from Meishan D Section, Changxing, Zhejiang, China, and its possible paleoecological significance. *Journal of Paleontology* **79** (2), 209-218.

A well-preserved radiolarian fauna reported from the Changxing Formation in the Meishan D Section, Changxing, Zhejiang, China, mainly includes abundant *Entactinia itsukaichiensis*, *Grandetortura nipponica*, *Copicyntra robustodentata*, *Lepingosphaera stauracanthus*, and a few *Entactinia meishanensis* n. sp., *Entactinia*? sp., *Entactinosphaera cimelia*, *Triaenosphaera* sp., *Tetragregnon* sp., *Paracopicyntra ziyunensis*, *Copicyntroides* sp. cf. *C. asteriformis*, *Copicyntroides* sp., and *Ishigum trifustis*, with the conodont *Neogondolella subcarinata* Zone. One new species, *Entactinia meishanensis*, is described in this paper. This radiolarian fauna is characterized by low abundance and low diversity, and apparently occurred in a water depth of 150-200 m.

HEINZE, C. & DITTERT, N. 2005. Impact of paleocirculations on the silicon redistribution in the world ocean. *Marine Geology* **214** (1-3), 201-213.

A global biogeochemical ocean general circulation model with a representation of the marine silicon (Si) cycle including the bioturbated sediment zone is integrated into full equilibrium including for four different velocity fields: One preindustrial circulation under partial use of forcing data from an atmospheric model, one preindustrial circulation under use of climatological atmospheric forcing fields from measurements only, a circulation representing Last Glacial Maximum conditions, and one circulation reflecting the mid-Miocene ocean with an open Panama isthmus. Results of paleo-simulations are compared with a paleoceanographic sediment data base for opal. Marine Si budgets for the glacial and pseudo mid-Miocene oceans are presented under the same biogeochemical forcing. It turns out that the sediment distribution reacts sensitively to a switch between velocity fields while the overall budgets and fluxes between Si cycle compartments change only to a minor degree. This indicates that opal sediment has a considerable potential as a paleoceanographic tracer for ocean circulation and biological productivity.

HOLLIS, C. J., DICKENS, G. R., FIELD, B. D., JONES, C. M. & STRONG, C. P. 2005. The Paleocene-Eocene transition at Mead Stream, New Zealand: a southern Pacific record of early Cenozoic global change. *Palaeogeography Palaeoclimatology Palaeoecology* **215** (3-4), 313-343.

Mead Stream in Marlborough, New Zealand, exposes a spectacular 650-m-thick stratigraphic section of well-bedded micritic limestone, chert, and marl that was deposited on a South Pacific upper continental slope from Late Cretaceous to middle Eocene. The similar to200 in upper Paleocene-lower Eocene succession was examined for its lithology, bulk carbonate carbon isotopes, and assemblages of radiolarians, calcareous nannoplankton and foraminifera, so that it could be placed into a global context. The interval displays several prominent carbon isotope anomalies and is correlated with South Pacific Radiolarian Zones RP5 to RP9 and Calcareous Nannofossil Zones NP6-8 to NP12. Additionally, Planktic Foraminiferal Zones P4 to P6b are identified in uppermost Paleocene and lower Eocene strata. Mead Stream has a near-continuous Paleocene-lower Eocene sediment record, and three globally significant climate events-the late Paleocene carbon isotope maximum (PCIM), the initial Eocene thermal maximum (IETM), and the early Eocene climatic optimum (EECO)-have obvious expressions. The PCIM is a similar to50-m-thick interval of biosiliceous micritic limestone in which delta(13)C is similar to3%. The lower part contains two organic-rich biosiliceous mudstone units that may represent expansion of an oxygen minimum zone (OMZ) during a global increase in marine biological productivity. The IETM is a similar to4-m-thick interval in which delta(13)C drops below 1.5% in a pattern seen at other locations. The basal 2.4 in is a distinctive recessed marl-rich unit that is defined herein as the Dee Marl. The IETM is marked by a rapid decline in the nannoplankton genus *Fasciculithus*, short-lived occurrences of *Discoaster* cf. *araneus* and *Morozovella aequa aequa*, and significant radiolarian faunal turnover. Owing to impoverished benthic faunas, the benthic foraminiferal extinction event (BFEE) is poorly defined. The onset of the EECO is marked by a similar to1% negative delta(13)C excursion, a transition from limestone-rich to marl-rich facies, and a marked decrease in

radiolarian abundance. Compacted sedimentation rates vary between 1.4-2.7 cm/kyr for upper Paleocene-lower Eocene strata at Mead Stream. Although individual beds with average thickness of similar to10 cm were deposited too fast to directly represent cycles in orbital parameters, time series analysis of bed thicknesses suggests that groups of beds may record Milankovitch-scale periodicity, perhaps with a significant obliquity component. Thus, the relative frequency and thickness of marl and limestone beds in this section is shown to be strongly influenced by climatic changes at a wide range of temporal scales, from suborbital and orbital cycles to aberrant short-term events and long-term trends. Predominance of marl in IETM and EECO intervals indicates that episodes of extreme global warming resulted in reduced oceanic productivity and increased terrestrial discharge in the high-latitude.

HOLLIS, C. J. & NEIL, H. L. 2005. Sedimentary record of radiolarian biogeography, offshore eastern New Zealand. *New Zealand Journal of Marine and Freshwater Research* **39** (1), 165-192.

Examination of 38 surface sediment samples from offshore eastern New Zealand, between 33&DEG; S and 54&DEG; S, yielded 100 radiolarian taxa, which are common to abundant in sediments deposited at > 1000 m water depth but rare at shallower depths. In general, radiolarians are most abundant, most diverse, and best preserved in assemblages north of the Subtropical Front (STF). Multivariate analysis of census data for 29 radiolarian-rich samples identifies six sample groups and eight species groups. The STF forms a major biogeographic barrier, separating three transitional zone (TR) and three subantarctic zone (SA) sample groups. The three primary sample groups (TR1, TR2, SA1) record a southward latitudinal trend of decreasing abundance of subtropical-tropical or warm-water taxa (species group 4) and increasing abundance of subantarctic-Antarctic or cool-water taxa (species groups 7 and 8). Two secondary sample groups (TR3 and SA2) may record the influence of shallow-water processes or strong surface currents on either side of the STF. A distinctive sample group (SA3), characterised by low abundance and diversity, records relatively shallow, stratified, and silica-limited conditions of the central Campbell Plateau.

HOPSON, C. A. & PESSAGNO, E. A. 2005. Tehama-Colusa serpentinite melange: A remnant of Franciscan jurassic oceanic lithosphere, northern California. *International Geology Review* **47** (1), 65-100.

The Coast Range ultramafic belt that borders the Sacramento Valley is largely a serpentinite-matrix melange, called the Tehama-Colusa serpentinite melange (TCSM) after the counties it spans. It is bordered on the west across the Coast Range fault by exhumed high-P/T metamorphic rocks of the Franciscan subduction complex, and on the east, across the steep Stony Creek fault, by the Jura-Cretaceous lerriginous elastic strata of the Great Valley Group (GVG). Remnants of the Coast Range ophiolite (CRO) that lie stratigraphically beneath the basal GVG are exposed only at the northern end of the Tehama-Colusa serpentinite melange belt. The serpentinite protolith was peridotite tectonite (harzburgite > dunite), comprising oceanic upper mantle. Non-native melange blocks in the serpentinite are chiefly basaltic submarine lava and sparse radiolarian ribbon chert (Middle and early Late Jurassic), plus rare plutonic rocks and slaty argillite. The serpentinite melange protolith was basaltic oceanic crust above uppermost mantle, overlain by radiolarian chert and thin argillite (deep-sea clay?). An open-ocean setting, far from a continent margin or volcanic arc, is inferred from the absence of terriginous elastic or volcaniclastic sediments. The TCSM wraps around the Stonyford volcanic complex, a basaltic seamount that grew atop the basaltic oceanic crust during the late Middle and Late Jurassic. A widespread deep-sea tectonic event in the Late Jurassic disrupted the proto-TCSM upper mantle and crust. Pervasive hydration turned peridotite into serpentinite, which invaded and mixed with the basalt/chert, oceanic crust, creating melange. Possible causes are discussed. The TCSM basaltic lavas and radiolarian chert closely resemble Franciscan oceanic crustal (not seamount) rocks, and are within the Franciscan basalt/chert age span; they are unlike the CRO igneous assemblage and its Late Jurassic tuffaceous chert. The TCSM was a segment of Franciscan oceanic lithosphere that records only Jurassic open-ocean depositional and tectonic history. It escaped latest Jurassic-Cretaceous continent-margin and trench sedimentation, subduction, subduction accretion, high-P/T metamorphism, and exhumation of deeply subducted rocks that characterize the Franciscan Complex farther west in the Coast Ranges. The TCSM and CRO terranes are remnants of two different mid Jurassic paleoequatorial oceanic plates, separated now by the Stony Creek-Beehive Flat fault system. TCSM evolution involves four successive stages of Mesozoic tectonic history: (1) Late Jurassic, when the CRO oceanic plate was being drawn NNE toward the Great Valley subduction zone in front of the oceanic Nevadan are, trailed by TCSM (eastern Franciscan) lithosphere; (2) the latest Jurassic-earliest Cretaceous, when (a) N-S dextral transform faulting replaced earlier dextral oblique subduction, bringing the Jurassic TCSM/Franciscan oceanic plate northward alongside the unsubducted CRO plate remnant, and (b) terriginous sediments from the new Nevadan orogen spread progressively seaward across the CRO and adjacent TCSM/Franciscan Jurassic ocean floor; (3) resumption of eastward subduction in the Early Cretaceous, from a new trench lying farther west, caused (a) disruption, melanging, and metamorphism of the Tithonian-Valanginian elastic strata and underlying Jurassic (Franciscan) oceanic crust, and (b) underthrusting, uplift, and eastward tilting of the unbroken TCSM/CRO oceanic basement, forming a new forearc ridge; and (4) a post-Valanginian Cretaceous era when Franciscan subduction operated west of the TCSM/CRO submarine ridge, and GVG forearc basin sedimentation progressed behind the ridge on the east. The Stony Creek-Beehive Flat composite fault sytem between the TCSM and CRO was a dextral transform fault during stage 2 (Tithonian-Valanginian) and a W-vergent reverse fault during stage 3 (Valanginian), during underthrusting and tilting of TCSM/CRO basement. The extensional Coast Range fault, bounding TCSM on the west, brought up deeply subducted Franciscan Cretaceous high-P/T metamorphic rocks in the late Cretaceous (Jayko et al., 1987).

HORI, N. 2001. Triassic and Jurassic radiolarians from the chert-clastic sequence of the Takatori Unit in the Torinoko Block, Yamizo Mountains. *News of Osaka Micropaleontologists, Special Volume* **12**, 159-180.

HORI, N. 2004a. Jurassic radiolarians from chert and clastic rocks of the Chichibu Belt in the Toyohashi district, Aichi Prefecture, Southwest Japan. *Bulletin of the geological Survey of Japan* **55** (9/10), 335-388.

Jurassic radiolarians were detected from 19 samples of chert, 12 samples of siliceous mudstone and 26 samples of mudstone of the Chichibu Belt in Toyohashi district, Aichi Prefecture, Southwest Japan. 69 species belonging to 39 genera are identified, and are shown in plates with undescribed morphotypes as a database for further study. Based on Jurassic radiolarian biostratigraphy presented by Hori (1990) and Matsuoka (1995a), the geologic ages of the examined chert, siliceous mudstone and mudstone samples range from early Early Jurassic to middle Middle Jurassic, middle Early Jurassic to late Middle Jurassic and middle Early Jurassic to early Late Jurassic, respectively.

HORI, N. 2004b. Oceanic plate stratigraphy of the accretionary complex of the Chichibu Belt in the Toyohashi district, Aichi Prefecture, Southwest Japan. *Bulletin of the geological Survey of Japan* **55** (9/10), 271-285.

Accretionary complex of the Chichibu Belt in the Toyohashi district, Aichi Prefecture, Southwest Japan is tectonostratigraphically divided into Unit A, B and C by Niwa and Otsuka (2001). Based on the radiolarian biostratigraphy, the oceanic plate stratigraphy (OPS) of Unit A and Unit B (Niwa and

Otsuka, 2001) is reconstructed. The OPS of Unit A is composed of Lower Permian to upper Middle Jurassic chert, upper Middle Jurassic siliceous mudstone and upper Middle to lower Upper Jurassic mudstone, in ascending order. The OPS of Unit B consists of Lower Permian to lower Middle Jurassic chert, upper Lower to upper Middle Jurassic siliceous mudstone and middle Lower to lower Upper Jurassic mudstone, in ascending order. The duration of the deposition of mudstone of Unit B is much longer than that of the other tectonostratigraphic units of the Jurassic accretionary complexes in Japan. Furthermore, in Unit B, there is a mudstone deposited during Pliensbachian age which is older than the age of the boundary of chert and siliceous mudstone. These suggest that not only Unit B can be subdivided chronologically, but also the reexamination of the tectonostratigraphic division by Niwa and Otsuka (2001) is required.

HORI, N. 2004c. Permian radiolarians from bedded cherts in Mt. Zao, Tahara City, Aichi Prefecture. *News of Osaka Micropaleontologists, Special Volume* **13**, 1-11.

HORI, N. 2004d. Permian radiolarians from chert of the Chichibu Belt in the Toyohashi district, Aichi Prefecture, Southwest Japan. *Bulletin of the geological Survey of Japan* **55** (9/10), 287-301.

Permian radiolarians were detected from 30 samples of chert of the Chichibu Belt in Toyohashi district, Aichi Prefecture, Southwest Japan. 22 species belonging to 7 genera are identified, and are shown in plates with undescribed morphotypes as a database for further study. Based on Permian radiolarian biostratigraphy presented by Ishiga (1990) and Kuwahara et al. (1998), the geologic age of the examined chert samples ranges from Early Permian to Late Permian.

HORI, N. 2004e. Triassic radiolarians from chert of the Chichibu Belt in the Toyohashi district, Aichi Prefecture, Southwest Japan. *Bulletin of the geological Survey of Japan* **55** (9/10), 303-334.

Triassic radiolarians were detected from 68 samples of chert of the Chichibu Belt in Toyohashi district, Aichi Prefecture, Southwest Japan. 55 species belonging to 33 genera are identified, and are shown in plates with undescribed morphotypes as a database for further study. Based on Triassic radiolarian biostratigraphy presented by Sugiyama (1997), the geologic age of the examined chert samples ranges from late Early Triassic to Late Triassic.

HORI, N., SAITO, M. & TOSHIMITSU, S. 2002. Late Jurassic radiolarian fauna from the Ikenohara Formation of the Kurosegawa Belt in the Toyo-Izumi area, Kumamoto Prefecture, Kyushu, Japan. *Bulletin of the Geological Survey of Japan* **53** (9/10), 689-724.

HORI, N. & WAKITA, K. 2002. Jurassic radiolarians from manganese carbonate nodules from the Northern Chichibu Belt in the Ino district, Kochi Prefecture, Shikoku. *Journal of the Geological Society of Japan* **108** (7), 478-481.

HORI, N. & WAKITA, K. 2004. Reconstructed oceanic plate stratigraphy of the Ino Formation in the Ino district, Kochi prefecture, central Shikoku, Japan. *Journal of Asian Earth Sciences* **24** (2), 185-197.

The Ino Formation, which has been regarded as a member of the Kurosegawa terrane, is distributed in the Ino district, central Shikoku, Japan. It is composed of metamorphosed and unmetamorphosed rocks. Radiolarians in the Late Triassic to Early Jurassic strata are found in the unmetamorphosed components. The Late Triassic radiolarians were collected from chert and siliceous mudstone. The Early Jurassic radiolarians are discriminated from the siliceous mudstone and mudstone samples. Based on chronological data and findings from previous studies, the Oceanic Plate Stratigraphy (OPS) of the unmetamorphosed part of the Ino Formation is reconstructed as follows: Late Carboniferous to Late Triassic (or earliest Jurassic) bedded chert, Late Triassic (late Carnian) to Early Jurassic siliceous mudstone and Early Jurassic mudstone in ascending order. Based on this observation, it is confirmed that the unmetamorphosed part of the Ino Formation is an Early Jurassic accretionary complex. Its origin can be attributed to the Chichibu terrane. The reconstructed OPS of the unmetamorphosed part of the Ino Formation is possibly correlated to the Yusugawa, Sumaizuku and Kamiyoshida units of the Northern Chichibu terrane or the unknown oldest unit of the Southern Chichibu terrane.

HORI, R. S. & CAMPBELL, H. J. 2004. *Lingularia* sp. (Brachipoda) from Middle Triassic bedded chert in Shikoku, Japan. *Journal of the Geological Society of Japan* **110** (12), 758-764.

HORI, R. S., KURIMOTO, C. & GOTO, H. 2004. Radiolarian fossils from the Ikuno district, Hyogo Prefecture, Tamba Terrane, Southwest Japan. *News of Osaka Micropaleontologists, Special Volume* **13**, 59-68.

ISHIDA, K., ISHIDA, N., SAKAI, T., KOZAI, T., OHTA, T. & KIRILLOVA, G. L. 2002a. Radiolarians from the Khabarovsk section. *In:* (KIRILLOVA, G. L. eds). *Upper Jurassic-Cretaceous Deposits of East Asian Continental Margin along the Amur River. Field Excursion Guidebook*. 23-25. DVO RAN, Khabarovsk.

ISHIDA, K., ISHIDA, N., SAKAI, T., KOZAI, T., OHTA, T. & KIRILLOVA, G. L. 2002b. Radiolarians from the Komsomolsk section. *In:* (KIRILLOVA, G. L. eds). *Upper Jurassic-Cretaceous Deposits of East Asian Continental Margin along the Amur River. Field Excursion Guidebook*. 50-55. DVO RAN, Khabarovsk.

ISHIDA, K. & KOZAI, T. 2001. Radiolarian ages of pre-Cretaceous accretionary complexes in the Yoshigahira area, Chichibu Superterrane, East Shikoku. *News of Osaka Micropaleontologists, Special Volume* **12**, 129-144.

ISHIDA, K. & KOZAI, T. 2004. Stratigraphy and radiolarian ages of the Sakashu Group, South Kurosegawa Terrane (Sakashu) Belt in East Shikoku. *News of Osaka Micropaleontologists, Special Volume* **13**, 135-148.

ISHIDA, K., KOZAI, T., PARK, S.-O. & MITSUGI, T. 2003. Gravel bearing radiolaria as tracers for erosional events: a review of the status of recent research in SW Japan and Korea. *Journal of Asian Earth Sciences* **21** (8), 909-920.

The authors introduce a case study of research on the provenance of radiolaria-bearing gravels and clasts of the monomictic chert-pebble conglomerates in the Lower Cretaceous Monobegawa Group, a paralic molasse in the Outer Zone of Southwest Japan.

Reconstruction of oceanic plate stratigraphy from gravels and clasts in monomictic chert-pebble conglomerates based on their lithology and radiolarian ages is possible and effective for the provenance research in the case of the Monobegawa Group. A review of provenance studies of radiolaria-bearing gravels in Mesozoic orogenic sediments in SW Japan and Korea is included. The paper concludes with the discussion of the erosional events of the Jurassic and pre-Jurassic accretionary complexes in SW Japan with reference to the Late Mesozoic geological history in the eastern margin of Asian continent.

ISHIDA, K., SHIMAKAWA, M., KOZAI, T. & YAO, A. 2004. Oceanic-plate stratigraphy and radiolarian zonation of the Hegawa Section in northern South Chichibu Belt (Kurano Subbelt), East Shikoku. *News of Osaka Micropaleontologists, Special Volume* **13**, 181-195.

ISHIDA, N. 2004. Lithostratigraphy of Mesozoic strata and Late Jurassic radiolarian assemblages in the Southern Chichibu Terrane in the Hinohara area, southeastern part of the Kanto Massif, central Japan. *News of Osaka Micropaleontologists, Special Volume* **13**, 89-109.

ITAKI, T. 2001. Radiolarian faunal changes in the eastern Japan Sea during the last 30 kyr. *News of Osaka Micropaleontologists, Special Volume* **12**, 359-374.

ITAKI, T. 2005. Introduction to radiolarian study. *Fossils* **77**, 45-50.

ITAKI, T. & IKEHARA, K. 2004. Middle to late Holocene changes of the Okhotsk Sea Intermediate Water and their relation to atmospheric circulation. *Geophysical Research Letters* **31** (24).

High abundance of the radiolarian *Cycladophora davisiana* in the Sea of Okhotsk has been observed at the Okhotsk Sea Intermediate Water (OSIW). This water is formed by brine rejection in the polynya and is characterized by cold, oxygenated conditions, with high a microbial content. The *C. davisiana* abundance recorded in three sediment cores from the southwestern part of the sea implies ventilation changes of the OSIW during the last 7.5 kyrs. The ventilation had significantly increased during the interval from 7.5 to 3.5 ka corresponding to a warm period, but declined during 3 to 2 ka and at 0.3-0.4 ka coincident with cold periods such as the Neoglaciation and Little Ice Age, respectively. The declined ventilation might be caused by reduction of the polynyas with the wind vector change from a northerly to an easterly direction relating to the southward shift of the Aleutian Low during the strong winter.

ITAKI, T. & NOJO, A. 2004. Radiolarian biostratigraphy from the Neogene Kuromatsunai Formation in the Imakane area, southwestern Hokkaido, Japan. *Journal of the Geological Society of Japan* **110** (5), 325-328.

IWAKI, M. & OTSUKA, T. 2001. Geology and radiolarian fossils of the Misogawa Complex in the Asahi and Kiso Villages, eastern Mino Terrane, Central Japan. *News of Osaka Micropaleontologists, Special Volume* **12**, 215-226.

JACOT DES COMBES, H., PIERRE CAULET, J. & TRIBOVILLARD, N. 2005. Monitoring the variations of the Socotra upwelling system during the last 250 kyr: A biogenic and geochemical approach. *Palaeogeography,Palaeoclimatology,Palaeoecology* **223** (3-4), 243-259.

A combination of changes in the species composition of the radiolarian populations, and in the sediment chemical composition (content and mass accumulation rates of carbonate, organic carbon, and selected major and trace elements, with special attention paid to Ba) is used to reconstruct the variations in upwelling activity over the last 250 kyr in the Socotra gyre area (Somali-Socotra upwelling system, NW Indian Ocean).In the Socotra gyre (Core MD 962073 at 10[deg]N), the variations in upwelling intensity are reconstructed by the upwelling radiolarian index (URI) while the thermocline/surface radiolarian index (TSRI) testifies to productivity variations during non-upwelling intervals. Despite an origin related both to marine and terrigenous inputs, the geochemical records of organic carbon, silica, and trace elements (Ba, P, Cu, and Zn) normalized to Al are controlled by the variations in surface paleoproductivity. The data indicate a continuous increase in upwelling intensity during the last 250 kyr with a maximum activity within the MIS 3, while high productivity periods in between the upwelling seasons occurred both during glacial and interglacial intervals.A comparison of our data with published observations from another gyre of the Somalian upwelling area located at 5[deg]N in the Somali gyre area shows differences regarding periods of upwelling activity and their geochemical imprint. Three hypotheses are proposed to explain these differences: (1) changes in the planktonic community, resulting in more silica-rich deposits in the Socotra gyre, and more carbonate-rich deposits in the Somali gyre, that are controlled by differences in the source water of the upwelling; (2) a more important terrigenous input in the southern gyre; and (3) a different location of the sites relative to the geographic distribution of the upwelling gyres and hydrologic fronts.

KAMATA, Y. & MIZOBE, S. 2001. Co-occurrence of an Early Jurassic ammonite and Middle Jurassic radiolarians in the Kuzu Comlex of the Ashio Belt, central Japan and its stratigraphic bearing. *News of Osaka Micropaleontologists, Special Volume* **12**, 191-201.

KAMATA, Y., MIZOBE, S. & SATO, T. 2003. An Early Jurassic ammonite from a limestone conglomerate in the Kuzu Complex of the Ashio Belt. *Paleontological Research* **7** (3), 185-194.

KAMETAKA, M., TAKEBE, M., NAGAI, H. & ZHU, S. 2002. Sedimentary petrography of the Middle Permian Gufeng Formation in the Chaouhu area, Anhui Province, China. *Bulletin of the Nagoya University and Museum*.

KAMETAKA, M., TAKEBE, M., NAGAI, H., ZHU, S. & TAKAYANAGI, Y. 2003. The origin of bedded radiolarian chert from the Middle Permian Gufeng Formation, Chaohu area, Anhui Province, China. *Geochimica Et Cosmochimica Acta* **67** (18), A196-A196.

KAMETAKA, M., TAKEBE, M., NAGAI, H., ZHU, S. & TAKAYANAGI, Y. 2005. Sedimentary environments of the Middle Permian phosphorite-chert complex from the northeastern Yangtze platform, China; the Gufeng

Formation: a continental shelf radiolarian chert. *Sedimentary Geology* **174** (3-4), 197-222.

Radiolarian chert deposited on a continental shelf occurs in the Middle Permian Gufeng Formation on the northeastern Yangtze platform, China. The sedimentary environments of radiolarian cherts from accretionary complexes have been well studied; however, there are few studies about radiolarian chert deposited on continental shelves. Therefore we have completed a sedimentological and geochemical study of the Gufeng Formation. The Gufeng Formation is subdivided into the Phosphate Nodule-bearing Mudstone Member (PNMM) and the Siliceous Rock Member (SRM) in ascending order. The basal PNMM consists of glauconite-bearing mudstone, which indicates deposition under aerobic shallow-marine conditions, whereas the upper PNMM is composed of mudstone including abundant phosphate nodules, suggesting deposition near the outer shelf in suboxic conditions. The SRM consists mainly of alternating beds of black chert, mudstone, and siliceous mudstone, with minor tuffaceous mudstone and porous chert beds. The black chert contains abundant radiolarians, sponge spicules, and organic matter. Framboidal pyrite occurs in the black chert. Porous chert in the SRM includes abundant rhombohedral cavities, which are dolomite moulds surrounded by quartz, suggesting dolomitization before silicification during early diagenesis. The Gufeng Chert is characterized by high Si, Mo, Ni, Cu, and Zn contents, and extremely low Mn content. The Gufeng Chert has high normal paraffin concentrations with petroleum-like markers. These geochemical features suggest that the Gufeng Chert was deposited under sulfate-reducing conditions; and is not hydrothermal, but rather biogenic in origin. The sedimentological and geochemical data suggest that the Gufeng Formation was deposited mainly on the outer shelf in suboxic-anoxic conditions caused by organic matter produced during upwelling. The upwelling probably led to high radiolarian productivity. Abundant silica and organic matter were deposited in the Gufeng basin. Compared with chert from other sites, the Gufeng Chert shows many similarities with chert from platformal basins, but not with chert from accretionary complexes. Especially, with respect to age, rock type, stratigraphy, and geochemical features, the chert of the Gufeng Formation is similar to that of the Phosphoria Formation in the western U.S.A., which is a world-class phosphorite giant. These similarities suggest that upwelling occurred around the eastern margins of Panthalassa and the Paleotethys concurrently during the Middle Permian. In general, shelf-type radiolarian chert, represented by the Gufeng Chert, usually shows some of the following features: dark color, lack of rhythmical bedding, association with phosphorite, platformal limestone, felsic ruff, abundant organic matter, and sulfides. Shelf-type radiolarian chert is deposited in a poorly aerated restricted basin, or in an oxygen-minimum zone.

KARIMINIA, S. M. 2004. Extraction of calcified Radiolaria and other calcified microfossils from micritic limestone utilizing acetic acid. *Micropaleontology* **50** (3), 301-306.

Micrite nodules are the only source of Radiolaria within the upper Tithonian to Aptian (Upper Jurassic-Lower Cretaceous) interval of Great Valley Supergroup (GVS), California Coast Ranges. Radiolaria recovered from GVS micrite nodules are either calcified or pyritized. This paper describes a method of extracting well preserved calcified radiolaria from micrites utilizing acetic acid. The same method resulted in the extraction of well preserved Upper Cretaceous plank-ionic foraminifera from indurated micrite within the Khoy ophiolitic complex of northwestern Iran; from micrite in the Green Horn Formation, Pueblo Colorado: from indurated chalk in the Austin Chalk, Dallas Texas. and from indurated micrite in Albian Duck Creek Formation of Texas. The preservation of extracted radiolaria and planktonic foraminifera from the indurated micrites and chalk is excellent and is often comparable to that found in most DSDP/ODP samples. Assumedly the clay content of the rock. and the chemical homogeneity of the calcified test are the principal reasons for differential solution of the acetic acid.

KARNAUKHOV, V. N. & YASHIN, V. A. 2003. A spectral study of single cells of sea microplankton. History and perspectives. *Biofizika* **48** (5), 940-949.

Methods and instruments for the spectral analysis of single cells of sea microplankton under the conditions of expeditions to the Mediterranean Sea and tropical zone of the Atlantic Ocean were proposed. Special emphasis was given to the ways of adaptation of sea microplankton communities to unfavorable environment with the formation of autotrophic and heterotrophic symbiont organisms (Radiolarian, Foraminifera, etc.) having closed cycles of phosphate metabolism and variotrophic microorganisms (Cyanophyceae and Dinoflagellata class).

KASHIWAGI, K., NIWA, M. & TOKIWA, T. 2005. Early Jurassic radiolarians from the Chichibu Composite Belt in the Sannokou area, central Kii Peninsula, Southwest Japan. *Journal of the geological Society of Japan* **111** (3), 170-181.

Early Jurassic radiolarians were recovered from the Sannokou Complex, which is a part of the accretionary complex of the Chichibu Composite Belt in the central Kii Peninsula, Southwest Japan. The Sannokou Complex, which tectonically overlies the Middle Jurassic to middle Early Cretaceous complexes, predominantly consists of thickly bedded sandstone with conglomerate and mudstone intercalations; and minor amounts of siliceous mudstone, bedded chert, and sheared mudstone including various kinds of blocks. Radiolarian fossils were extracted from three and four samples of siliceous mudstone and chert, respectively. The siliceous mudstone samples bear well-preserved radiolarians, which are assigned to be early and middle Toarcian of late Early Jurassic in age. Age of cherts, ranging from Sinemurian to Pliensbachian, is slightly older than that of siliceous mudstone. It has been argued that the Chichibu Composite Belt in the central Kii Peninsula has been divided into seven complexes. Furthermore the six complexes except the Sannokou Complex are tectonically stacked with a downward-younging polarity from early Middle Jurassic to middle Early Cretaceous due to radiolarian biochronology. On the basis of occurrences of Early Jurassic radiolarians, the Sannokou Complex, which occupies the uppermost tectonic horizon in the Chichibu Composite Belt, shows the older age than these complexes. Thus the tectonic stacking with a downward-younging polarity can be recognized overall in the Chichibu Composite Belt of the central Kii Peninsula.

KAWAI, M. & TAKEUCHI, M. 2001. Permian radiolarians from the Omi area in the Hida-gaien Tectonic Zone, central Japan. *News of Osaka Micropaleontologists, Special Volume* **12**, 23-32.

KAWAKAMI, S. 2001. Upper Miocene radiolarians from the Nishizaki Formation and Ishido Group in the southern part of Boso Peninsula, Japan, and their geological significance. *News of Osaka Micropaleontologists, Special Volume* **12**, 343-358.

KAWAKAMI, S. 2004. Reexamined geology of Mineoka Tectonic Zone, Boso Peninsula, Japan, from the age of Tertiary radiolarians and gravelly rocks. *News of Osaka Micropaleontologists, Special Volume* **13**, 197-204.

KAWAMURA, Y. & SASHIDA, K. 2004. Cretaceous radiolarians from the eastern part of the Sanchu Cretaceous System, Kanto Mountains, central Japan. *News of Osaka Micropaleontologists, Special Volume* **13**, 167-180.

KEMKIN, I. V. & TAKETANI, Y. 2004. New radiolarian species from Late Jurassic chert-terrigenous deposits of the Taukha Terrane, Southern Sikhote-Alin. *Paleontological Research* **8** (4), 325-336.

KIDDER, D. L. & MUMMA, S. A. 2003. Silica-replaced oolites, bedded shelf cherts and Paleozoic changes in the silica cycle. *Sedimentary Geology* **162** (3-4), 159-166.

Oolites that were replaced by early diagenetic silica and were not reworked from their original depositional setting can serve as a useful tool to evaluate a previously suggested retreat of biosiliceous facies from peritidal environments to deeper water settings in the Early Paleozoic. The silica-replaced oolites suggest that the retreat was largely over by the Middle Ordovician, which is consistent with emerging compilations of the spatial and temporal distribution Ordovician cherts. Whether the retreat was a function of declining concentration of dissolved silica in shallow marine waters or of radiation of faunas from nearshore into offshore settings or some combination of both is an issue that may be clarified with improved resolution of the timing of the retreat. A small Upper Carboniferous peak in silica-replaced oolite abundance coincides with a minor rebound in shelf chert accumulation and the common presence of coastal flint deposits in Upper Carboniferous cyclothems, suggesting that cherty facies returned to shallow water environments at this time.

KNOLL, A. H. 2003. Biomineralization and evolutionary historyeds). *Biomineralization* Reviews in Mineralogy & Geochemistry **54**. 329-356.

KOBAYASHI, Y. & OTSUKA, T. 2002. Subduction-accretion process from deformation features and illite crystallinity of the Jurassic Samondake Unit in the Mino terrane, central Japan. *Journal of the Geological Society of Japan* **108** (1), 59-73.

KOJIMA, S., AHMAD, T., TANAKA, T., BAGATI, T. N., MISHRA, M., KUMAR, R., ISLAM, R. & KHANNA, P. 2001. Early Cretaceous radiolarians from the Indus suture zone, Ladakh, northern India. *News of Osaka Micropaleontologists, Special Volume* **12**, 257-270.

KOWALEWSKI, M. & HOFFMEISTER, A. P. 2003. Sieves and Fossils: Effects of Mesh Size on Paleontological Patterns. *Palaios* **18** (4), 460-469.

Bulk samples are among the foremost sources of quantitative data retrieved from the fossil record. However, such samples are not sieved in a uniform way, even among research projects with a very similar research focus. Several studies recently have demonstrated the sensitivity of paleontological patterns to changes in sieve size and underscored the importance of controlling for mesh size in paleontological analyses. Building on previous work, this study exploits a large dataset of Miocene mollusks that is fortuitously suitable for exploring the effect of mesh size: dimensions of each fossil were measured, all samples were acquired with fine screens (<=1 mm mesh), and data for numerous paleoecological and taphonomic variables were obtained for each specimen. This large dataset was sieved artificially (i.e., subsampled in computer simulations) to explore the effects of mesh size. The results show that paleontological variables, from taphonomic and paleoecological parameters to diversity indices, can fluctuate, to various degrees, as a function of mesh size. Some parameters (e.g., evenness indices) appear remarkably invariant to mesh size, while others (e.g., encrustation rate) can vary dramatically with a small change in mesh size. Most importantly, even when the compared datasets are sieved uniformly with the same standard mesh size, outcomes of comparative analyses can lead to disparate conclusions when that standard size is changed. The mesh-size sensitivity observed here for a wide assortment of paleontological patterns points to ubiquitous influence of body size on taphonomic, ecological, and evolutionary patterns and underscores the importance of developing sampling strategies and/or corrective analytical measures for making data more comparable in terms of mesh size across and within studies. Future research also should concentrate on evaluating secular trends in size-filtering aspects of extraction methods used to acquire quantitative samples throughout the Phanerozoic fossil record.

KOZAI, T., ISHIDA, K. & KONDO, Y. 2004. Radiolarian ages and bivalve fauna of the Birafu Formation, central Shikoku. *News of Osaka Micropaleontologists, Special Volume* **13**, 149-165.

KUMAR, S. G., KOZO, T. & SHANKAR, D. V. 2004. Taxonomy and distribution of Pleistocene radiolarians from the Tasman region. *Neues Jahrbuch Fur Geologie Und Palaontologie-Abhandlungen* **231** (3), 297-347.

The paper presents a first comprehensive account of Pleistocene radio-larians based on 93 samples from a piston core (KH 94-4 TSP-4 PC) in the Tasman region of the Southern Ocean. Taxonomy, morphological variations and distribution of 83 radiolarian taxa are described and compared with those from other regions. 83 radiolarian species were identified and described from the Pleistocene sequence. Two radiolarian zones were recognized in the core. A few new taxa were encountered and described but they have not been formally named.

KURIHARA, T. 2003a. Early Devonian Palaeoscenidiidae (Radiolaria) from the "Yuoshiki Formation" in the Fukuji area of the Hida-gaien Terrane, central Japan, and its biostratigraphic significance. *Journal of the Geological Society of Japan* **109** (11), 635-647.

KURIHARA, T. 2003b. Stratigraphy and geologic age of the Middle Paleozoic strata in the Kuzuryu Lake - Upper Ise River area of the Hida-gaien Terrane, central Japan. *Journal of the Geological Society of Japan* **109** (8), 425-441.

KURIHARA, T. 2004. Silurian and Devonian radiolarian biostratigraphy of the Hida Gaien belt, central Japan. *Journal of the Geological Society of Japan* **110** (10), 620-639.

Silurian and Devonian radiolarian biostratigraphy was studied for tuffaceous clastic rocks developed in the Fukuji - Hitoegane and Kuzuryu Lake - Upper Ise River areas of the Hida Gaien belt, central Japan. The objective of the study was to improve chronostratigraphic calibration of these intervals and to discuss local correlation among the Middle Paleozoic strata in Japan. Radiolarian zones characterized by eight distinctive assemblages have been defined in the seven measured sections, as follows: *Haplotaeniatum tegimentum* - *Syntagentactinia excelsa* (middle to upper Llandovery), *Fusalfanus osobudaniensis* - *Secuicollacta itoigawai* (lower Ludlow), *Zadrappolus spinosus* - *Praespongocoelia parva* (lower or middle Ludlow), *Stylosphaera* (?) *magnaspina* (upper Ludlow), *Pseudospongoprunum* (?) *tauversi* (lower to middle Pridoli), *Futobari solidus* - *Zadrappolus tenuis* (lower or middle Pridoli to Lower Devonian), *Palaeoscenidium ishigai* - *Deflantrica furutanii* (Lochkovian or Pragian to lower Emsian), and *Pactarentinia intermedia* - *Pactarentinia igoi* (lower Emsian) Assemblage Zones. Age control is based on the stratigraphic relationship between the zones, other fossils, and

correlation with other radiolarian zones established in the southern Urals, west Texas, and the Kurosegawa belt, Southwest Japan. Biostratigraphic correlations clearly show that Ludlow to Emsian tuffaceous clastic rocks of deep-water origin in the Hida Gaien belt are exceedingly similar to those in the Kurosegawa and South Kitakami belts in depositional age. It provides a constraining link between these terranes during the early evolutionary stage of their geologic history.

KURIHARA, T. & MATSUOKA, A. 2004. Shell structure and morphologic variation in *Spongosphaera steptacantha* Haeckel (Spumellaria, Radiolaria). *Science Reports of Niigata University, Series E, (Geology)* **19**, 35-48.

The detailed shell structures of Spongosphaera streptacantha Haeckel collected from the Sea of Japan, off Tassha, Aikawa Town, Sado Island, Niigata Prefecture, central Japan, are described based on high magnification SEM and transmitted light microscopic observations. The shell of *S. streptacantha* consists of a dodecahedral inner microsphere, spherical latticed outer microsphere, long three-bladed main spines arising from the surface of the outer microsphere, and a surrounding three-dimensional spongiose network. Main spines commonly number six or seven, rarely eight or nine, and the number shows no correlation with the size of the spongiose shell. Results of observations on 19 individuals reveal that the differences between the number and arrangement of the main spines and size, shape, and density of a spongiose shell produce morphologic variations in *S. streptacantha*. Since variability of the spongiose shell depends largely on the number of the main spines and the crude density of sponge-forming apophyses, morphologic variation of *S. streptacantha* has much to do with how many main spines arise from the outer microsphere during the early ontogenic process.

KURIHARA, T. & MATSUOKA, A. 2005. Shell variability of *Pseudocubus obeliscus* Haeckel in the early autumn radiolarian fauna off Tassha, Sado Island, central Japan. *Science Reports of Niigata University, Series E, Geology and Mineralogy* **20**, 29-45.

KURIHARA, T., SATO, Y. & TAZAWA, J.-I. 2005. Early Devonian radiolarians from the Ohno Formation in the Hikoroichi area of the South Kitakami Belt, Northeast Japan. *Journal of the geological Society of Japan* **111** (3), 187-190.

The following four species of Early Devonian radiolarians have been discovered from felsic tuff of the lower part of the Ohno Formation in the Hikoroichi area of the South Kitakami Belt, Northeast Japan: *Protoholoeciscus hindea* Aitchison, *Protoholoeciscus triangularis* (Wakamatsu, Sugiyama and Furutani) , *Glanta* sp. cf. *G. fragilis* Wakamatsu, Sugiyama and Furutani, and *Tlecerina horrida* Furutani. The radiolarian fauna is correlated with the *Tlecerina-Glanta* Assemblage recognized in the Devonian of the Kurosegawa Belt, Southwest Japan. This fauna is no older than Lochkovian or Pragian and is no younger than Emsian, considering comparisons to other Devonian radiolarian assemblages. This age assignment is consistent with macroinvertebrate age constraints of the Ohno Formation and the stratigraphic relationship to the overlying Eifelian Nakazato Formation. Based on the occurrence of these radiolarians, the Ohno Formation can be correlated with the Nakahata Formation of the Kurosegawa Belt.

KUSUNOKI, T., OHARA, M. & MUSASHINO, M. 2004. Carboniferous-Permian microbiostratigraphy in chert sequence from the southeastern part of the Tamba Belt, Shizukawa District, Uji City (online note). *Earth Science, Journal of the Association for the geological Collaboration in Japan* **58** (1), 37-54.

We discovered the Permian chert block with alternating beds of chert and dolarenite, which are well exposed in the Shizukawa district, the Mt. Kisenyama area in the right bank of the Ujigawa river of the southern Tamba terrane. There are several intercalations of dolarenite layer in its lower part of the chert. In this continuous outcrops of bedded chert block, conodonts and radioralians were obtained from 52 chert samples. As a result of the investigation, it is clear that the Shizukawa section ranges in age from late Late Carboniferous to late Late Permian (Changhsingian). The C/P boundary in this Shizukawa section is presumed to be existed somewhere between the sample no.3 and the sample Se. This Sizukawa section is correlative with the Kasugabe section of chert and dolostone alternating beds from Southern Kameoka City.

KUWAHARA, K. & KAKUWA, Y. 2004. Relative frequencey of radiolarians and sponge spicules in Permian bedded chert from Ohmori section, Tamba Belt. *News of Osaka Micropaleontologists, Special Volume* **13**, 13-20.

KUWAHARA, K. & YAMAKITA, S. 2001. Microbiostratigraphy on chert facies of Upper Permian in the Northern Chichibu Belt, Shikoku, Southwest Japan. *News of Osaka Micropaleontologists, Special Volume* **12**, 51-59.

KUWAHARA, K. & YAO, A. 2001. Late Permian radiolarian faunal change in bedded chert of the Mino Belt, Japan. *News of Osaka Micropaleontologists, Special Volume* **12**, 33-49.

KUWAHARA, K. & YAO, A. 2004. Analysis of radiolarian fossil assemblage using "model of steady faunal change". *Geoinformatics* **15** (3), 151-157.

KUWAHARA, K., YAO, A. & MIZUTANI, S. 2004a. Database of Japanese radiolarian literatures - 2004 CD Version -. *News of Osaka Micropaleontologists, Special Volume* **13**, 229-232.

KUWAHARA, K., YAO, A., YAO, J. & LI, J. 2004b. Late Permian radiolarians and sponge spicules from the Tongtiayan section, Liuzhou, Guangxi, China. *Journal of Geosciences, Osaka City University* **47**, 85-99.

Late Permian radiolarians were found from chert and siliceous mudstone of the "Gufeng Formation" in the Tongtianyan section, Liuzhou, Guangxi, China. The radiolarian assemblage includes *Latentifistula similicutis*, *Foremanhelena* aff. *triangula*, and *Hegleria mammilla*, with a small amount of *Albaillella cavitata* and *Albaillella yamakitai*. Since the radiolarian-bearing strata are correlated to the Upper Permian *Follicucullus charveti-Albaillella yamakitai* Assemblage Zone, the Upper Permian Dalong Formation is thought to be present in this area. These strata should be separated from the Middle Permian Gufeng Formation. The relative abundance of radiolarians and sponge spicules was examined at each sampling horizon. The abundance of sponge spicules increases.

LARGHI, C., CORDEY, F., CORRADINI, C., GAETANI, M. & NICORA, A. 2005. Palaeozoic (Silurian and Devonian) radiolarians and conodonts from chert olistoliths of the Volissos Turbidites, Chios island, Greece. *Eclogae geologicae Helvetiae (In press)*.

LAZARUS, D. **2005**. A brief review of radiolarian research. *Paläontologische Zeitschrift* **79** (1), 183–200.

The biosiliceous shells of radiolarian zooplankton are common fossils since the Cambrian. With several hundred species living in all ocean regions and at all water depths, their fossils provide a richly detailed record of Phanerozoic oceans and biological evolution for study. Radiolarians have been employed with great success in studies of climate change (e. g. CLIMAP), in biostratigraphic dating of both Cenozoic deep-sea sediments and more ancient sedimentary rocks, often in metamorphosed tectonic terranes, and in studies of evolutionary processes, including speciation and factors controlling macroevolutionary change in entire faunas. More recently radiolarians have been employed to understand productivity change in the oceans, using the ratio of surface to deep-water species as an organic carbon export indicator. Radiolarian research, while successful, is still limited by poor knowledge of the biology of the group, and by incomplete taxonomy, even at the most basic level of species descriptions.

LAZARUS, D., FAUST, K. & POPOVA-GOLL, I. 2005. New species of prunoid radiolarians from the Antarctic Pliocene and Miocene. *Journal of Micropaleontology (in press)*.

LI, Y. J., SUN, L. D., WU, H. R., ZHANG, G. Y., WANG, G. & HUANG, Z. B. 2005. Permo-Carboniferous radiolarians from the Wupata'erkan Group, western South Tianshan, Xinjiang, China. *Acta Geologica Sinica-English Edition* **79** (1), 16-23.

The Wupata'erkan Group, also called Wupata'erkan Formation, distributed in the South Tianshan, Xinjiang, China, mainly consists of gray and dark gray fine-grained elastic rocks, interlayered with volcanic rocks, carbonates and cherts. Some ultra-basic rocks (blocks) punctuate the formation. The formation was variously assigned to Silurian-Middle Devonian, Silurian-Lower Devonian, and pre-Devonian, mainly based on *Atrypa bodini* Mansuy, *Hypothyridina parallelepipedia* (Brour.) and *Prismatophyllum hexagonum* Yoh collected from the limestone interlayers, respectively. However, radiolarian fossils obtained from 24 chert specimens of the Wupata'erkan Group, mainly include *Albaillella* sp. cf. *A. undulata* Deflandre, *Albaillella* sp. cf. *A. paradoxa* Deflandre, *Albaillella* cf. *A. deflandrei* Gourmelon, *Albaillella* sp. cf. *A. indensis* Won, *Albaillella* sp. cf. *A. excelsa* Ishiga, Kito and Imoto, *Albaillella* sp. and Latentifistulidae gen. et. sp. indet., are earliest Carboniferous and Late Permian. The earliest Carboniferous assemblage is characterized by *Albaillella* sp. cf. *A. undulata* Deflandre, *Albaillella* sp. ef. *A. paradoxa* Deflandre, *Albaillella* cf. *A. deflandrei* Gourmelon and *Albaillella* sp. cf. *A. indensis* Won, and the Late Permian assemblage by *Albaillella* sp. cf. *A. excelsa* Ishiga, Kito and Imoto. This new stratigraphic evidence indicates that the Wupata'erkan Group is possibly composed of rocks with different ages from Silurian to Permian, and therefore, it is probably an ophiolite melange. The discovery of Late Permian *Albaillella* sp. ef. *A. excelsa* provides more reliable evidence supporting the existence of a Permian relic ancient oceanic basin in the western part of Xinjiang South Tianshan.

LIANG, B., FENG, Q. L., WANG, Q. W., GUO, J. Q., ZHONG, C. H. & LI, Z. J. 2005. Ladinian radiolarian fauna, siliceous rock from the Xianshuihe Belt, West Sichuan and their tectonic significance. *Science in China Series D-Earth Sciences* **48** (1), 42-47.

Ladinian radiolarian fauna, including *Muelleritortis*, *Baumgartneria*, *Oertlispongus*, *Paroertlispongus*, *Pseudoertlispongus*, etc., was discovered from the siliceous rock of the Runiange Formation in the Xianshuihe belt, West Sichuan Province. Geochemical test on five samples from the siliceous rock indicates that SiO2 content varies in 71.16%-90.06% and Si/Al ratio, in 49-71, which shows that the siliceous rock contains more terrigenous mud sediments. The siliceous rock is characterized by the large ratios of Al2O3/(Al2O3+Fe2O3) (0.63-0.81) and Ti/V (> 26), the low ratio of V/Y (< 2.8), and low vanadium content (< 23 mu g/g), which are similar to the geochemical characteristics of continental margin siliceous rock. The Ce/Ce* ratios of the four samples vary in 1.02-1.47 and the La-N/Ce-N ratio, in 0.75-1.07, which imply that the siliceous rock was deposited in the continental margin basin. But only one sample is similar to the oceanic siliceous rock in REE. Turbidite-siliceous rock bearing radiolarian-basalt assemblage and the geochemical characteristics of the siliceous rock indicate that the Xianshuihe belt is in the strong rift stage in the Ladinian age.

LITTLE, C. T. S., DANELIAN, T., HERRINGTON, R. J. & HAYMON, R. M. 2004. Early Jurassic hydrothermal vent community from the Franciscan Complex, California. *Journal of Paleontology* **78** (3), 542-559.

The Figueroa sulfide deposit located in Franciscan Complex rocks in the San Rafael Mountains, California, contains the only known Jurassic hydrothermal vent community. Based on radiolarian biostratigraphy it is Pliensbachian (early Jurassic) in age. The Figueroa fossil organisms lived at a deepwater, high temperature vent site located on a mid-ocean ridge or seamount at an equatorial latitude. The vent site was then translated northeastward by the motion of the Farallon Plate and was subsequently accreted to its present location. The vent fossils are preserved as molds of pyrite and there is no remaining shell or tube material. The fossil assemblage is specimen rich, but of low diversity, and comprises, in order of decreasing abundance, vestimentiferan worm tubes, rhynchonellide brachiopods (*Anarhynchia* cf. *gabbi*), and trochoidean gastropods (*Francisciconcha maslennikovi* new genus and species). These fossils represent only primary consuming organisms, some of which may have had chemosynthetic microbial endosymbionts, like many modern dominant vent animals. The Figueroa vent assemblage shares vestimentiferan tube worms and gastropods with other fossil and modem vent communities, but is unique in having rhynchonellide brachiopods. It shares this feature with contemporary Mesozoic cold seep communities. Many other taxonomic groups found at modern vent sites are missing from the Figueroa assemblage. The presence of vestimentiferan tube worm fossils in the Figueroa deposit is at odds with the supposed time of origin of the modern vestimentiferans (similar to100 Ma), based on molecular data.

LUTERBACHER, H. P., ALI, J. R., BRINKHUIS, H., GRADSTEIN, F. M., HOOKER, J. J., MONECHI, S., OGG, J. G., POWELL, J., RÖHL, U., SANFILIPPO, A. & SCHMITZ, B. 2004. The Paleogene Period. *In:* (GRADSTEIN, F. M., OGG, J. G. & SMITH, A. G. eds). *A Geologic Time Scale 2004*. 384-408. Cambridge University Press.

LYLE, M., WILSON, P., JANECEK, T., BACKMAN, J., BUSCH, W., COXALL, H., FAUL, K., GAILLOT, P., HOVAN, S., KNOOP, P., KRUSE, S., LANCI, L., LEAR, C., MOORE, T., JR., NIGRINI, C., NISHI, H., NOMURA, R., NORRIS, R., PALIKE, H., PARES, J., QUINTIN, L., RAFFI, I., REA, B., REA, D., STEIGER, T., TRIPATI, A., VANDEN BERG, M. & WADE, B. 2003. Leg 199 investigates the "greenhouse" Eocene in the tropical Pacific Ocean. *JOIDES Journal* **29** (1), 6-10.

MALAVIEILLE, J., MARCOUX, J. & DE WEVER, P. 2002. L'océan perdu. *In:* (CNRS-MNHN eds). *Himalaya – Tibet. Le choc des continents*. 32-39.

MALIVA, R. G., KNOLL, A. H. & SIMONSON, B. M. 2005. Secular change in the Precambrian silica cycle:

Insights from chert petrology. *Geological Society of America, Bulletin* **117** (7), 835-845.

Chert deposits preserve a record of secular change in the oceanic silica cycle. The evolutionary radiation of silica-secreting organisms resulted in a transition from abiological silica deposition, characteristic of the Archean and Proterozoic eons, to the predominantly biologically controlled silica deposition of the Phanerozoic. Comparative petrography of Phanerozoic and Precambrian cherts indicates that an earlier change in chert deposition occurred toward the end of the Paleoproterozoic era (ca. 1.8 Ga). In Neoproterozoic and Mesoproterozoic strata, early diagenetic chertification is largely restricted to peritidal environments. These early diagenetic cherts typically occur as nodules or discontinuous beds within carbonate deposits that have similar depositional textures. The cherts formed primarily by carbonate replacement with subsidiary direct silica precipitation. Some of the Paleoproterozoic cherts associated with iron formations, however, are distinctly different from younger cherts and appear to have formed largely by direct silica precipitation at or just below the seabed. These primary cherts lack ghosts or inclusions of carbonate precursors, have fine-scale grain fracturing (possibly from syneresis), exhibit low grain-packing densities, and are not associated with unsilicified carbonate deposits of similar depositional composition. Cherts in some Paleoproterozoic iron formations (e.g., the Gunflint Formation, northwestern Lake Superior region) are composed of silica types similar to those in Phanerozoic sinters (e.g., the Devonian Rhynie and Windyfield cherts, Scotland). Such cherts may provide evidence that basinal, and perhaps global, oceanic silica concentrations were higher during the Paleoproterozoic era than at later times.

MASAKI, U. & YUTARO, S. 2005. Aeronian (Llandovery, Early Silurian) radiolarians from the Kallholn Formation in Siljan district, Sweden. *Micropaleontology* **51** (1), 83-91.

Early Aeronian (middle Llandovery, Early Silurian) radiolarians collected from calcareous nodules of the Kallholn Formation in the Siljan district, Sweden, are described. Seven genera and I I species, including one new family Gyrosphaeridae and two new species, *Palaeoscenidium kuriharai* and *Gyrosphaera primigena*, are described. This fauna is characterized by the dominance of large spherical radiolarians, which constitute 54% of the total number of specimens per nodule. The fauna is similar to the middle Telychian fauna insofar as it is dominated by *Haplotaeniatum cathenatum*. However, it can be distinguished from the late Rhuddanian fauna by the sparse occurrence of *H. aperturatum*. These data suggest that the period from the Aeronian to the middle Telychian was marked by the dominance of *H. cathenatum*. Radiolarian spines, a morphological innovation, are believed to have evolved in the Aeronian. The time of radiolarian diversification corresponds to that of other planktonic/nektonic faunas including graptolites, chitinozoans, and fish, which suggests that marine macroplanktonic/nektonic faunas and microplankton diversified simultaneously in the Aeronian.

MATSUMOTO, Y., SASHIDA, K. & HORI, N. 2001. Paleozoic and Mesozoic radiolarians from the area east of Koide Town, Kitauonuma County, Niigata Prefecture. *News of Osaka Micropaleontologists, Special Volume* **12**, 99-112.

MATSUOKA, A. 2004. Toarcian (Early Jurassic) radiolarian fauna from the Nanjo Massif in the Mino Terrane, central Japan. *News of Osaka Micropaleontologists, Special Volume* **13**, 69-87.

MATSUOKA, A., SHINZAWA, M., YOSHIDA, K., MACHIDORI, S., KURITA, H. & TODO, T. 2002a. Early summer radiolarian fauna in surface waters off Tassha, Aikawa Town, Sado Island, central Japan. *The Science Reports of Niigata University, Series E, Geology and Mineralogy* **17**, 17-25.

MATSUOKA, A., YANG, Q., KOBAYASHI, K., TAKEI, M., NAGAHASHI, T., ZENG, Q. & WANG, Y. 2002b. Jurassic-Cretaceous radiolarian biostratigraphy and sedimentary environments of the Ceno-Tethys: records from the Xialu Chert in the Yarlung-Zangbo Suture Zone, southern Tibet. *Journal of Asian Earth Sciences* **20**, 277-287.

MATSUOKA, A., YOSHIDA, K., HASEGAWA, S., SHINZAWA, M., TAMURA, K., SAKUMOTO, T., YABE, H., NIIKAWA, I. & TATEISHI, M. 2001. Temperature profile and radiolarian fauna in surface waters off Tassha, Aikawa Town, Sado Island, central Japan. *The Science Reports of Niigata University, Series E, Geology and Mineralogy* **16**, 83-93.

MEOR, H. H. & LEE, C. P. 2005. The Devonian-Lower Carboniferous succession in Northwest Peninsular Malaysia. *Journal of Asian Earth Sciences* **24** (6), 719-738.

A new stratigraphic nomenclature is proposed for the approximately 600 m thick, mainly clastic transitional sequence between the underlying Mempelam Limestone and overlying Kubang Pasu/Singa Formation in northwest Peninsular Malaysia. This sequence represents shallow marine deposits of the continental margin of the Sibumasu Terrane during the Middle Palaeozoic (Devonian-Carboniferous). It is separated into several formations. The Timah Tasoh Formation is an approximately 76 m sequence consisting of 40 m of laminated tentaculitid shales at the base, containing *Monograptus yukonensis* Jackson and Lenz and *Nowakia* (*Turkestanella*) *acuaria* Alberti, giving an Early Devonian (Pragian-Emsian) age, and about 36 m of rhythmically interbedded, light coloured argillo-arenites. The Chepor Formation is about 90 m thick and consists mainly of thick red mudstone interbedded with sandstone beds, of Middle to Late Devonian age. A new limestone unit is recognized and named the Sanai Limestone, which contains conodonts of Famennian age. The Binjal Formation consists of red and white mudstone interbedded with sandstone beds showing Bouma sequences. The Telaga Jatoh Formation is 9 m thick and consists mainly of radiolarian chert. The Wang Kelian Formation is composed of thick red mudstone beds interbedded with silty sandstone, and contain fossils indicative of an Early Carboniferous (Visean) age. The succession was deposited on the outer shelf, with depositional environments vertically fluctuating from prodelta to basinal marine. The Devonian-Carboniferous boundary is exposed at Hutan Aji and Kampung Guar Jentik, and indicates a major regressive event during the latest Devonian.

MIHALYNUK, M. G., ERDMER, P., GHENT, E. D., ARCHIBALD, D., FRIEDMAN, R. M., CORDEY, F. & JOHANNSON, G. G. 2004. Age constraints for emplacement of the Northern Cache Creek Ocean and implications of Youngest Blueschist Metamorphism. *Geological Society of America Bulletin* **116** (7), 910-922.

MISSONI, S., GAWLICK, H.-J., SUZUKI, H. & DIERSCHE, V. 2005. Die paläogeographische Stellung des Watzmann Blockes in dem Berchtesgadener Kalkalpen - Neu ergebnisse auf der Basis der Analyse der Trias- und Jura-Entwicklung. *Journal of Alpine Geology* **47**, 169-209.

MIYAMOTO, T., NAKAMURA, S. & KUWAZURU, J. 2001. Radiolarian biostratigraphy of the Jurassic Kawamata Group (new name) in the Bisho area of the Hinagu Belt, west Kyushu, Southwest Japan. *News of Osaka Micropaleontologists, Special Volume* **12**, 227-251.

MORARD, A., GUEX, J., BARTOLINI, A., MORETTINI, E. & DE WEVER, P. 2003. A new scenario for the Domerian - Toarcian transition. *Bull. Soc. Géol. Fr.* **t.174** (4), 351-356.

MOTOKI, H. & SASHIDA, K. 2004. Preliminary report on the chronological and lithostratigraphical studies of the Toishi-type shale (siliceous claystone) distributed in the Ashio Mountains, central Japan. *News of Osaka Micropaleontologists, Special Volume* **13**, 47-57.

MOTOYAMA, I., OTA, M., KOKUSHOU, T. & TANAKA, Y. 2005. Seasonal changes in fluxes and assemblages of radiolarians collected by sediment trap experiments in the northwestern Pacific: a family-level analysis. *Journal of the Geological Society of Japan* **111** (7), 404-416.

MOTOYAMA, I., TANAKA, H., YAMAZATO, N., KANEKO, N. & ITO, T. 2001. Radiolarian study on the Neogene of Okinawa-jima, Kume-jima, Iriomote-jima and Yonaguni-jima Islands, Okinawa Prefecture, Japan. *News of Osaka Micropaleontologists, Special Volume* **12**, 337-342.

MURCHEY, B. L. 2004. Regional analysis of spiculite faunas in the Permian Phosphoria Basin; implications for paleoceanography. *In:* (HEIN, J. R. eds). *Life cycle of the Phosphoria Formation; from deposition to the post-mining environment.* Handbook of Exploration and Environmental Geochemistry **8**. 111-135. Elsevier.

MUTTONI, G., ERBA, E., KENT, D. V. & BACHTADSE, V. 2005. Mesozoic Alpine facies deposition as a result of past latitudinal plate motion. *Nature* **434** (7029), 59-63.

The fragmentation of Pangaea as a consequence of the opening of the Atlantic Ocean is documented in the Alpine - Mediterranean region by the onset of widespread pelagic sedimentation(1). Shallow-water sediments were replaced by mainly pelagic limestones in the Early Jurassic period, radiolarian cherts in the Middle - Late Jurassic period, and again pelagic limestones in the Late Jurassic - Cretaceous period(1). During initial extension, basin subsidence below the carbonate compensation depth (CCD) is thought to have triggered the transition from Early Jurassic limestones to Middle - Late Jurassic radiolarites(1). It has been proposed that the transition from radiolarites to limestones in the Late Jurassic period was due to an increase in calcareous nannoplankton abundance when the CCD was depressed below the ocean floor(1). But in modern oceans, sediments below the CCD are not necessarily radiolaritic. Here we present palaeomagnetic samples from the Jurassic - Cretaceous pelagic succession exposed in the Lombardian basin, Italy. On the basis of an analysis of our palaeolatitudinal data in a broader palaeogeographic context, we propose an alternative explanation for the above facies tripartition. We suggest that the Lombardian basin drifted initially towards, and subsequently away from, a near-equatorial upwelling zone of high biosiliceous productivity. Our tectonic model for the genesis of radiolarites adds an essential horizontal plate motion component to explanations involving only vertical variations of CCD relative to the ocean floor. It may explain the deposition of radiolarites throughout the Mediterranean and Middle Eastern region during the Jurassic period.

NAKAE, S. 2001. Permian radiolarians from cherts of the Tamba Terrane in the Nishizu district, Fukui, Southwest Japan. *Bulletin of the Geological Survey of Japan* **52** (6/7), 245-252.

NAKAE, S. & KAMADA, K. 2003. Late Jurassic radiolarians from the Rikuchu-Seki District in the North Kitakami Belt, northeast Japan. *Journal of the Geological Society of Japan* **109** (12), 722-725.

Radiolarian fossils were discovered from a mudstone of the Seki Formation at the Rikuchu-Seki district in the North Kitakami Belt. The mudstone containing the radiolarians comprises a part of "chert-clastics sequences" together with stratigraphically underlying cherts. The radiolarian fauna consists of several genera including *Archaeodictyomitra*, *Parvicingula* (?), *Sethocapsa*, *Transhsuum*, *Xitus* (?), *Zhamoidellum* and others. They are generally regarded as Jurassic radiolarians, but state of their preservation is not good enough to determine preciser age of this fauna. Nevertheless, the age is considered to be middle Late Jurassic (Kimmeridgian) on the basis of the presence of *Transhsuum* sp. cf. *Tr. maxwelli* (Pessagno), *Sethocapsa hexagona* Hori and *Zhamoidellum ovum* Dumitrica. The above proves that a Late Jurassic accretionary complex (Seki Formation) is widely exposed in this district.

NAKAE, S., KOMATSUBARA, T. & NAITO, K. 2002. Geology of the Nishizu District. With geological sheet map at 1:50,000. *Geological survery of Japan, AIST. Quadrangle Series, Scale 1:50,000, Kanazawa* **10** (78), 1-90.

NEUMANN, P. 2003. Ablagerungsprozesse, Event- und Biostratigraphie kreidezeitlicher Tiefwassersedimente der Tethys in der Olonos-Pindos-Zone Westgriechenlands. *Münchner geowissenschaftliche Abhandlungen. Reihe A, Geologie und Paläontologie* **40**, 1-156.

The content of this volume the reconstruction of the dynamics, evolution and influencing factors of deposition in a deep-marine basin of the Mediterranean Tethys during the Cretaceous period. The Olonos-Pindos Zone of the western Greek Alpidic fold-thrust belt (Hellenides) constitutes a well-preserved example of one of numerous, former deep-water basins to be found throughout the peri-Adriatic realm. Paleogeographically, the Mesozoic-Paleogene sedimentary rocks exposed in the Pindos Mountains and the Peloponnese, originated from an elongated basin of the Apulian passive continental margin and now rest upon their former southwestern foreland as a series of stacked and imbricated thrust sheets. Due to regular in-sequence thrusting the facies trends and composition of the compressed basin can be restored. This study provides insight into the sedimentary processes acting within the basin as well as its former, now partly hidden platform edges. The detailed event-stratigraphy can serve as powerful tool for correlation with other basins and paleogeographic units (e.g. Dinarides). During this integrated study seven complete sections of the Cretaceous as well as numerous detailed sections, chosen with regard to outcrop quality and tectonic situation, were tectonically backstripped, recorded, sampled (partly bed-by-bed) and presented as strata columns on scales of 1 : 100 and 1 : 500. In the following the selected sections were studied by means of

microbiostratigraphy, sedimentological analysis of the turbidite facies, geochemistry and paleocurrent analysis.

NIGRINI, C., SANFILIPPO, A. & MOORE, T. C. J. 2005. Cenozoic radiolarian biostratigraphy: A magnetobiostratigraphic chronology of Cenozoic sequences from ODP Sites 1218, 1219 and 1220, equatorial Pacific. *Scientific Results of the Proceedings of the Ocean Drilling Program, Volume 199 (in press)*.

A generally rich radiolarian fauna ranging in age from Quaternary to early Eocene (Zone RP7) was found at five of the eight sites drilled during ODP Leg 199. Of particular interest are the stratigraphically complete assemblages, ranging in age from middle Miocene (Zone RN5) to early Eocene (Zone RP7), found by combining Sites 1218, 1219 and 1220. At the same sites multitrack (MST) data show consistent cycles that can be correlated on a submeter scale from early Miocene to early Eocene. In addition, the magnetic reversal records from these three sites allow for the construction of an absolute time scale. A series of 305 radiolarian morphologic first and last occurrences and evolutionary transitions for radiolarians has been determined and correlated directly with the accompanying MST and paleomagnetic data resulting in a detailed and accurate dating of events. Since many of the bioevents are found at more than one site, it is also possible to test their reliability within the study area. Twelve new species are described. The new taxa are *Dorcadospyris anastasis*, *Dorcadospyris cyclacantha*, *Dorcadospyris copelata*, *Dorcadospyris ombros*, *Dorcadospyris scambos*, *Eucyrtidium mitodes*, *Thyrsocyrtis* (*Pentalacorys*) *orthotenes*, *Calocycletta* (*Calocycletta*) *anekathen*, *Theocyrtis careotuberosa*, *Theocyrtis perpumila*, *Theocyrtis perysinos*, and *Theocyrtis setanios*.

NIKOLAEV, S. I., BERNEY, C., FAHRNI, J. F., BOLIVAR, I., POLET, S., MYLNIKOV, A. P., ALESHIN, V. V., PETROV, N. B. & PAWLOWSKI, J. 2004. The twilight of Heliozoa and rise of Rhizaria, an emerging supergroup of amoeboid eukaryotes. *Proceedings of the National Academy of Sciences of the United States of America* **101** (21), 8066-8071.

Recent molecular phylogenetic studies revealed the extraordinary diversity of single-celled eukaryotes. However, the proper assessment of this diversity and accurate reconstruction of the eukaryote phylogeny are still impeded by the lack of molecular data for some major groups of easily identifiable and cultivable protists. Among them, amoeboid eukaryotes have been notably absent from molecular phylogenies, despite their diversity, complexity, and abundance. To partly fill this phylogenetic gap, we present here combined small-subunit ribosomal RNA and actin sequence data for the three main groups of "Heliozoa" (Actinophryida, Centrohelida, and Desmothoracida), the heliozoan-like Sticholonche, and the radiolarian group Polycystinea. Phylogenetic analyses of our sequences demonstrate the polyphyly of heliozoans, which branch either as an independent eukaryotic lineage (Centrohelida), within stramenopiles (Actinophryida), or among cercozoans (Desmothoracida), in broad agreement with previous ultrastructure-based studies. Our data also provide solid evidence for the existence of the Rhizaria, an emerging supergroup of mainly amoeboid eukaryotes that includes desmothoracid heliozoans, all radiolarians, Sticholonche, and foraminiferans, as well as various filose and reticulose amoebae and some flagellates.

NISHIMURA, A. 2001. Paleocene radiolarians from DSDP Leg 43, Site 384 in the Northwest Atlantic. *News of Osaka Micropaleontologists, Special Volume* **12**, 293-320.

NISHIZONO, Y. 2001. Jurassic radiolarians from the Sakamoto Formation in the Kurosegwa Terrane, Kyushu, Southwest Japan. *News of Osaka Micropaleontologists, Special Volume* **12**, 203-214.

NISHIZONO, Y. 2004. Jurassic radiolarians from the Uminoura coast in the Kurosegawa Terrane, western Kyushu, Southwest Japan. *News of Osaka Micropaleontologists, Special Volume* **13**, 111-133.

NOBLE, P. J. & DANELIAN, T. 2004. Radiolarians. *In:* (WEBBY, B. D., PARIS, F., DROSER, M. & PERCIVAL, I. G. eds). *The great Ordovician biodiversification event*. 97-101. Columbia University Press, New York, NY.

NOJO, A., ITAKI, T. & ISHIMURA, T. 2003. A review of recent advances in Cenozoic microfossil studies in Hokkaido, Japan, since 1990. *Earth Science* **57**, 343-355.

O'DOGHERTY, L., DE WEVER, P. & GUEX, J. 2005. Is the Nassellarian/Spumellarian diversity ratio a paleoenvironmental proxy indicator in the geological record? *Bull. Soc. Géol. Fr. (in press)*.

OGANE, K. 2004. The three-dimensional skeletal structures and the terminology of discoidal radiolarians. *News of Osaka Micropaleontologists, Special Volume* **13**, 205-219.

OHTA, T. & SAKAI, T. 2003. Revised stratigraphy of the Paleozoic and Mesozoic successions and proposal of the Jurassic Ashikita Group in the Uminoura area of the Kurosegawa tectonic belt, western Kyushu, SW Japan. *Journal of the Geological Society of Japan* **109** (12), 671-688.

Lithostratigraphy and geological structure of Mesozoic successions were re-examined in the Kurosegawa Tectonic Belt in the Uminoura area, western Kyushu. The conventional Permian to Cretaceous stratigraphy in the study area is revised, and a new late Early Jurassic to Late Jurassic stratigraphic unit, the Ashikita Group is proposed. The Ashikita Group consists of the Idenohana (newly defined), Kyodomari (newly defined) and Sakamoto (redefined) Formations, which represent discrete fining-upward sequences. The fossils newly found are Late Toarcian ammonite Haugia cf. variabilis and Middle to Late Jurassic radiolarians indicative of the *Tricolocapsa plicarum* to *Pseudodictyomitra primitiva* zones. An assessment of the previously reported Permian and Triassic fossils advocated that these fossils were derived fossils contained in the mass-wasting deposits. Contrary, hemipelagic drape deposits have exclusively yielded Jurassic fossils, although some of which were also suspicious of reworked origin. Furthermore, the newly reported fossil data are concordant with the geological structures characterized by the northwesterly verging overturned to recumbent folds. All facts demonstrated in the present contribution indicate that the previous stratigraphy that had been assigned to the Permian to Cretaceous should be revised.

OHTO, T., TAKEMURA, S., TAKEMURA, A. & NISHIMURA, T. 2001. Cretaceous and Paleogene radiolarians from the Shishi-jima Island, Kagoshima Prefecture, Southwest Japan. *News of Osaka Micropaleontologists, Special Volume* **12**, 283-291.

OKAZAKI, Y., TAKAHASHI, K., ITAKI, T. & KAWASAKI, Y. 2004. Comparison of radiolarian

vertical distributions in the Okhotsk Sea near the Kuril Islands and in the northwestern North Pacific off Hokkaido Island. *Marine Micropaleontology* **51** (3-4), 257-284.

The vertical distribution of radiolarians was investigated by using a closing-type net with 63 [mu]m mesh in the Okhotsk Sea (Station NU'2, near Bussol' Strait) down to 1000 m depth and in the northwestern North Pacific (Oyashio region, Station X) down to 500 m depth. Both stations were sampled in September 1995. Radiolarian standing stocks were high between 50 and 200 m at both stations, and generally decreased with depth. The depth-integrated living total radiolarian standing stock from 0 to 500 m at Station NU'2 was more than three times higher than that at Station X. The maximum standing stocks of polycystine radiolarians occurred in the 50-100 m depth interval, but there were also significant abundance peaks of phaeodarian radiolarians in the 100-200 m interval at both stations. The radiolarian production is likely to be associated with not only phytoplankton production in upper waters, but also with microbial production in intermediate waters. A total of 79 taxa were encountered: 25 Spumellaria, 41 Nassellaria, and 13 Phaeodaria. Five radiolarian groups were obtained based on R-mode cluster analysis: Group A: lower intermediate water dwellers (300-1000 m), Group B: taxa with different distributions in the Okhotsk Sea (300-1000 m) and in the Oyashio region (0-100 m), Group C: upper intermediate water dwellers (200-500 m), Group D: surface-subsurface water dwellers (0-200 m), and Group E: taxa with pronounced 200 m.

OKAZAKI, Y., TAKAHASHI, K., NAKATSUKA, T. & HONDA, M. C. 2003. The production scheme of *Cycladophora davisiana* (Radiolaria) in the Okhotsk Sea and the northwestern North Pacific: implication for the paleoceanographic conditions during the glacials in the high latitude oceans. *Geophysical Research Letters* **30** (18).

The sediment trap study clearly unraveled that the distinct peaks of *C. davisiana* fluxes occurred during summer to autumn in both the Okhotsk Sea and the northwestern North Pacific. The production of *C. davisiana* is closely related to the microbial production in the intermediate water. In the Okhotsk Sea, the distinct microbial biomass in the intermediate water, which is associated with the seasonal sea- ice rejected brine water during winter, may support the high *C. davisiana abundance*. Therefore, the significantly high *C. davisiana* abundance during the Last Glacial Maximum (LGM) in the high latitude open oceans implies the distinct microbial biomass in the intermediate water caused by the seasonal sea- ice coverage analogous to the present Okhotsk Sea.

ORESHKINA, T. V., ALEKSANDROVA, G. N. & KOZLOVA, G. E. 2004. Early Eocene marine planktonic record of the East Urals margin (Sverdlovsk region): biostratigraphy and paleoenvironments. *Neues Jahrbuch Fur Geologie Und Palaontologie-Abhandlungen* **234** (1-3), 201-222.

We have carried out an integrated study of siliceous planktonic groups (diatoms, silicoflagellates, radiolarians) and marine palynomorphs from the ca. 30 m thick Lower Eocene Irbit Formation on the eastern slope of the Urals. We have established the Succession of regional diatom zones: (i) *Moisseevia* (= *Coscillodiscus*) *uralensis/Hemiaulus proteus*, (ii) *Coscinodiscus payeri*, *Pyxilla gracilis*; regional radiolarian zones: (i) *Petalospyris foveolata*, (ii) *Petalospyris fiscella*, (iii) *Petalospyris aphorma-Heliodiscus lentis*, (iv) *Heliodiscus inca*; dinocyst zones: (i) *Deflandrea oebisfeldensis* and (ii) *Wetlzeliella meckelfeldensis* Zones of Northern Europe (HEILMANN-CLAUSEN & COSTA 1989), corresponding to the NP10-NP12 biochrons. The changes in the ecological Structure of planktonic assemblages and depositional cycles enabled us to recognize 5 phases in the evolution of the basin: phase 1 - abnormal neritic environments with increased continental run-off, freshwater influx, and water stratification, evidently corresponding to post-CIE time; phase 2 - start of the transgression, invigoration of circulation within the basin; phases 3 and 4 - increase of coastal Upwelling and predominance of siliceous over organic-walled plankton due to the development of well oxygenated conditions; phase 5 corresponds to the onset of a new transgressive event.

OWEN, R. B. 2005. Modern fine-grained sedimentation-spatial variability and environmental controls on an inner pericontinental shelf, Hong Kong. *Marine Geology* **214** (1-3), 1-26.

Fine-grained sediments in Hong Kong form part of an extensive cover that extends from nearshore locations to the mid-continental shelf. This featureless mud blanket is associated with sediment inputs from the Pearl River and has generally been considered to be homogeneous in its characteristics. However, detailed sedimentological and geochemical analyses have revealed that the superficial deposits show systematic spatial variations that reflect contrasts in deposition between the Pearl River Estuary to the west and fully marine conditions to the east. Results indicate significant differences in particle size, accumulation rates, biogenic silica, organic carbon content, C/N ratios, and stable carbon and nitrogen isotopes that reflect location with respect to the Pearl River Delta. Calcium carbonate content varies widely, tending to be higher close to land. Major controls over spatial variability include rainfall patterns and the supply of estuarine suspended particulate matter; the effects of palaeotopography and modern water depth; resuspension induced by monsoon winds and typhoons; and human impacts on the sea floor.

OYAIZU, A., MIURA, K., TANAKA, T., HAYASHI, H. & KIMINAMI, K. 2002. Geology and radiolarian ages of the Shimanto Supergroup, western Shikoku, Southwest Japan. *Journal of the Geological Society of Japan* **108** (11), 701-720.

PALMER-JULSON, A. 2004. Pre- and post-impact paleoceanographic conditions on the Eocene mid-Atlantic continental margin; evidence from radiolarians. *In:* (EDWARDS, L. E., HORTON, J. W., JR. & GOHN, G. S. eds). *ICDP-USGS workshop on Deep drilling in the central crater of the Chesapeake Bay impact structure, Virginia, USA; proceedings volume* United States geological Survey, Open File Report. 70.

PASSERI, L., BERTINELLI, A. & CIARAPICA, G. 2005. Paleogeographic meaning of the Late Triassic-Early Jurassic Lagonegro units. *Bollettino della Società geologica italiana* **124** (1), 231-245.

POLET, S., BERNEY, C., FAHRNI, J. & PAWLOWSKI, J. 2004. Small-subunit ribosomal RNA gene sequences of Phaeodarea challenge the monophyly of Haeckel's Radiolaria. *Protist* **155** (1), 53-63.

In his grand monograph of Radiolaria, Ernst Haeckel originally included Phaeodarea together with Acantharea and Polycystinea, all three taxa characterized by the presence of a central capsule and the possession of axopodia. Cytological and ultrastructural studies, however, questioned the monophyly of Radiolaria, suggesting an independent evolutionary origin of the three taxa, and the first molecular data on Acantharea and Polycystinea brought controversial results. To test further the monophyly of Radiolaria, we sequenced the complete small subunit ribosomal RNA gene of three phaeodarians and three polycystines. Our analyses reveal that phaeodarians clearly branch among the recently described phylum

Cercozoa, separately from Acantharea and Polycystinea. This result enhances the morphological variability within the phylum Cercozoa, which already contains very heterogeneous groups of protists. Our study also confirms the common origin of Acantharea and Polycystinea, which form a sister-group to the Cercozoa, and allows a phylogenetic reinterpretation of the morphological features of the three radiolarian groups.

POPOVA-GOLL, I. & GOLL, R. M. 2005. Cenozoic Radiolaria biostratigraphy of Hole 1223A in the North Pacific: ODP, Leg 200. *ODP Scientific Reports (in press)*.

POPOVA-GOLL, I., VISHNEVSKAYA, V. & BAUMGARTNER, P. O. 2005. Upper Cretaceous (Santonian-Campanian) radiolarians from Voronesh Anticline, southwestern Russia. *Micropaleontology* **51** (1), 1-37.

Core-samples from wells and an outcrop located on the Voronesh Anticline in the southeastern part of the Russian Platform contain Late Cretaceous radiolaria. 83 species are described and illustrated (SEM and transmitted light images) from Santonian-early Campanian deposits, and two assemblages are distinguished. The older assemblage with *Alievium gallowayi*, *Archaeospongoprunum bipartitum*, *Archaeospongoprunum* cf. *A. salumi* as well as other less age-diagnostic taxa, is interpreted as Santonian correlative with the *Euchitonia santonica-Alievium gallowayi* Assemblage Zone of the Moscow Basin (Vishnevskaya 1993). The younger assemblage, of Santonian - early Campanian age, contains *Patulibracchium* cf. *P. davisi*, *Crucella irwini*, *Cryptamphorella sphaerica*, *Praeconocaryomma californiensis*, *Dictyomitra lamellicostata* among other species and is correlative with the *Orbiculiforma quadrata-Lithostrobus rostovtsevi* Assemblage Zone of the Moscow Basin. In terms of inter-regional faunal comparisons, both of the Voronesh Anticline radiolarian assemblages demonstrate relatively close affinities to coeval rocks from the Volga River region, but less similarity to the assemblages from the Moscow Basin. Only a few of the common endemic species of Siberian assemblages occur in our samples. On an inter-regional level, the radiolarian assemblages described herein have similarities with assemblages reported from Japan and California. Index-species characteristic for the Santonian-Campanian radiolarian biozonations of the Atlantic and Pacific Oceans are not found in our collection. However, the presence of many cosmopolitan species known from the European Platform, Japan and California suggests a marine connection between the Voronesh Anticline region, the western Atlantic and eastern Tethys during Santonian-Early Campanian time.

PRINCIPI, G., BORTOLOTTI, V., CHIARI, M., CORTESOGNO, L., GAGGERO, L., MARCUCCI, M., SACCANI, E. & TREVES, B. 2004. The pre-orogenic volcano-sedimentary covers of the Western Tethys oceanic basin: A review. *Ofioliti* **29** (2), 177-211.

The records of the Jurassic Western Tethys Ocean are the ophiolitic rocks now scattered in the Tertiary orogenic belts of the Alps, Apennines and Betic Cordillera. These ophiolites, involved in a convergent margin environment, are affected I) by HP/LT metamorphism derived from a subduction process or II) by very low grade overprint. corresponding to the tectonic prism at the margin of the overriding plate. On the whole, they share common characteristics: a- The MORB geochemical signature. b- The ophiolitic successions often "reduced" and thin. c- The volcano-sedimentary covers often directly overlying the serpentinised peridotites. d- The widespread occurrence of cherts as Jurassic pelagic sediment. In the thickest "complete" ophiolitic successions, basalt flows, generally thin, are preceded and followed by ophiolitic breccias. Only the basal portion of the breccias on top of the serpentinites (Levanto Breccias) has a tectonic origin, all other levels have a sedimentary origin. These breccia-basalt assemblages are overlain by thick sequences of Mt. Alpe Cherts and Calpionella Limestones, followed by Palombini Shales. In the reduced (or incomplete) successions, thin breccias and cherts were directly deposited above the Levanto Breccias (ophicalcites pro parte), and followed by Palombini Shales. This stratigraphic pattern-seems to be widespread in the whole Western Tethys ocean. In some sequences. transitional mid-ocean ridge (T-MOR) basalts are present and the ophiolitic rocks are associated with Variscan continental slices and debris. as in the Err-Platta succession (Central Alps) and in some exotic blocks in the flysch of the External Ligurides (Northern Apennines). In the Balagne (Corsica) T-MOR basalts are associated with quartzarenites. These occurrences show that an unroofed mantle and sections of oceanic crust evolved very near to a continental margin. The different radiolarian ages of the cherts deposited before, within, or on top of the MOR basalts allow to infer a minimum time interval for the Western Tethys oceanisation. This interval can be considered between 16 and 21 Ma (from Late Bajocian to Kimmeridgian/Tithonian). If we assume 1cm/yr spreading rate during this time. the basin would have reached about 150-200 km width. The same ages suggest that the ocean opening was diachronous along the Western Tethys basin. Mainly on the basis of the Northern Apennines and Corsica data, it is possible to reconstruct the following evolutive geodynamic, paleogeographic and sedimentary evolution of the Western Tethys ocean basin: 1- Bajocian/Bathonian stage: opening of the Ligurian Northern Apennines oceanic segment and, perhaps, also of the Ligurian, Western and Central Alps ones. 2- Bathonian/Callovian stage: opening of all the segments of the Western Tethys ocean basin. The volcano-sedimentary covers formed during these two stages are constituted by breccias, basalts and siliceous pelagites (cherts). 3- Tithonian/Beniasian: end of the ocean spreading (Tithonian) and beginning of the quiescent stage in the whole basin, marked by the lack of any tectonic activity and by the sedimentation of the Calpionella Limestones and, locally, of mixed siliceous-calcareous deposits (Nisportino-Murlo Fm.). 4- Hauterivian/Santhonian: this is the longest quiescent stage of the basin, dominated by the sedimentation of the Palombini Shales and Limestones. Some siliciclastic deposits are shed from both passive continental margin sides. During the Early Cretaceous, there is also evidence of a rare intraplate magmatism in Southern Tuscany. The Western Tethys ophiolitic successions are similar to those of present day, slow spreading oceans, in particular to those of the Atlantic Ocean (Mutter and Karson, 1992; Tucholke and Linn, 1994). The Galician North Atlantic margin provides a model for the process of mantle denudation. For the oceanic evolution, the model of Tucholke and Linn (1994) is particularly taken in consideration. According to this model, tectonic extension was one major process in the Western Tethys oceanic development.

RASMUSSEN, J. A., NOHR-HANSEN, H. & SHELDON, E. 2003. Palaeoecology and palaeoenvironments of the lower palaeogene succession, offshore West Greenland. *Marine and Petroleum Geology* **20** (9), 1043-1073.

The microfossil and palynofloral assemblages of the Paleocene to middle Eocene succession, offshore West Greenland, have been investigated. Several taxa, which are believed to reflect specific palaeoenvironments were selected, and their relative abundances measured. Subsequently, an interpretation of the changing depositional settings in the Hellefisk-1, Ikermiut-1, Kangamiut-1, Nukik-1 and Nukik-2 boreholes through the lower Palaeogene has been made.

REGGIANI, L., BERTINELLI, A., CIARAPICA, G., MARCUCCI, M., PASSERI, L., RICCI, C. & RIGO, M. 2005. Triassic-Jurassic stratigraphy of the Madonna del Sirino succession (Lagonegro Basin, Southern Apennines, Italy). *Bollettino Della Societa Geologica Italiana* **124** (1), 281-291.

The Madonna del Sirino succession belongs to the Meso-Caenozoic Lagonegro basin (Southern Apennines). The aim of this study is to obtain more information about the evolution of this

basin during the Late Triassic-Early Jurassic interval. The section of Madonna del Sirino begins with cherty limestones (upper part of the Calcari con Selce fm), passing upwards to radiolarites and shales (Scisti Silicei fm) through a <<transitional interval>>. The Scisti Silicei fm is divided in four members: a) <<Buccaglione>> with red shales, radiolarites and two anoxic levels; b) <<Nevera>> with black shales and black cherty layers; c) <<Serra>> with red radiolarites and red shales; d) <<Acqua Sulfurea>> with green radiolarites and green chert. New biostratigraphic data provided elements for referring some events to specific ages. A conodont assemblage allows us to assert that the change from calcareous to siliceous deposition did not begin before the Sevatian. Various samples in the Buccaglione member provided radiolarian associations typical of the Rhaetian, never recorded in these sections by previous studies. Pyritized radiolarian assemblages in the calcarenites of the Nevera member display features typical of the Triassic and Jurassic forms. in the Serra member Early Jurassic radiolarians were found in the upper part. These observations allows us to confine the Triassic/Jurassic boundary in ten meters; it should be included in the last black shales interval (Nevera member). It is important to point out that in the Lagonegro Basin the Triassic/Jurassic boundary, which corresponds to a major mass extinction event, was preceded by a period of repeated environmental changes.

ROJKOVIC, I., OZVOLDOVA, L. & SYKORA, M. 2003. Manganese mineralization near Sarisske Jastabie Village, Pieniny Klippen Belt, Western Carpathians, Slovakia. *Slovak Geological Magazine* **9** (1), 51-64.

SCOPELLITI, G., BELLANCA, A., COCCIONI, R., LUCIANI, V., NERI, R., BAUDIN, F., CHIARI, M. & MARCUCCI, M. 2004. High-resolution geochemical and biotic records of the Tethyan 'Bonarelli Level' (OAE2, latest Cenomanian) from the Calabianca-Guidaloca composite section, northwestern Sicily, Italy. *Palaeogeography Palaeoclimatology Palaeoecology* **208** (3-4), 293-317.

High-resolution micropalaeontological and chemostratigraphic records for the upper Cenomanian portion of the Calabianca-Guidaloca composite section (NW Sicily) provide new insight into the palaeoclimatic and palaeoceanographic evolution of the Tethys Ocean. The Bonarelli Level equivalent was identified on the basis of lithology and well constrained by calcareous plankton biostratigraphy and radiolarian assemblages, as well as by the delta(13)C curve showing a marked positive excursion (up to 4.7 parts per thousand). The Bonarelli Level equivalent deposition is characterized by highly eutrophic conditions as testified by radiolarian proliferation. Black shale samples from the Calabianca-Guidaloca composite section contain very high TOC (up to 26%) and moderate to high amounts of CaCO3 (on average 20%). Among the planktonic foraminifera, hedbergellids and globigerinelloids tolerated the environmental stress induced by the Oceanic Anoxic Event 2 (OAE2). The occurrence of some benthic foraminifera testifies to dysoxic rather than completely anoxic conditions at the sea floor during the deposition of some portions of the Bonarelli Level equivalent. Based on micropalaeontological results and geochemical proxies (delta(13)C, D*, Rb, Ti, V, Ni, Ba, Si, Cr), the Bonarelli Level equivalent is interpreted as a high-productivity event driven by increasingly warm and humid climatic conditions promoting an accelerated hydrological cycle. We propose that periodically increased riverine influxes, triggered by enhanced humidity, resulted in a sluggish circulation mode and consequent anoxic/euxinic conditions favotning the preservation of organic matter at the sea-floor. Spectral analyses performed on selected geochemical signals reveal within the main high productivity event a strong orbital- climatic forcing represented by a long-term eccentricity-steered humidity cyclicity that amplifies a short-term precession-controlled productivity fluctuation.

SEROVA, M. Y. 2004. The Lower Paleocene of the Kronotskii Peninsula, Eastern Kamchatka. *Stratigraphy and Geological Correlation* **12** (5), 514-522.

Upper Cretaceous and Lower Paleocene deposits of the Kronotskii Peninsula and their foraminiferal and radiolarian faunas are considered. As is shown, marine sedimentation during the Late Cretaceoust, Early Paleocene was continuous in the Kronotskii and other peninsulas of the eastern and western Kamchatka, in the Koryak Upland, and Sakhalin Island.

SHANG, Q. H. 2004. Occurrences of Permian radiolarians in central and eastern Nei Mongol (Inner Mongolia) and their geological significance to the Northern China Orogen. *Chinese Science Bulletin* **49** (24), 2613-2619.

The Zhesi (Jisu) Formation of the Middle Permian in Nei Mongol (Inner Mongolia) was commonly considered to be a shallow marine sequence. Here I report the radiolarians found in the argillite bed of that formation in Zhesi and Xilinhot areas. This fact indicates a deep marine sedimentary facies persisted during the Middle Permian, and suggests that the ocean between the North China Block and Siberian Craton was not closed until the Late Guadalupian. The suture of this two blocks is probably extends along the Linxi ophiolite belt, south of the Hegenshan ophiolite belt.

SHARMA, V. & RAM, M. P. 2003. Early to middle Miocene radiolarian assemblages and biostratigraphy, Andaman Islands, northeast Indian Ocean. *Journal of the Palaeontological Society of India* **48**, 1-39.

Neogene sedimentary sequences of the Andaman and Nicobar islands in the Northeast Indian Ocean, which are largely composed of deep marine facies, contain rich microfossil assemblages. The radiolarian assemblages in the sequences are comparable in abundance and diversity to those found in low latitude deep sea drill cores. In this work, radiolaria from six stratigraphic sections in the Andaman islands have been documented. The assemblages range from early to middle Miocene and are assigned to *Stichocorys wolffii* Zone and *Calocycletta* (*Calocyclissima*) costata Zone. Ten radiolarian events have been identified. These events have been compared with those observed by other investigators in low latitude sediments from Atlantic, Pacific and Indian Ocean. The succession of events in different biostratigraphic zones show good agreement in almost all the sites except in the east central Pacific. Brief taxonomic notes and illustrations of all the reported taxa are presented.

SHERVAIS, J. W., MURCHEY, B. L., KIMBROUGH, D. L., RENNE, P. R. & HANAN, B. 2005. Radioisotopic and biostratigraphic age relations in the Coast Range Ophiolite, northern California: Implications for the tectonic evolution of the Western Cordillera. *Geological Society of America Bulletin* **117** (5-6), 633-653.

The Coast Range ophiolite (CRO) in northern California includes two distinct remnants. The Elder Creek ophiolite is a classic suprasubduction zone ophiolite with three sequential plutonic suites (layered gabbro, wehrlite-pyroxenite, quartz diorite), a mafic to felsic dike complex, and mafic-felsic volcanic rocks; the entire suite is cut by late mid-oceanic-ridge basalt (MORB) dikes and overlain by ophiolitic breccia. The Stonyford volcanic complex (SFVC) comprises three volcanic series with intercalated chert horizons that form a submarine volcano enclosed in sheared serpentinite. Structurally below this seamount are melange blocks of CRO similar to Elder Creek. U/Pb zircon ages from plagiogranite and quartz diorites at Elder Creek range in age from 165 Ma to 172 Ma. U/Pb zircon ages obtained from CRO melange blocks below the SFVC are similar (166-172 Ma). Ar-40-Ar-39 ages of alkali basalt glass in the upper SFVC are all younger at

approximate to 164 Ma. Radiolarians extracted from chert lenses intercalated with basalt in the SFVC indicate that the sedimentary strata range in age from Bathonian (Unitary Association Zone 6-6 of Baumgartner et al., 1995a) near the base of the complex to late Callovian to early Kimmeridgian (Unitary Association Zones 8-10) in the upper part. The SFVC sedimentary record preserves evidence of a major faunal change wherein relatively small sized, polytaxic radiolarian faunas were replaced by very robust, oligotaxic, nassellarian-dominated faunas that included *Praeparvicingula* spp. We suggest that CRO formation began after the early Middle Jurassic (172-180 Ma) collision of an exotic or fringing are with North America and initiation of a new or reconfigured east-dipping subduction zone. The data show that the CRO formed prior to the Late Jurassic Nevadan orogeny, probably by rapid forearc extension above a nascent subduction zone. We infer that CRO spreading ended with the collision of an oceanic spreading center ca. 164 Ma, coincident with the oldest high-grade blocks in the structurally underlying Franciscan assemblage. We further suggest that the "classic" Nevadan orogeny represents a response to spreading center collision, with shallow subduction of young lithosphere causing the initial compressional deformation and with a subsequent change in North American plate motion to rapid northward drift (J2 cusp) causing sinistral transpression and transtension in the Sierra foothills. These data are not consistent with models for Late Jurassic arc collision in the Sierra foothills or a backarc origin for the CRO.

SHIMIZU, N., ISOZAKI, Y., MATSUDA, T., YAO, J. & JI, Z. 2004. Detailed stratigraphy across the Permo-Triassic boundary at Chaotian in Northern Sichuan, China. *Journal of Geography (Tokyo)* **113** (1), 87-106.

SHOJAAT, B., HASSANIPAK, A. A., MOBASHER, K. & GHAZI, A. M. 2003. Petrology, geochemistry and tectonics of the Sabzevar ophiolite, North Central Iran. *Journal of Asian Earth Sciences* **21** (9), 1053-1067.

The Sabzevar ophiolite is a highly dismembered ophiolite complex located along the northern boundary of the central Iranian microcontinent (CIM), and is one of the internal Iranian group of ophiolites and colored melanges. The igneous rocks of this complex consist of peridotites (harzburgite, dunite and lherzolite), serpentinite, minor pyroxenite, gabbros, and a volcanic sequence that exhibits a wide range of composition from basalts and basaltic andesites to rhyodacite-dacites, rhyolites and basanites. Sedimentary rocks include a variety of Upper Triassic to Lower Cretaceous deep- and shallow-marine rocks. These include pelagic fossiliferous carbonates that are mixed with the pillow basalt and basaltic andesite as interlayers or exotic blocks ranging in size from 10 to 100 m. Also present are extensive units of radiolarian chert, which are interbedded within the basalts and basaltic andesites. A combination of petrographic observations and analyses of incompatible trace elements and rare earth elements indicates the presence of at least four different types of extrusive rocks in the Sabzevar ophiolite. The geochemical data clearly identifies some of the extrusive rocks to have formed from three distinct types of basaltic melts; (i) the group-1 basaltic rocks, which formed from an initial melt with N-MORB-like (LREE depleted) chemical signatures and are petrogenetically related to the gabbros, (ii) group-2 basaltic rocks which have E-MORB chemical signatures, and (iii) group-3 basaltic rocks with LREE-enriched signatures and incompatible trace element patterns that suggest an island arc affinity. The data also suggest that the gabbros and the group-1 basaltic rocks are petrogenetically related and produced by fractionation of plagioclase and to a lesser extent clinopyroxene and hornblende. Similar to other studied Iranian ophiolites (e.g. Khoy, Band-e-Zeyarat/Dar Anar, Neyriz, Kermanshah and Baft) the results from the Sabzevar ophiolite demonstrate the presence of relics of mid-ocean ridge basalt (MORB)-like signatures in the extrusive units of Neo-Tethyan ophiolites and suggests that the fossil oceanic lithosphere preserved in these ophiolites developed at an oceanic spreading center. In addition, the Sabzevar ophiolite contains other volcanic rocks that have non-MORB-like geochemical signatures (e.g. within-plate, island arc). The differences between these geochemical signatures could be a result of a differing upper mantle composition, or different degrees of partial melting of the same upper mantle. The presence of sizable Nb anomalies in the extended rare earth element (REE) patterns for andesites and the group-3 basalts is characteristic of volcanic arc magmas, or possibly are products of the ascending magma that was modified by crustal contamination. The presences of the basanites and the silica-undersaturated rocks could be attributed to extrusive activity following ophiolite emplacement. Plate reconstructions suggest that rocks of the Sabzevar ophiolite were part of the Tethyan oceanic crust that was formed during rifting of a narrow but deep seaway that separated the CIM from the Eurasian plate. The ophiolite was emplaced during northeast dipping subduction (i.e. closure) of this segment of the Tethyan seaway (Sabzevar Ocean).

SHUTO, T. & OTSUKA, T. 2004. Late Jurassic-Lower Cretaceous accretionary complex of the eastern Mino Terrane, central Japan; radiolarian age and imbricate structure of the Misogawa Complex. *Journal of the Geological Society of Japan* **110** (2), 67-84.

The Misogawa Complex is a Mesozoic accretionary complex widely exposed in the eastern Mino Terrane, central Japan. The Misogawa Complex in the Kisofukushima area consists of two lithologic units; one is chert-dominant unit and the other is sandstone-dominant unit. The former is composed of pelagic chert and hemipelagic siliceous mudstone, and the latter is composed of a large amount of sandstone and mudstone. They show various deformation features up to dismembered formation. In the chert-dominant units, chert-clastics sequences that are composed of pelagic chert and overlying trench-fill sediments are repeatedly exposed with imbricate thrusts. The trench-arrival age of the oceanic plate is Late Jurassic and the depositional age of the complex possibly reaches latest Jurassic or earliest Cretaceous on the basis of radiolarian biostratigraphic data obtained from three continuous successions. The trench-arrival age shows the structurally downward younging polarity through the structurally overlying Sawando Complex and the underlying Misogawa Complex. It is inferred that both complexes were formed through continuous subduction-accretion process from late Early Jurassic to latest Jurassic or earliest Cretaceous. Considering lithofacies, structures and radiolarian ages, the Takatori Unit and the Kasama Unit in the Yamizo Mountains and southern part of the Kamiaso Unit in the western Mino Terrane are correlative with the Misogawa Complex.

SLUIJS, A., PROSS, J. & BRINKHUIS, H. 2005. From greenhouse to icehouse; organic-walled dinoflagellate cysts as paleoenvironmental indicators in the Paleogene. *Earth-Science Reviews* **68** (3-4), 281-315.

Dinoflagellates are an important component of the extant eukaryotic plankton. Their organic-walled, hypnozygotic cysts (dinocysts) provide a rich, albeit incomplete, history of the group in ancient sediments. Building on pioneering studies of the late 1970s and 1980s, recent drilling in the Southern Ocean has provided a wealth of new dinocyst data spanning the entire Paleogene. Such multidisciplinary studies have been instrumental in refining existing and furnishing new concepts of Paleogene paleoenvironmental and paleoclimatic reconstructions by means of dinocysts. Because dinocysts notably exhibit high abundances in neritic settings, dinocyst-based environmental and paleoclimatic information is important and complementary to the data derived from typically more offshore groups as planktonic foraminifera, coccolithophorids, diatoms and radiolaria. By presenting case-studies from around the globe, this contribution provides a concise review of our present understanding of the paleoenvironmental significance of dinocysts in the Paleogene (65-25 Ma). Representing Earth's greenhouse-icehouse transition, this episode holds the key to the understanding of extreme transient climatic change. We discuss the potential of dinocysts for the reconstruction

of Palcogene sea-surface productivity, temperature, salinity, stratification and paleo-oxygenation along with their application in sequence stratigraphy, oceanic circulation and general watermass reconstructions.

SMUC, A. & GORICAN, S. 2005. Jurassic sedimentary evolution of a carbonate platform into a deep-water basin, Mt. Mangart (Slovenian-Italian border). *Rivista Italiana di Paleontologia e Stratigrafia* **111** (1), 45-70.

A complete Jurassic succession, recording the evolution from platform margin to a deep-water basin, is exposed at Mt. Mangart in the Julian Alps. The succession is a part of the Julian Nappe, where the Southern Alps overlap with the Dinarides. In the Jurassic, the area comprised part of the south Tethyan passive continental margin. The section was studied sedimentologically in detail and dated with radiolarians. It is divided into five lithostratigraphic units: Unit 1: Lower Jurassic shallow-water peloidal and oncoidal limestones; Unit 2: Pliensbachian distal shelf limestones rich in juvenile ammonites and sponge spicules topped by an Fe-Mn hardground; Unit 3: lower to possibly middle Toarcian sequence of black shales with interbedded siliceous limestone; Unit 4: upper Bajocian/Bathonian to lower Tithonian cherts, cherry limestones, and carbonate gravity-flow deposits; Unit 5: upper Tithonian red nodular cherty limestones with abundant calpionellids and aptychi. A stratigraphic gap, comprising the late Toarcian to early Bajocian, separates Unit 4 from Unit 3. In general, the succession correlates well with known Tethyan transgressive/regressive facies cycles. In addition, two periods of accelerated subsidence were recognized, the first, in the Pliensbachian, drowned the platform, the second, prior to the late Bajocian, created accommodation space for resedimented carbonate deposits from the adjacent Friuli Carbonate Platform. The present day position of the succession is between the Belluno Basin to the west and the Slovenian Basin to the south. The hitherto described successions of these two basins were located more distally from the Friuli Carbonate Platform than the Mt. Mangart succession.

STASIUK, L. D. & FOWLER, M. G. 2004. Organic facies in Devonian and Mississippian strata of Western Canada Sedimentary Basin: relation to kerogen type, paleoenvironment, and paleogeography. *Bulletin of Canadian Petroleum Geology* **52** (3), 234-255.

Petrographic analyses of dispersed organic matter (including macerals and palynomorphs), siliceous and calcareous microfossil assemblages and microtextures (e.g. stromatolitic) have been used to define and interpret five organic facies and regionally map their distribution for the following informal groupings of potential hydrocarbon source rocks in the Western Canada Sedimentary Basin: Upper Devonian Woodbend group, Upper Devonian Winterburn group and Upper Devonian to Lower Mississippian black shales of the Exshaw and Bakken formations. Five petrographic organic facies (A-E) are defined for the potential source rocks based on assemblages of alginites, acritarchs, sporinites, siliceous microfossils and algal mat microtextures. Organic facies A, B (prasinophyte alginites and acritarchs) and C (coccoidal alginite), represent accumulation in relatively deep (basin), intermediate (shelf-platform), and shallow water depths (bank-reef margin to lagoonal). Organic facies D is defined by siliceous microfossils (e.g. Radiolaria) and accumulated in deep basinal to outer shelf settings immediately east of an ancient Pacific Ocean, or south of an ancient Arctic Ocean. This facies may reflect regions of upwelling which extended into intracratonic and epicontinental settings. Organic facies E, characterized by stromatolitic microtextures with or without coccoidal alginite, only occur within Upper Devonian Winterbum Group shallow water, restricted shelf to lagoonal dolostones associated with evaporites. As a whole, the regional distribution of organic facies is related to paleogeography, paleobathymetry or paleostructure in the source rocks. Surprisingly, petrographic organic facies do not show strong positive correlation with kerogen type as defined by Hydrogen-Oxygen indices or TOC-S2 plots.

STEINBERG, D. K., NELSON, N. B., CARLSON, C. A. & PRUSAK, A. C. 2004. Production of chromophoric dissolved organic matter (CDOM) in the open ocean by zooplankton and the colonial cyanobacterium *Trichodesmium* spp. *Marine Ecology-Progress Series* **267**, 45-56.

Chromophoric (or colored) dissolved organic matter (CDOM) has been identified as a major determinant of the optical properties of oligotrophic oceans. The factors controlling distribution of CDOM far from the direct influence of land are not well known, as CDOM abundance and distribution does not directly correlate with phytoplankton productivity or biomass, or with dissolved organic matter (DOM) concentration. As part of a larger study of the dynamics of CDOM in the open ocean, we investigated direct release from plankton as a factor contributing to distribution patterns of CDOM. We measured the production of CDOM by zooplankton (copepods, euphausiids, amphipods, salps, polychaetes), protozoans (colonial radiolaria), and by the colonial cyanobacterium *Trichodesmium* spp. in the North Atlantic subtropical gyre. Groups of individual species of plankton were incubated and absorption spectra were obtained for their release products. CDOM was produced by all organisms examined, and absorption spectra varied by taxa, with major taxa exhibiting characteristic absorption peaks. Plankton-produced DOM is a source of labile carbon and thus facilitates microbial activity, and CDOM may also serve as photoprotection for near-surface-living organisms. Zooplankton likely play an important role in the CDOM cycle in the Sargasso Sea, directly through release/excretion of CDOM and indirectly by providing a labile substrate (excretia) for microbial-mediated production of CDOM.

STEPANJANTS, S. D., KRUGLIKOVA, S. B., BJØRKLUND, K. R. & CORTESE, G. 2004. The Bipolar Distribution of Marine Organisms with Emphasis on Radiolaria and Cnidarians: A Step Forward. *In:* (KAFANOV, A. I. eds). *Main problems in marine biogeography: In Memory of the Academician O.G. Kusakina*. 132-181. Dal'nauka, Vladivostok.

STICKLEY, C. E., BRINKHUIS, H., ROESSIG, K. L. M., CHAPRONIERE, G. C. H., FULLER, M. D., KELLY, D. C., NUERNBERG, D., PFUHL, H. A., SCHELLENBERG, S. A., SCHOENFELD, J., SUZUKI, N., TOUCHARD, Y., WEI, W., WILLIAMS, G. L., LARA, J. & STANT, S. A. 2004. Late Cretaceous-Quaternary biomagnetostratigraphy of ODP Sites 1168, 1170, 1171, and 1172, Tasmanian Gateway. *In:* (EXON, N. F., KENNETT, J. P. & MALONE, M. J. eds). *Proceedings of the Ocean Drilling Program, Scientific Results* **189**. 1-57.

Late Cretaceous (Maastrichtian)–Quaternary summary biostratigraphies are presented for Ocean Drilling Program (ODP) Leg 189 Sites 1168 (West Tasmanian Margin), 1170 and 1171 (South Tasman Rise), and 1172 (East Tasman Plateau). The age models are calibrated to magnetostratigraphy and integrate both calcareous (planktonic foraminifers and nannofossils) and siliceous (diatoms and radiolarians) microfossil groups with organic walled microfossils (organic walled dinoflagellate cysts, or dinocysts). We also incorporate benthic oxygen isotope stratigraphies into the upper Quaternary parts of the age models for further control. The purpose of this paper is to provide a summary age-depth model for all deep-penetrating sites of Leg 189 incorporating updated shipboard biostratigraphic data with new information obtained during the 3 yr since the cruise. In this respect we provide a report of work to November 2003, not a final synthesis of the biomagnetostratigraphy of Leg 189, yet we present the most

complete integrated age model for these sites at this time. Detailed information of the stratigraphy of individual fossil groups, paleomagnetism, and isotope data are presented elsewhere. Ongoing efforts aim toward further integration of age information for Leg 189 sites and will include an attempt to correlate zonation schemes for all the major microfossil groups and detailed correlation between all sites.

SUGIYAMA, K., KAWAKAMI, S. & TAKANO, M. 2001. Aerial photograph and stratigraphic correlation of the Triassic and Lower Jurassic siliceous claystone and bedded chert units of the Inuyama and Hisuikyo areas, central Japan. *News of Osaka Micropaleontologists, Special Volume* **12**, 145-157.

SUN, D. & XIA, W. 2003. Characteristics of *Albaillella* (Albaillellarian, Radiolarian) Fauna from Guadalupian to Lopingian Series in Permian, South China. *Journal of China University of Geosciences* **14** (4), 314-320.

On the basis of establishment of radiolarian biostratigraphy and conodont biostratigraphy,a radiolarian *Albaillella* fauna in the transitional environment from Guadalupian to Lopingian Series in Permian was found at a pelagic chert section in southeast Guangxi, South China. Radiolarian *Albaillella* is one of the most sensitive biology to the transitional environment. The *Albaillella* fauna shows an ecological evolutionary process from Guadalupian to Lopingian: declined stage-recovery stage-flourishing stage. The study of characteristics of the *Albaillella* fauna in the transitional environment may provide more information, not only for the subdivision and correlation of a high-resolution biostratigraphy, but also for influence of radiolarian *Albaillella* fauna on the pre-Lopingian mass extinction.

SUZUKI, H. 2001a. Zur Radiolarienstratigraphie im Unter-Callovium in den Nördlichen Kalkalpen -das Klauskogelbachprofil westlich von Hallstatt (Österreich). *Zentralblatt fur Geologie und Palaontologie. Teil I, Allgemeine, angewandte regionale und historische Geologie* **1/2**, 167-184.

SUZUKI, H., MAUNG, M., AUNG, A. K. & TAKAI, M. 2004. Jurassic radiolaria from chert pebbles of the Eocene Pondaung Formation, central Myanmar. *Neues Jahrbuch Fur Geologie Und Palaontologie-Abhandlungen* **231** (3), 369-393.

Jurassic radiolarians are described from chert pebbles contained in the Eocene Pondaung Formation of central Myanmar for the first time. Chert pebbles yield some stratigraphically important species as *Emiluvia sedecimporata*, *Paronaella mulleri*, *Williriedellum carpathicum*, *Mirifusus* cf. *dianae*, *Zhamoidellium ovum* and others. These species indicate clearly a Jurassic age, ranging from the Callovian to the Kimmeridgian. It is confirmed that a Jurassic chert sequence, which has not been known in Myanmar, has been already exposed around the sedimentary basin of central Myanmar in Eocene time. The regional geology and composition of conglomerates suggest that the chert pebbles of the Pondaung Formation were derived from the ophiolites of the Indo-Burman Ranges.

SUZUKI, N. 2001b. Mathematical expressive revisions to *Vallupus* / *Eucyrtidellum* Number for better usage. *News of Osaka Micropaleontologists, Special Volume* **12**, 253-256.

SUZUKI, N. 2005. Physiological axopodial activity of *Rhizosphaera trigonacantha* Haeckel (a spheroidal radiolarian, Polycystina, Protista). *Marine Micropaleontology* **54** (3-4), 141-153.

Plankton samples containing specimens of the Polycystine radiolarian *Rhizosphaera trigonacantha* Haeckel were collected from surface ocean waters influenced by the warm Kuroshio Current at a locality approximately 2 km south of Sesoko Island (Okinawa, Southwest Japan). The axopodial activity of one *R. trigonacantha* individual was observed for 3 days by continuously recording with two video systems. This individual possessed an inner, dark grayish-red spherical part and an outer pale liver-brown part with numerous radiating axopodia. Axopodia are radially elongated, exceed 1.2 mm in length, and may be divided distinguished into two types: proximally observable fine axopodia (Type I), and distinct, thick axopodia (Type II). Most axopodia are Type I; few Type II axopodia radiate from the ectoplasm. *Rhizosphaera trigonacantha* lacks chlorophyll-bearing symbionts, as shown by autofluorescent microscopy with UV-excitation. The video recordings show that most axopodia remain elongated for hours, but a few Type II axopodia show intermittent, irregular contraction, and extension. The movement of Type II axopodia can be divided into four phases based on the state of the axopodia and movement of axopodial particles: a short phase (S-phase), an extension phase (E-phase), a long phase (L-phase), and a contraction phase (C-phase). The C-phase is divided into two subphases, CI and CII. The systematic extension and contraction of axopodia, is easily disrupted by external disturbance. The function of axopodia in *R. trigonacantha* is not well understood, but three hypotheses are proposed: (1) the immobile phase of most axopodia is associated with the planktonic lifestyle and the maintenance of buoyancy; (2) the sudden contraction provides escape, e.g., against attack; and (3) axopodial extension and contraction on a limited part of the ectoplasm serves in predation.

SUZUKI, N., AKIBA, N. & KANO, H. 2002. Late Olenekian radiolarians from bedded chert of Ashio Terrane, northeast Japan, and faunal turnovers in western Panthalassa during Early Triassic. *Journal of China University of Geosciences* **13** (2), 124-140.

SUZUKI, N., ENNYU, A. & KIDA, S. 2003. Leg 189: Cenozoic paleoceanographic change with Tasmanian Gateway Opening, the Southern Oceans. *The Earth Monthly, Special Volume* **40**, 103-109.

SUZUKI, N. & KIDA, S. 2004. How many radiolarians should be counted? a method of estimating the relative abundance in the parent populations. *News of Osaka Micropaleontologists, Special Volume* **13**, 221-227.

SUZUKI, N., KOJIMA, S., KANO, H., YAMAKITA, S., MISAKI, A., EHIRO, M., OTOH, S., KURIHARA, T. & AOYAMA, M. 2005. Permian radiolarian faunas from chert in the Khabarovsk Complex, Far East Russia, and the age of each lithologic unit of the Khabarovsk Complex. *Journal of Paleontology* **79** (4), 687-701.

The Khabarovsk Complex, a Jurassic accretionary complex distributed in and around the Khabarovsk city area, Far East Russia, comprises melange and schist facies. From the review of previous studies including Russian papers, the lithology and age of the constituent rocks of the melange facies can be summarized as follows: Upper Paleozoic basic volcanic rocks, mainly pillow lava, and altered gabbro, Upper Carboniferous to Upper Permian fusulinoidean-bearing limestone associated with tuff, Lower and Middle Jurassic siliceous mudstone, Upper Jurassic tuffaceous mudstone, uppermost Jurassic carbonate concretions embedded in mudstone, and age-unknown sandstone. Newly found sequences of limestone-chert and of basalt-chert in the melange facies crop out along the Amur River in the Khabarovsk city area. A chert sample

of the limestone-chert sequence contains *Albaillella* aff. *asymmetrica* and *Pseudoalbaillella* aff. *lomentaria*, and a chert sample of the basalt-chert sequence includes *Follicucullus monacanthus*, *Follicucullus porrectus*, and *Pseudoalbaillella* cf. *yanaharaensis*. The radiolarian assemblages from the limestone-chert and basalt-chert sequences have a maximum age of middle Early Permian and late Middle Permian, respectively, overlapping the time of deposition of the fusulinoidean-bearing limestone. The co-occurrence of chert and limestone indicates that the fusulinoidean-bearing limestone was formed on a basaltic topographic high in a pelagic ocean whereas the radiolarians accumulated in a deeper part. Limestone debris occasionally flowed into the depositional site of the radiolarian chert. Although the Khabarovsk Complex was simply considered as a northern extension of the Mino-Tamba Belt of the Inner Zone of southwest Japan, we propose a new correlation based on the lithologic associations. The melange facies of the Khabarovsk Complex is correlative with one of the Kasugano, Funabuseyama, Nabi, and Yabuhara Formations in the Mino-Tamba Belt, whereas the schist facies is correlative with the Hikami Formation of the Ultra-Tamba Belt.

SUZUKI, N. & OGANE, K. 2004. Paleoceanographic affinities of radiolarian faunas in late Aalenian time (Middle Jurassic) recorded in the Jurassic accretionary complex of Japan. *Journal of Asian Earth Sciences* **23** (3), 343-357.

A total of 140 polycystine radiolarians (84 nassellarians and 56 spumellarians; called Mn-03 assemblage herein) were identified from a manganese nodule in mudstone of the chert-clastic sequence distributed in the Jurassic accretionary complex of the Kuzumaki-Kamaishi Belt, Northern Kitakami Mountains, Northeast Japan. The horizon yielding this well-preserved assemblage was correlated to the uppermost part of the radiolarian JR4 Zone (the Upper Aalenian, Middle Jurassic) on the basis of the presence of *Tricolocapsa tegiminis*, the probable decendant of *Laxtorum* (?) *jurassicum*, and the absence of *L.* (?) *jurassicum* and *Tricolocapsa plicarum*. The Mn-03A assemblage is of high diversity but shows nearly half of the diversity of the contemporaneous assemblage which was reported from manganese nodules in another Jurassic accretionary complex of the Mino Belt in Japan. Both assemblages are considered to have been derived from the same province due to faunal similarity. The difference between both assemblages is explained by lower productivity in the depositional region of the Mn-03A assemblage. Comparison of the Mn-03A assemblage to the contemporaneous assemblage indicates that the fauna lived in the equatorial to lower latitudinal zone of the Pacific Superocean in late Aalenian time.

TAKAHASHI, K. & YAMASHITA, H. 2004. Temporal and vertical flux changes of radiolarians in the western and central equatorial Pacific during the 1999 La Niña conditions. *Journal of the Geological Society of Japan* **110** (8), 463-479.

Temporal flux changes of radiolarians were investigated employing time-series sediment traps deployed in the western and central equatorial Pacific during January to November 1999. On board R/V Mirai the sediment traps were deployed at four sites located between 135°E and 175°E, i.e., across the western Pacific warm pool (WPWP) region and the Equatorial Upwelling region (EUR). Total radiolarian fluxes showed higher values at Sites MT1, 2, 5 than that at Site MT3. Radiolarian production reflected levels of biological productivity, i.e., the levels of nutrient supply. The radiolarian flux species compositions at each site did not vary much seasonaly whereas levels of total radiolarian flux varied significantly. Several useful environmental indicator species are presented in this study. For instance, *Lithomelissa setosa* and *Pseudocubus obeliscus* are good eutrophic indicators. They are important tracers of the present WPWP migration in the western and central equatorial Pacific. The flux pattern of *Lophophaena cylindrica* was nearly the same as that of total radiolarians, and this species could represent the whole radiolarian productivity in the western and central equatorial Pacific. Furthermore, in order to understand the vertical radiolarian transport, the sediment trap samples were compared with the samples from plankton tows as well as core tops obtained using a multiple corer. The changes of Nassellaria-Spumellaria ratios between the suspended and sinking radiolarian populations were not significant, but there were significant differences between the sinking and surface sediment populations. It suggested that in the western and central equatorial Pacific the significant dissolution of radiolarians took place in surface sediments. The radiolarian assemblages were affected by selective dissolution. It appears that every species receives different levels of dissolution during their vertical transportation. The results provide important information when radiolarian microfossils are used to reconstruct paleoceanographic conditions.

TAKAHASHI, O. 2004. Phaeodarian Radiolaria from the Upper Cretaceous beds of central Japan. *Revue de Micropaléontologie* **47** (3), 119-125.

Upper Cretaceous Phaeodarea (Radiolaria) were recovered from the Shoya Formation, which crops out 100 km northwest of Tokyo, central Japan. The Shoya Formation consists of about 600 m-thick marine sedimentary rocks, represented by alternating beds of sandstone and mudstone, which are overlain by about 10 m of Phaeodarian-bearing siliceous mudstone. The latter is assigned to the Upper Cretaceous (late Campanian to early Maastrichtian) based on the associated Polycystine Radiolarian fossils. In spite of the poor general preservation of nearly all Phaeodarian specimens as recrystallized quartz infillings, three new Phaeodarian species, *Challengeranium cretaceum*, *Challengeron paleotriangulum*, and *Medusetta* fossilis, were identified on the basis of their shape and ornamentation. Our finding, together with two other very recent reports of fossil Phaeodarians clearly document that the origin of Phaeodarian Radiolarians can be extended back to at least the Upper Cretaceous.

TAKAHASHI, O., YUASA, T., HONDA, D. & MAYAMA, S. 2004. Molecular phylogeny of solitary shell-bearing Polycystinea (Radiolaria). *Revue de Micropaléontologie* **47** (3), 111-118.

The phylogeny of the Family Spongodiscidae (polycystine Radiolaria), which includes *Dictyocoryne profunda* Ehrenberg, *Dictyocoryne truncatum* (Ehrenberg) and *Spongaster tetras* Ehrenberg, was examined using 18S ribosomal DNA (small-subunit ribosomal DNA) sequence analysis. Three types of tree construction methods, the neighbor joining (NJ), maximum parsimony (MP), and maximum likelihood (ML) methods, were used to infer the phylogenetic relationships of the polycystine and acantharian Radiolaria among eukaryotes. The obtained 18S rDNA molecular phylogenetic tree argues for the monophyly of the two groups. Furthermore, the Polycystinea is divided into at least two distinct lineages consisting of: (1) colonial and skeletonless Polycystinea, including Thalassicollidae, Collospaeridae, and Sphaerozoidae; and (2) shell-bearing solitary Polycystinea, including Spongodiscidae. The Polycystinea thus show a paraphyly among Radiolaria. Moreover, the monophyly of the clade including the acantharians and the spongodiscid polycystines was supported by bootstrap values, which were 94%, 53%, and 59% in the NJ, MP, and ML analyses, respectively. This lineage is characterized by having latticed or spongy skeletons of different chemical composition, namely SiO2 (Class Polycystinea) or SrSO4 (Class Acantharea). According to the present taxonomic scheme, the Acantharea and the Polycystinea have not been placed in different classes, but the results of our molecular study show the opposite. We therefore suggest, based on the monophyly of the two clades, that a new taxonomic group of Radiolaria can be established. Our molecular data also suggest that the currently used radiolarian taxonomic system may need serious revisions.

TAKASHIMA, R., KAWABE, F., NISHI, H., MORIYA, K., WANI, R. & ANDO, H. 2004. Geology and stratigraphy of forearc basin sediments in Hokkaido, Japan: Cretaceous environmental events on the north-

west Pacific margin. *Cretaceous Research* **25** (3), 365-390.

Litho-. bio-. and chemostratigraphy of the Cretaceous forearc basin sediments exposed in Hokkaido, northern Japan allow a synthesis of the faunal, sedimentological, and environmental history of the north-west Pacific margin. Although the succession, named the Yezo Group, has yielded an abundant record of mid- to late Cretaceous invertebrates, monotonous lithologies of sandstone and mudstone, showing occasional lateral facies changes, have caused confusion regarding the lithostratigraphic nomenclature. Based on our wide areal mapping of the sequence, and analysis of litho- and biofacies, a new lithostratigraphic scheme for the Yezo Group is proposed. In ascending order, the scheme is Lis follows: the Soashibetsugawa Formation (Lower Aptian mudstone unit); the Shuparogawa Formation (Lower Aptian-lower Upper Albian sand stone-dominant turbidite unit); the Maruyama Formation (lower Upper Albian tuffaceous sandstone unit);, the Hikagenosawa Formation (Upper Albian-Middle Cenomanian mudstone-dominant unit) ; the Saku Formation (Middle Cenomanian-Upper Turonian sandstone-common turbidite unit); the Kashima Formation (Upper Turonian-Lower Campanian mudstone-dominant unit); and the Hakobuchi Formation (Lower Campanian-Paleocene shallow-marine sandstone-conglomerate unit). In addition, we designate two further lithostratic graphic units, the Mikasa Formation (Upper Albian-Turonian shallow-marine sandstone-dominated unit) and the Haborogawa Formation (Middle Turonian-Campanian shelf mudstone/sandstone unit), which correspond in age to the shallower facies of the Saku and Kashima formations, respectively. Despite a lack of so-called "black shales", because of siliciclastic dilution, our Stratigraphic integration has revealed the horizons of oceanic anoxic events (OAEs) in the Yezo Group. The OAE1a horizon in the Soashibetsugawa Formation is characterized by a lack of foraminifers, macrofossils and bioturbation, and a prominent positive excursion of delta(13)C(org). A significant hiatus during the late Aptian and early Albian removed the OAE1b horizon. The OAE1c horizon in the Maruyama Formation shows a distinct negative excursion of delta(13)C(org), with a concomitant high productivity of radiolarians. The OAE1d horizon in the middle part of the Hikagenosawa Formation consists of weakly laminated, pyrite-rich mudstone. Planktonic and calcareous benthic foraminifers are absent, whereas racholarians are abundant above the OAE1d horizon. The mid-Cenomanian event (MCE) horizon is identified at the top of the Hikagenosawa Formation. Stepwise extinction of calcareous benthic foraminifers and a decrease in radiolarian diversity become apparent above the MCE horizon. In the study area, the OAE2 horizon has been well documented, and is placed in the middle part of the Saku Formation.

TAKAYANAGI, A., HORI, N. & SASHIDA, K. 2001. Tectonostratigraphy of the sedimentary complex of the Ashio Terrane in the northern part of the Ashikaga area, Tochigi Prefecture, and the occurrence of radiolarians. *News of Osaka Micropaleontologists, Special Volume* **12**, 113-127.

TAKEMURA, A. & MIYAKE, M. 2001. Preliminary report on the occurrence of Miocene radiolarians from Koyamaichi area, Okayama Prefecture, Southwest Japan. *Hyogo University of Teacher Education Journal* **21**, 23-30.

TAKEMURA, S., SAKAMOTO, S., TAKEMURA, A., NISHIMURA, T., AITA, Y., YAMAKITA, S., KAMATA, Y., SPÖRLI, K. B., CAMPBELL, H. J., SAKAI, T., SUZUKI, N., HORI, R. S., SAKAKIBARA, M., OGANE, K., KODAMA, K. & NAKAMURA, Y. 2004a. Lithofacies of Middle to Late Permian pelagic sedimentary rocks at Arrow Rocks, North Island, New Zealand. *News of Osaka Micropaleontologists, Special Volume* **13**, 21-28.

TAKEMURA, S., SAKAMOTO, S., TAKEMURA, A., NISHIMURA, T., AITA, Y., YAMAKITA, S., KAMATA, Y., SPÖRLI, K. B., CAMPBELL, H. J., SAKAI, T., SUZUKI, N., HORI, R. S., SAKAKIBARA, M., OGANE, K., KODAMA, K. & NAKAMURA, Y. 2004b. Lithology of the ARG section, North Island, New Zealand. *Hyogo University of Teacher Education Journal, Series 3* **24**, 25-31.

TAKENOUCHI, K., TAKIZAWA, F., MIYASHITA, S., KIMURA, K. & OHKOUCHI, M. 2002. Geology and structure of the Joetsu Belt and the western zone of the Ashio Belt, central Japan. *Excursion Guidebook, the 109th Annual Meeting of the Geological Society of Japan*, 41-63.

TAKEUCHI, M. 2001. Morphologic study of multicyrtid Nassellaria (Radiolaria) from the Lower Jurassic bedded cherts in the Inuyama Area, Mino Terrane, Central Japan. *News of Osaka Micropaleontologists, Special Volume* **12**, 181-189.

TEKIN, U. K. & MOSTLER, H. 2005a. Late Ladinian (Middle Triassic) Spumellaria (Radiolaria) from the Dinarides of Bosnia and Herzegovina. *Rivista Italiana di Paleontologia e Stratigrafia* **111** (1), 21-43.

A limestone sample from southern Bosnia and Herzegovina near Fojnica town yielded extremely abundant and well-preserved radiolarians. The radiolarians are late Ladinian in age and clearly indicate the *Spongoserrula fluegeli* Subzone of Muelleritortis cochleata Zone based on the index forms and associated fauna. A highly diverse spumellarian fauna is described from this sample. Within the defined spumellarian fauna, five genera (*Ligulatubus*, *Tubospongopallium*, *Hexacatoma*, *Octostella* and *Discofulmen*), seventeen species (*Dumitricasphaera galeata*, *D. trialata*, *Spongostylus bosniensis*, *Spongopallium crassum*, *Ligulatubus yaoi*, *Tubospongopallium gracile*, *T. kozuri*, *T. tornatum*, *Archaeospongoprunum globosum*, *Vegbicyclia cruciforma*, *V. krystyni*, *Hexacatoma elegantissima*, *H. nobleae*, *Octostella pulchra*, *Pentaspongodiscus similediscus*, *Discofulmen dumitricai*, *D. ishidai*) are new.

TEKIN, U. K. & MOSTLER, H. 2005b. Longobardian (Middle Triassic) entactinarian and nassellarian radiolaria from the Dinarides of Bosnia and Herzegovina. *Journal of Paleontology* **79** (1), 1-20.

Abundant and well-preserved radiolarians are. reported from a limestone sample taken from near the town of Fojnica, southern Bosnia and Herzegovina. A late late Ladinian age is assigned to this sample based on the index species *Spongoserrula fluegeli* and *Muelleritortis cochleata* and associated radiolarian fauna. As a result of taxonomic studies on the entactinarian and nassellarian fauna of this sample, three species (*Pseudostylosphaera multispinata*, *P. oblonga*, and *P. procera*) from the suborder Entactinaria, and 18 species (*Bulbocyrtium cordeyi*, *B.? longobardicum*, *Goestlingella goricanae*, *G. pseudoillyrica*, *Monicasterix ornata*, *M. parvisegmentata*, *M. pulchra*, *Nabolella brevispinosa*, *N.crenulata*, *N. trispinata*, *Ladinocampe dinarica*, *Spinotriassocampe praecarnica*, *Pseudosaturniforma ladinica*, *Pararuesticyrtium coniformis*, *P.? sanfilippoae*, *Conospongocyrtis bragini*, *Castrum blomei*, and *Triassocyrtium longum*) from the suborder Nassellaria are described as new. Moreover, the genus *Pseudosaturniforma* is emended based on the new materials.

TESTA, M. & ANDRI, E. 2003. Preliminary note on the upper Miocene radiolarian assemblage of Cappella Montei (Alessandria). *Bollettino della Societa Paleontologica Italiana* **42** (1-2), 191-195.

We carried out a preliminary quantitative and qualitative study on the radiolarian fauna of the spongolitic levels of Cappella Montei. The radiolarian assemblage, formed by 60 taxa, proves, in our opinion, that these levels settled in a neritic environment.

TOLMACHEVA, T., HOLMER, L., POPOV, L. & GOGIN, I. 2004. Conodont biostratigraphy and faunal assemblages in radiolarian ribbon-banded cherts of the Burubaital Formation, West Balkhash Region, Kazakhstan. *Geological Magazine* **141** (6), 699-715.

Biostratigraphical study of the early to mid-Ordovician conodont fauna from ribbon-banded radiolarian cherts of the middle Burubaital Formation in Central Kazakhstan reveals an almost complete succession of conodont biozones from the late Tremadocian to the early Darriwilian. During this interval, biosiliceous sediments were deposited in basinal environments, inhabited by lingulate brachiopods, sponges, pterobranchs and caryocaridids in conditions of high fertility and primary productivity of surface water. The community structure of taxonomically diverse conodont assemblages typifying open oceanic environments is not significantly different from that of epicratonic basins of the North Atlantic conodont province. The regional increase of oxygenated bottom waters at the base of the *Oepikodus evae* Biozone is possibly related to considerable changes in palaeo-oceanographical circulation patterns. The finds of three natural clusters of *Prioniodus oepiki* (McTavish) enable us to propose an emended diagnosis of this species.

TUCHKOVA, M. I., BRAGIN, N. Y. & KRYLOV, K. A. 2004. Clay mineral associations in Triassic-Lower Cretaceous rocks of the Dal'negorsk key section, southern Sikhote Alin. *Lithology and Mineral Resources* **39** (2), 156-168.

Investigation of the Triassic-Lower Cretaceous rocks of the Dal'negorsk key section (southern Sikhote Alin) revealed the following successive associations of authigenic clay minerals: (1) sericite-chlorite (Lower Triassic); (2) mica-chlorite (Anisian-Norian); (3) chlorite-mica (Rhaetian-Lower Jurassic); and (4) smectite-chlorite-mica (Upper Jurassic-Lower Cretaceous). These four associations reflect the primary composition of terrigenous admixture in the siliceous sediments and, hence, serve as important indicators of paleosedimentation conditions. The first association represents a product of the erosion of metamorphic rock complexes. The second one reflects the onset of volcanic activity within the sedimentation basin coinciding in time with a vigorous bloom of siliceous plankton (radiolarians) and short-term appearance of specific (anoxic) carbonaceous sediments in the sequence. The third association characterizes the epoch of minimal supply of the basin with volcanic and terrigenous clastic materials and the dominant accumulation of almost pure planktonogenic sediments. The fourth association marks the change of marginal-marine conditions for pelagic ones and is expressed in a significant input of pyroclastic and clastic materials and the formation of distal flysch deposits.

UMEDA, M. & SUZUKI, Y. 2005. Aeronian (Llandovery, Early Silurian) Radiolarians from the Kallholn Formation in Siljan district, Sweden. *Micropaleontology* **51** (1), 83-92.

Early Aeronian (middle Llandovery, Early Silurian) radiolarians collected from calcareous nodules of the Kallholn Formation in the Siljan district, Sweden, are described. Seven genera and 11 species, including one new family Gyrosphaeridae and two new species, *Palaeoscenidium kuriharai* and *Gyrosphaera primigena*, are described. This fauna is characterized by the dominance of large spherical radiolarians, which constitute 54% of the total number of specimens per nodule. The fauna is similar to the middle Telychian fauna insofar as it is dominated by Haplotaeniatum cathenatum. However, it can be distinguished from the late Rhuddanian fauna by the sparse occurrence of *H. aperturatum*. These data suggest that the period from the Aeronian to the middle Telychian was marked by the dominance of *H. cathenatum*. Radiolarian spines, a morphological innovation, are believed to have evolved in the Aeronian. The time of radiolarian diversification corresponds to that of other planktonic/nektonic faunas including graptolites, chitinozoans, and fish, which suggests that marine macroplanktonic/nektonic faunas and microplankton diversified simultaneously in the Aeronian.

UMEDA, M. & TAGA, H. 2001. Note of occurrence of radiolarian fossils in the Nanjo Massif, Fukui Prefecture, central Japan -no. 5- Yunoo-dani Area. *Bulletin of the Fukui City Museum of Natural History* **48**, 27-47.

UMEDA, M. & TAGA, H. 2002. Note of occurrence of radiolarian fossils in the Nanjo Massif, Fukui Prefecture, central Japan -no. 6- the north of Sugetan-touge. *Bulletin of the Fukui City Museum of Natural History* **49**, 27-52.

VAZIRI, S. H. & YAO, A. 2005. First record of Late Permian radiolarians from Jolfa Region, Northwestern Iran. *Journal of Geosciences, Osaka City University* **48** (2), 17-37.

Late Permian (Early Djulfian) radiolarians were detected from nodular and bedded cherts of the Jolfa Formation (Selgord and Shammar members) in the Jolfa Region, Northwestern Iran for the first time. Two stratigraphic sections of the Shammar Member in south of the Aras Dam, western Jolfa Region, one stratigraphic section of the Shammar Member and one stratigraphic section of the Jolfa and Ali Bashi formations at Kuh-e-Ali Bashi (Ali Bashi Mountain), eastern Jolfa Region were lithostratigraphically and biostratigraphically examined. The Jolfa Formation in the study sections consists of marls, marly limestones, bedded cherts and cherty limestones, which were deposited in a shallow marine environment. The rich foraminifer fauna indicates an Early Djulfian age of the formation. Fifteen species of Late Permian (Early Djulfian) radiolarians include the *Ampulla tubulata*, *Copiellintra fontainei*, *Entactinia*? sp. A, *Entactinia*? sp. B, *Entactinia*? sp. C, *Entactinosphaera*? sp., *Orbiculiforma*? sp. A, *Orbiculiforma*? sp. B, *Raciditor*? sp., Spherical Radiolaria A, Spherical Radiolaria B, Spherical Radiolaria C, Ellipsoidal Radiolaria A, Ellipsoidal Radiolaria B, and Ellipsoidal Radiolaria C were detected. The detected radiolarians are correlative with those of China, Thailand, Japan, Malaysia, Turkey, Russian Far East, North America, Philippines and Italy. According to time unit, all recorded radiolarians can be correlated with the Upper Permian radiolarian zones which include the *Follicucullus bipartitus* - *Follicucullus charveti* Zone in southeast Guangxi, South China, *Neoalbaillella ornithoformis* Zone in Dachongling section, South China, *Follicucullus charveti – Albaillella yamakitai* Zone in Southwest Japan and *Neoalbaillella ornithoformis* Zone in Oregon, USA. Also the detected radiolarians are correlated with the *Codonofusiella-Reichelina* foraminiferal Zone and the age is assigned to Early Djulfian.

VAZIRI, S. H., YAO, A. & KUWAHARA, K. 2005. Lithofacies and microbiofacies (foraminifers and radiolarians) of the Permian Sequence in the Shalamzar area, Central Alborz, North Iran. *Journal of Geosciences, Osaka City University* **48** (3), 39-69.

The Permian sequence in the Shalamzar area occurs along the Gord Calleh Mountain in Central Alborz (NW Tehran), North Iran and

attains a thickness of up to 622 meters. This sequence is composed mainly of clastic rocks in the lower part and fossiliferous carbonate rocks in the upper part. The clastic facies were deposited in continental (meandering rivers) and transitional (deltaic and littoral) environments, and the carbonate facies were deposited in a shallow marine environment of the continental margin in the Paleo-Tethys. This sequence consists of three formations: the Dorud (Asselian-Sakmarian), the Ruteh (Artinskian-Murgabian) and the Nesen (Early Djulfian) formations, and overlies non-conformably on the volcanic rocks (Devonian?) of the basement. This sequence is disconformably overlain by the Elikah Formation (Scythian-Ladinian). The rich foraminifer fauna indicates an Asselian to Early Djulfian age of the succession. Five biozones by foraminifers are established in the Permian System of this region. These biozones include the *Pseudofusulina-Schwagerina* Assemblage Zone (Asselian-Sakmarian), *Schubertella-Mesosubertella* Assemblage Zone (Artinskian), *Dunbarula-Neoschwagerina* and *Neoendothyra-Globivalvulina* Assemblage zones (Murgabian), and *Codonofusiella-Reichelina* Assemblage Zone (Early Djulfian). Ten species of the Permian radiolarians include the *Latentifistula*? sp. A, *Latentifistula*? sp. B, *Latentifistularia* A, *Latentifistularia* B, *Orbiculiforma*? sp. A, *Orbiculiforma*? sp. B, Spherical Radiolaria A, Spherical Radiolaria B, Spherical Radiolaria C and Ellipsoidal Radiolaria A were detected from the Ruteh Formation for the first time in the present study. Index foraminifer's age of the Ruteh Formation assigns the age of detected radiolarians to Artinskian and Murgabian. The detected radiolarians are correlative with those of China, Thailand, Japan, Malaysia, Turkey, Far East of Russia, Kazakhstan, North America, Philippines and Italy. According to time unit, all recorded radiolarians can be correlated with the Permian radiolarian zones in South China, Southwest Japan and Oregon, USA and also are correlated with the *Schubertella-Mesoschubertella* Assemblage Zone (Artinskian), *Dunbarula-Neoschwagerina* and *Neoendothyra- Globivalvulina* Assemblage zones (Murgabian).

VOLPI, V., CAMERLENGHI, A., HILLENBRAND, C. D., REBESCO, M. & IVALDI, R. 2003. Effects of biogenic silica on sediment compaction and slope stability on the Pacific margin of the Antarctic Peninsula. *Basin Research* **15** (3), 339-363.

Analysis of physical properties measured on cores and on discrete samples collected by the Ocean drilling Program (ODP) Leg 178 on the Pacific margin of the Antarctic Peninsula reveals anomalous down-hole curves of porosity, density, water content, and P-wave velocity. These indicate an overall trend of increasing porosity with depth and suggest that the drifts are mostly undercompacted. Analysis of seismic reflection, down-hole logging, geotechnical and mineralogical data from two drilling sites indicates that the observed anomalous consolidation trends are a consequence of the presence of biogenic silica (diatom and radiolarian skeletons) even with a small to moderate amount. This work shows how physical properties of shallow fine-grained marine sediments can be analyzed as basin-wide indicators of biogenic silica abundance. The diagenetic alteration of siliceous microfossils is a possible cause of slope instability along world continental margins where bottom-simulating reflectors related to silica diagenesis are present at a regional scale.

VRIELYNCK, B., BONNEAU, M., DANELIAN, T., CADET, J. P. & POISSON, A. 2003. New insights on the Antalya Nappes in the apex of the Isparta Angle; the Isparta Cay Unit revisited. *Geological Journal* **38** (3-4), 283-293.

The Isparta Cay unit was defined in the valley of the Isparta Cay (river) as one of the units that constitutes the Antalya Nappes. Situated structurally between the Bey Daglari Autochthon and the Miocene neo-autochthon, the Isparta Cay unit provides decisive arguments with respect to the timing of emplacement of deep basinal units, cropping out in the central part of the Isparta Angle, as well as for a model of reconstruction of the Pamphylian Basin, located to the south of the Taurus Belt. The Isparta Cay unit (previously named "Isparta Cay Formation") consists of a pile of thrust sheets all of which display the following basic sedimentary sequence: Triassic marls and sandstones containing plant remains and limestones with Halobia, overlying Jurassic to Cretaceous deep-sea sedimentary rocks (radiolarites). Detailed mapping, combined with new and revised stratigraphic data, confirms the existence of a very complex pile of tectonic, rather thin sheets. The basic sequence is composed, from bottom to top, of the following sedimentary units: (1) marls and turbiditic sandstones rich in plant debris; (2) limestones interbedded with marls and; (3) regularly-bedded cherty limestones. These three lower units contain rather abundant fossils (i.e. Halobia and ammonites) and are Triassic in age: (4) lenticular calcareous breccia in which Middle Jurassic foraminifera are found; (5) radiolarites, green and then red, including lenticular beds of reworked calcareous sands (now dolomitized and/or silicified). The radiolarians from the red radiolarites establish a Jurassic to Early Cretaceous age and; (6) red silts and clays with interbedded calcareous breccia, which are probably Cretaceous in age. The total thickness of the basic sequence as described above varies between 100 and 150 m, depending on the thickness of the lenticular breccia intercalations. Such a sequence is frequent in the Antalya Complex as one of the deep basinal sequences. It has been interpreted as one sequence expelled from the Pamphylian Basin, located between the Anamas-Akseki Platform (western Taurus) to the NE, and the Bey Daglari Platform to the SW. The age of the radiolaritic sequences of the Antalya Nappes, extended to all the units of SW Turkey, is discussed.

WAKITA, K. & METCALFE, I. 2005. Ocean plate stratigraphy in East and Southeast Asia. *Journal of Asian Earth Sciences* **24** (6), 679-702.

Ancient accretionary wedges have been recognised by the presence of glaucophane schist, radiolarian chert and melange. Recent techniques for the reconstruction of disrupted fragments of such wedges by means of radiolarian biostratigraphy, provide a more comprehensive history of ocean plate subduction and successive accretion of ocean floor materials from the oceanic plate through offscraping and underplating. Reconstructed ocean floor sequences found in ancient accretionary complexes in Japan comprise, from oldest to youngest, pillow basalt, limestone, radiolarian chert, siliceous shale, and shale and sandstone. Similar lithologies also occur in the melange complexes of the Philippines, Indonesia, Thailand and other regions. This succession is called 'Ocean Plate Stratigraphy' (OPS), and it represents the following sequence of processes: birth of the oceanic plate at the oceanic ridge; formation of volcanic islands near the ridge, covered by calcareous reefs; sedimentation of calcilutite on the flanks of the volcanic islands where radiolarian chert is also deposited; deposition of radiolarian-skeletons on the oceanic plate in a pelagic setting, and sedimentary mixing of radiolarian remains and detrital grains to form siliceous shale in a hemipelagic setting; and sedimentation of coarse-grained sandstone and shale at or near the trench of the convergent margin. Radiolarian biostratigraphy of detrital sedimentary rocks provides information on the time and duration of ocean plate subduction. The ages of detrital sediments becomes younger oceanward as younger packages of OPS are scraped off the downgoing plate. OPS reconstructed from ancient accretionary complexes give us the age of subduction and accretion, direction of subduction, and ancient tectonic environments and is an important key to understanding the paleoenvironment and history of the paleo-oceans now represented only in suture zones and orogenic belts.

WANG, C. S., HU, X. M., SARTI, M., SCOTT, R. W. & LI, X. H. 2005a. Upper Cretaceous oceanic red beds in southern Tibet: a major change from anoxic to oxic, deep-sea environments. *Cretaceous Research* **26** (1), 21-32.

Red marine mudstones intercalated with pelagic marlstones, limestones and radiolarian cherts comprise the Chuangde Formation, which overlies mid-Cretaceous dark grey shales in the northern subzone of the Himalayan Tethys of southern Tibet. The red mudstones reflect deposition below the carbonate

compensation depth (CCD) in a deep oceanic basin. The intercalated, thin-bedded marlstones represent fine-grained turbidites derived from the upper slope and transported into the adjacent deep basin. Planktonic foraminifera and nannofossils in the marlstones indicate a Santonian-early Campanian age for the formation. The red beds of the Chuangde Formation were deposited in a highly oxygenated deep-sea environment. This is confirmed by the high iron-trioxide content, the negative Cerium anomaly at the bottom of the red sequence, and the very low total organic carbon content (TOC 0.01-ca. 0.14%). Deposition of the red beds coincided with a Santonian-early Campanian diversity peak of planktonic foraminifera. The environmental interpretation is supported by the bulk carbon isotope delta(13)C value of carbonate turbidites that becomes more positive stratigraphically up from the base of the formation. The highly oxygenated bottom-water conditions were not restricted to a deep ocean basin, but extended up to the continental rise/slope, as indicated by synsedimentary red marls incorporated in slumps and olistoliths near the top of the formation. This indicates that not only the bottom waters but also intermediate waters were highly oxygenated. Deposits of the Chuangde Formation are similar to Upper Cretaceous oceanic red beds (CORBs) in Western Europe, such as the Scaglia Rossa in Italy and the Capas Rojas in southern Spain. They represent the easternmost occurrence of Upper Cretaceous pelagic red beds of the Tethys. Late Cretaceous oxic oceanic conditions extended into the southern Tethys because the formation was deposited in southern palaeolatitudes. Therefore, the change from a dysoxic/anoxic to an oxic bottom ocean environment during the Late Cretaceous was at least hemiglobally if not globally wide. The change to oxic bottom conditions occurred later in the southern Tethys than in the western Tethys, where it began during the late Turonian. Several different earth processes could have caused such change. We suggest that the oxidized character of these deep-sea deposits was a result of a combination of various processes, among which very low sedimentation rates and changes in bottom ocean circulation may have been the most important.

WANG, P. X. & LIPPS, J. H. 2005. Micropaleontology of the South China Sea. *Marine Micropaleontology* **54** (1-2), 1-3.

WANG, Y. & QUN, Y. 2003. Radiolarians from the Middle Permian Kuhfeng Formation of the Renhua Area, Shaoguan, Guangdong Province. *Acta micropalaeontologica sinica* **20** (4), 333-341.

WANG, Y.-J., YANG, Q. & GUO, T.-Z. 2005b. The Late Middle Triassic radiolarians - *Spongoserrula rarauana* fauna from the Hoh Xil region, Qinghai. *Acta micropalaeontologica sinica* **22** (1), 1-9.

WANG, Y. B. & YANG, H. 2004. Middle Permian palaeobiogeography study in East Kunlun, A'nyemaqen and Bayan Har. *Science in China Series D-Earth Sciences* **47** (12), 1120-1126.

Three regions can easily be identified in the study area according to the Middle Permian palaeobiogeographic distribution of biota, they are the southern slope of East Kunlun, A'nyemaqen and Bayan Har. Biotic constitution and ecology in the southern slope of East Kunlun and Bayan Har are very similar. Both the diversity and abundance of organisms in these two areas are very high and reefs are widely developed. However, biotic diversity and abundance in A'nyemaqen which is between the above two areas are obviously low. Differentiation of palaeobiogeographic distribution in these areas should be due to the baring of A'nyemaqen ocean in the time of Middle Permian. Middle Permian radiolarian chert and thick abyssal red ooze are widely spread in A'nyemaqen, implying that the A'nyemaqen ocean had a great scale in size. Vast scale of deep ocean basin became an impassable gulf for some of the benthos, and as a result, only part of the organisms could have the chance to get to the isolated islands situated in ocean basin. Small living space and hard conditions in the islands further limited the abundance and diversity of biota. Tectonic background reflected by the geochemical study of basalt in the three areas is coupling well enough with the palaeobiogeographic division.

WATTINNE, A., VENNIN, E. & DE WEVER, P. 2003. Evolution d'un environnement carbonaté lacustre à stromatolithes, par l'approche paléo-écologique (carrière de Montaigu-le-Blin, bassin des Limagnes, Allier, France). *Bull. Soc. Géol. Fr.* **t.174** (3), 243-260.

WON, M. Z., IAMS, W. J. & REED, K. 2005. Earliest Ordovician (Early to Middle Tremadocian) radiolarian faunas of the Cow Head Group, western Newfoundland. *Journal of Paleontology* **79** (3), 433-459.

Well-preserved earliest Ordovician (early to middle Tremadocian) radiolarian faunas were recovered from carbonate rocks of the Cow Head Group of the Great Northern Peninsula of the island of Newfoundland, Canada. The earliest Ordovician faunal assemblages are from Green Point, Martin Point, Broom Point North and South, and St. Paul's Inlet in Gros Morne National Park. Latest Cambrian faunas were also recovered from Green Point and St. Paul's Inlet, but are extremely low in both abundance and diversity. The radiolarian faunas include five families, 10 genera, and 24 species. Of these, one family Aspiculumidae, one genus, and 19 species are new. The new family and new genus are Aspiculumidae and *Aspiculum*, respectively. The new species are *Pararcheoentactinia*? *cowheadensis*, *Aspiculum eccentricum*, *Aspiculum*? *angulatum*, *Parechidnina delicata*, *P. variospina*, *Curvechidnina multiramosa*, *Echidnina conexa*, *E. laxa*, *E. semiconexa*, *E. severedeformis*, *Echidnina? immanis*, *Palaeospiculum curvum*, *P. multifurcatum*, *P. neofurcatum*, *P. tetractium*, *Protoentactinia deformis*, *P. kozuriana*, *P. primigena*, and *P. transformis*. The Aspiculumidae is established on the basis of the new genus *Aspiculum* and on *Parechidnina*, whose family-level assignments were previously indeterminate. The new family Aspiculumidae is distinguished from the other four families by the absence of the spicule system. All genera of the earliest Ordovician radiolarian faunas can be placed in the families Aspiculumidate, Archeoentactiniidae, Echidninidae, Palaeospiculumidae, and Protoentactiniidae, as can the genera of the Cambrian radiolarian faunas. However, echidninids from Cambrian faunas are generally characterized by interlocked or fused spicules whose original structure is recognizable, while those from the earliest Ordovician are commonly characterized by fused and/or modified spicules. Also, the very rare protoentactinids of the Late Cambrian are extremely abundant and diverse in the earliest Ordovician faunas described herein. Specimens of the families Palaeospiculumidae and Archaeoentactinidae are less diverse and/or less plentiful in the earliest Ordovician compared to those in Cambrian. The genus *Parechidnina*, which now belongs to Aspiculumidae, is more plentiful and very diverse in the earliest Ordovician, and, at the same time, lineages of the new genus *Aspiculum* and a related not-yet-named genus began to evolve. The detailed biostratigraphic ages of the earliest Ordovician radiolarian faunas were determined mainly by the co-occurring conodonts. The age range of the earliest Ordovician faunas represented extends from the *Cordylodus findstromi* Zone through the *C. angulatus* Zone to the *Rossodus manitouensis* Zone.

WONGANAN, N. & CARIDROIT, M. 2005. Middle and Upper Devonian radiolarian faunas from Chiang Dao area, Chiang Mai province, northern Thailand. *Micropaleontology* **51** (1), 39-57.

Diverse and significant well-preserved radiolarians were obtained from ribbon-bedded chert in an area to the north of Chiang Dao city, Chiang Mai, northern Thailand. The area is mainly composed of an accretionary complex, which is recently considered as a key

part of a newly described Suture zone in the Southeast Asian region. Devonian radiolarian-bearing cherts are exposed within this area. These cherts contain identical radiolarian faunas, which include nine families and forty-three species belonging to thirteen genera. Among these faunas, Entactinaria are dominant. Three new species, *Trilonche chiangdaoensis*, *Trilonche dihelicis* and *Trilonche vachardi*, are erected and about thirty species, which have never been reported from Thailand, are also present. The *Trilonche minax* (lower Frasnian) radiolarian assemblage from Australia is recognized in the area. The radiolarian faunas are systematically described and relationships between them and fauna from adjacent radiolarian provinces are discussed. These cherts with their radiolarian faunas are evidence for the presence of a wide paleo-ocean once existed between Shan-Thai and Indochina continental terranes.

XIA, W., NING, Z., WANG, G. & KAKUWA, Y. 2004. Pelagic radiolarian and conodont biozonation in the Permo-Triassic boundary interval and correlation to the Meishan GSSP. *Micropaleontology* **50** (1), 27-44.

A phylogenetic sequence in the radiolarian genus Albaillella, from Changhsingian chert sequences of Upper Permian, Upper Ubara, Gochi-Hachawa, and Tenjinmaru, Southwest Japan, is divided into six lineage-zones. The youngest two of these zones are new, and are based on newly recognized dwarfed taxa in depauperate faunas. Conodont correlations between the Japanese sections and the Permo-Triassic GSSP at Meishan, southern China, is strengthened by new end-Permian pelagic conodont biozonation from Huangshi, Hubei, China. The correlations show that the decline and extinction of the albaillellinid lineage coincides with the period of mass extinction at the end of the Permian. The two depauperate Albaillella lineage-zones alternate with three barren interzones with anomalous isotope ratios, supporting the theory that the end-Permian event may actually have consisted of three closely-spaced biotic crises; a fourth crisis is suggested in basal Triassic strata at Huangshi. Because the deep-water radiolarian lineage can be closely correlated with the Permo-Triassic GSSP utilizing conodonts, most notably by the boundary-index conodont Hindeodus parvus (Kozur and Pjatakova), we suggest that the Ubara section may be a good candidate for a boundary hypostratotype section in a pelagic cherty facies in which planktonic fossils are abundantly preserved, and in which the Permo-Triassic boundary may be confidently correlated.

YAMAMOTO, H. & YAMAUCHI, M. 2002. Changes in the Kuroshio Current and Oyashio Current in the past 130,000 years, it is based on radiolaria fossils in the western North Pacific Ocean on the R/V Mirai Cruise [MR01-K02]. *Report of Japan Marine Science and Technology Center* **46**, 47-57.

YAMAMOTO, T., KURIMOTO, C. & YOSHIOKA, T. 2002. Geology of the Yamasaki District. With geological sheet map at 1:50,000. *Geological Survery of Japan. Quadrangle Series, Scale 1:50,000, Okayama* **12** (46), 1-48.

YAMAMOTO, Y. & KAWAKAMI, S. 2005. Rapid tectonics of the Late Miocene Boso accretionary prism related to the Izu-Bonin arc collision. *Island Arc* **14** (2), 178-198.

The structure, paleomagnetism and biostratigraphy of the Nishizaki and Kagamigaura formations on the southern Boso Peninsula, central Japan, were investigated to determine the chronographic constraints on the accretion, post-Late Miocene rotation and regional tectonics in the Izu-Bonin island arc collision zone. The geological structures on the southern Boso Peninsula are characterized by an east-west trending and south-verging fold and thrust belt that curves toward the northwest-southeast in the northwest extent of the Nishizaki Formation. Two stages of tectonic rotation were revealed by paleomagnetic and structural studies. The first is believed to have occurred after the accretion of the Nishizaki Formation and before the deposition of the Kagamigaura Formation, while the second is confidently correlated with the 1 Ma Izu block collision. The northwest extent of the Nishizaki Formation was rotated clockwise by approximately 65-80 degrees, whereas the rotation was only 25-30 degrees in the east, and 11-13 degrees in the overlying Kagamigaura Formation. Radiolarian biostratigraphy suggests a depositional age of 9.9-6.8 Ma (Upper Miocene period) for the Nishizaki Formation and 4.19-3.75 Ma (Pliocene period) for the lower Kagamigaura Formation. These results indicate that the age of accretion and first-stage rotation of the Nishizaki Formation can be constrained to the interval of 6.80-3.75 Ma. This structure most likely represents the northward bending caused by collisions of the Tanzawa and Izu blocks with the Honshu island arc, and suggests rapid processes of accretion, collision, uplift and the formation of new sedimentary basins within a relatively short period of time (2.61-3.05 my).

YAMANAKA, M. 2001. Permian radiolarian biostratigraphy and radiolarian morphological change in bedded chert sequence of the Tamba Terrane in Sasayama area. *News of Osaka Micropaleontologists, Special Volume* **12**, 13-22.

YAMAUCHI, M. & YAMAMOTO, H. 2001. A change in the warm water Kuroshio Current system from the final glacial age end to the interglacial period, it is based on radiolarian fossils in the western North Pacific during the R/V Mirai Cruise [MR99-K04]. *Report of Japan Marine Science and Technology Center* **43**, 73-82.

YANG, Q., WANG, Y. J., YIN, L. M., SHU, L. S., LOU, F. S. & WANG, B. 2005. On the age of the ophiolitic complexes in northeastern Jiangxi: A micropaleontological analysis. *Acta Geologica Sinica-English Edition* **79** (3), 308-312.

The age assignment of cherts from ophiolitic/metamorphic complexes in northeastern Jiangxi is widely regarded as one of the crucial issues in the tectonic interpretation of South China. The ophiolitic and metamorphic complexes in northeastern Jiangxi have been traditionally regarded as part of the Proterozoic "Banxi (=Penhsi) Group" of the Jiangnan Uplift. However, recent reports of Late Paleozoic radiolarians from the rock complexes have caused some researchers to question the traditional interpretation of the tectonic and paleogeographic framework in the region; but other workers are suspicious about these findings. In order to test the validity of the putative radiolarians, we, an interdisciplinary study group including micropaleontologists, tectonic specialists and regional geologists, conducted field investigations and multiple re-samplings of the localities where the reported fossils were collected. Our comprehensive study shows that the chert of the ophiolitic complex and the associated low-grade metamorphic slate yield Mesoproterozoic and Neoproterozoic acritarchs, confirming the traditional view of their age assignment (Proterozoic); on the other hand, no recognizable radiolarian fossils have been discovered therein, thus raising questions about the recently published result of Paleozoic radiolarian findings. Probable causes for the putative radiolarian findings are thus discussed herein. Geochemical characteristics indicate that the chert sedimentation most probably occurred under a continental margin setting.

YAO, A. & KUWAHARA, K. 2004. Radiolarian fossils from the Permian-Triassic of China. *News of Osaka Micropaleontologists, Special Volume* **13**, 29-45.

YAO, A., MIZUTANI, S. & KUWAHARA, K. 2001. Trend of Japanese radiolarian research from a

viewpoint of radiolarian database on literatures. *News of Osaka Micropaleontologists, Special Volume* **12**, 375-382.

YAZYKOVA, E. 2004. Ammonite biozonation and litho-/chronostratigraphy of the Cretaceous in Sakhalin and adjacent territories of Far East Russia. *Acta Geologica Polonica* **54** (2), 273-U27.

The stratigraphy and ammonite faunas of the Cretaceous succession in Sakhalin are discussed. A high-resolution biostratigraphic zonation (24 zones in total) is proposed; it is correlated with adjacent areas and corresponds well to inoceramid and radiolarian zones. The definition of all stage and some substage boundaries in Sakhalin is discussed, and possibilities for interregional and global correlations are assessed. In addition, the main mass extinction and faunal turnover events recognised in these sections are taken into consideration.

YAZYKOVA, E. A., PERYT, D., ZONOVA, T. D. & KASINTZOVA, L. I. 2004. The Cenomanian/Turonian boundary in Sakhalin, Far East Russia: ammonites, inoceramids, foraminifera, and radiolarians. *New Zealand Journal of Geology and Geophysics* **47** (2), 291-320.

The Cenomanian-Turonian succession of faunal assemblages identified in Sakhalin has enabled the establishment of 10 ammonite, 7 inoceramid, 4 radiolarian, and 2 foraminiferal zones, which correlate relatively well with those recorded for the northeastern region of Russia (Kamchatka and Koryakia) and for Japan. The problems surrounding placement of the Cenomanian/Turonian boundary in Sakhalin and in adjacent areas are reviewed. Significant macrofaunal turnover and radiation have been identified across the (locally defined) Cenomanian/Turonian boundary, as well as in the middle Turonian for ammonites and in the upper Turonian for inoceramids. The first occurrences of the widely distributed Pacific ammonite *Jimboiceras planulatiforme* (Jimbo), the cosmopolitan ammonite *Fagesia*, and the inoceramid *Mytiloides* aff. *labiatus* (Schlotheim), define the base of the Turonian Stage. The succession of foraminiferal assemblages does not exhibit any major extinction at the Cenomanian/Turonian boundary; however, a temporary faunal restructuring occurred at that time. The radiolarian fauna appears to have survived this interval without marked taxonomic change; a diversity decrease took place later, near the middle/late Turonian boundary.

YOOL, A. & TYRRELL, T. 2005. Implications for the history of Cenozoic opal deposition from a quantitative model. *Palaeogeography, Palaeoclimatology, Palaeoecology* **218** (3-4), 239-255.

In addition to being a time of enhanced crustal activity and a warmer climate, the Eocene also saw prolonged periods of silica accumulation on the ocean floor. The peak of this accumulation occurred at approximately 50 Ma, creating Horizon AC, a layer of silica-rich sediments spanning approximately 4 My. Horizon AC is comparatively isolated in time from known silicic acid addition processes, leading McGowran (1989) [McGowran, B., 1989. Silica burp in the Eocene ocean. Geology, 17 pp. 857-860.] to suggest a novel mechanism (the "silica burp" hypothesis) that centres on the temporal decoupling of silicic acid supply and burial by climatic variation. Here we examine this hypothesis using a quantitative biogeochemical model of the silicon cycle. Our results unequivocally show that McGowran's hypothesis is unable to account for Horizon AC. The model's residence time and ocean capacity for silicic acid are insufficient to permit the degree of temporal decoupling proposed by McGowran. Inverting the model's results suggests that, instead, the sediment record may be a useful proxy for silicic acid additions to the ocean.

YUAN, J., CHEN, M. Y., SHAO, P., ZHOU, H., CHEN, Y. Q. & QU, L. H. 2004. Genetic diversity of small eukaryotes from the coastal waters of Nansha Islands in China. *Fems Microbiology Letters* **240** (2), 163-170.

Population structures and genetic diversity of the small eukaryotic plankton from the coastal waters of the Nansha Islands in China were investigated. Two genes libraries using 18S rDNA of the marine small eukaryotes were constituted, and 323 clones were identified within alveolates (more than 43%), acanthareas, viridiplantaes, and stramenopiles. Many novel clones were detected in the two libraries, including two groups of alveolates and two clades related to both acanthareas and polycystineas. Several sequences unrelated to any other known eukaryotes may represent early branches in the phylogenetic tree. Our results reveal that there is a high diversity and abundance of small eukaryotes in the marine regions of China.

YURTSEVER, T. S., TEKIN, U. K. & DEMIREL, I. H. 2003. First evidence of the Cenomanian/Turonian boundary event (CTBE) in the Alakircay Nappe of the Antalya Nappes, southwest Turkey. *Cretaceous Research* **24** (1), 41-53.

The Doyran section in the Alakircay Nappe of the Antalya Nappes includes the organic carbon-rich black shales within radiolarian-rich pelagic sediments that were deposited in an off-margin abyssal environment. A biostratigraphical analysis, based on radiolarian assemblages, indicates that the rock units studied encompass the Cenomanian/Turonian boundary (CTBE). The total organic carbon contents of the black shales in this horizon vary from 7.89 to 42.19% wt with an average value of 22.0% wt. The calculated values of the hydrogen and oxygen indexes indicate that the organic carbon originated from marine organic matter (type I/II kerogen). The black shales' include thin-bedded and laminated layers deposited at low sedimentation rates with little terrestrial input. Lamination, no bioturbation and abundant pyrite occurrences indicate that the anoxic conditions prevailed on the depositional environment and favoured the preservation of organic matter. Lithological features and the radiolarian fauna of the CTBE in the Doyran section are in keeping with each other and correlate with the CTBE at other localities in the Atlantic and Tethyan realms.

ZAMORAS, L. R. & MATSUOKA, A. 2004. Accretion and postaccretion tectonics of the Calamian Islands, North Palawan block, Philippines. *Isl Arc* **13** (4), 506-519.

Upper Paleozoic to Mesozoic sedimentary sequences of chert (Liminangcong Formation), clastics (Guinlo Formation) and a number of limestone units (Coron Formation, Minilog Formation and Malajon Limestone) constitute the accretionary complex of the North Palawan block, Philippines. Based on chert-to-clastic transitions from different stratigraphic sequences around the Calamian Islands, three accretionary belts are delineated: the Northern Busuanga Belt (NBB), the Middle Busuanga Belt (MBB) and the Southern Busuanga Belt (SBB). The accretion events of these belts along the East Asian accretionary complex, indicated by their sedimentary transitions, began with the Middle Jurassic NBB accretion, followed by the Late Jurassic MBB accretion and the Early Cretaceous SBB accretion. Several limestone blocks that formed over the seamounts became juxtaposed with chert-clastic sequences during accretion. During the Late Cretaceous, accretion-subduction along the East Asian margin subsided bringing tectonic stability to the region. The seafloor spreading during the mid-Oligocene disconnected the entire North Palawan block from the Asian mainland and then migrated southward. The collision between the North Palawan block and the Philippine Island Arc system in the middle Miocene generated a megafold structure in the Calamian Islands as a result of the clockwise turn of the accretionary belts in the eastern Calamian from originally northeast-southwest to northwest-southeast.

ZHANG, C. L., GAO, S., ZHANG, G. W., GUO, A. L., YUAN, H. L., LIU, X. M. & WANG, J. Q. 2004a. Geochemistry of ophiolite cherts from the Qinling orogenic belt and implications for their tectonic settings. *Science in China Series D-Earth Sciences* **47** (4), 329-337.

Paleozoic cherts from the Mianlue and the Erlangping ophiolite zones of the Qinling orogenic belt are characterized by low Si/Al ratios (52.14-683.52 in the Mianlue cherts, 12.29-58.62 in the Erlangping cherts), Fe2O3 (0.01-0.35 and 0.02-1.24) and high Al2O3/(Al2O3+Fe2O3) ratios (0.82-0.99 and 0.83-0.99). The negative correlation between Si2O and Al2O3 in the cherts reflects the important role of terrigenous components. The Erlangping cherts have La-n/Ce-n = 0.9-1.15 and Ce/Ce = 0.95-1.15 with low contents of V, Ni and Cu, consistent with those of cherts forming on the continental margin. In contrast, the Ce/Ce ratios of the Mianlue cherts range from 0.71 to 1.18 and La-n/Ce-n from 0.88 to 1.43 with slightly high V, Ni and Cu, which are similar to cherts found in the mid-ocean ridges and pelagic basins. Combined with the features of basic lavas associated with the cherts, it is suggested that during the Paleozoic, when the back-arc basin represented by the Erlangping ophiolite commenced shrinking in size in the mid-Ordovician, the southern Qinling was still in an extensional regime and finally grew into a new limited oceanic basin in the early Carboniferous.

ZHANG, K. J., XIA, B. D., WANG, G. M., LI, Y. T. & YE, H. F. 2004b. Early Cretaceous stratigraphy, depositional environments, sandstone provenance, and tectonic setting of central Tibet, western China. *Geological Society of America Bulletin* **116** (9-10), 1202-1222.

The period following Late Jurassic continental collision but preceding Late Cretaceous-Cenozoic arc magmatism represents a significant, yet poorly understood tectonic transition in central Tibet, western China. The Asa basin (31degrees00'-32degrees40', 84degrees30'-87degrees05') in central Tibet, which crosses the southern margin of the Qiangtang block, the Bangong-Nujiang suture zone, and the northern half of the Lhasa block, is characterized by up to 5000 m of continentalmarine clastic-carbonate sediments and is ideally positioned to provide constraints on this transition. Sedimentary and volcanic data from recent field studies suggest that contraction controlled Berriasian-Valanginian tectonics, whereas back-arc extension may have controlled Hauterivian-Early Cenomanian basin evolution. Berriasian-Valanginian strata occur over the northern half of the Asa basin (approximately north of 31degrees40') and unconformably overlie a varied basement. Sediment transport and fining directions are generally toward the south. The sandstones (Q(78)F(11)L(11), Qm(72)F(11)Lt(17)' Qp(38)Lvm(8)Lsm(54)) in the central Bangong-Nujiang suture zone are dominated by monocrystalline quartz grains with undulose extinction but also contain abundant chert grains and some ultrabasic lithic fragments and radiolarian fragments. Hauterivian-Lower Barremian strata are characterized by siliciclastic rocks deposited in high-energy tidal environments, and barrier-bank skeletal bioclastic grainstone and wackestone. Intraformational limestone breccia or conglomerate and bimodal volcanic rocks are in places found within the sedimentary sequences in the southern margin of the basin (approximately south of 31degrees35'). Sandstones (Q(54)F(20)L(26),Qp(45)F(20)Lt(35),Qp(20)Lvm(59)Lsm(21)) are characterized by complex derivations from both recycled orogen and volcanic arc provenances. Widespread thick carbonate is a characteristic feature of Upper Barremian-Lower Cenomanian lithofacies, possibly formed in both restricted platform and platform interior environments. Lithic fragments in the sandstones (Q(34)F(24)L(42),Qm(33)F(24)Lt(43), Qp(3)Lvm(87)Lsm(10)) interbedded with the carbonates predominantly reflect volcanic source areas (65%). The Berriasian-Valanginian sequence is interpreted to represent molasse sediments from a northern orogen and indicates that the collision between the Qiangtang and Lhasa blocks could have extended into the Valanginian. The change from orogenic to magmatic are source areas for sandstones during the beginning of the Hauterivian, along with a coeval extensive marine transgression in central-southern Tibet, normal faulting, and rich intercalations of bimodal volcanic rocks, are interpreted to be related to back-arc extension of the Gangdese arc during the Middle Cretaceous (ca. 120-95 Ma). This may have occurred in response to a rollback of the Tethyan oceanic slab. During the Middle Cretaceous, the entire southern Eurasian margin could have been characterized by a series of back-arc rift basins (including those in Kohistan and Ladakh). Some basins may have been floored by oceanic crust whereas others remained underlain by continental or transitional basement, much like the present western Pacific margin.

ZHANG, K. X., LIN, Q. X., ZHU, Y. H., YIN, H. F., LUO, M. S., CHEN, N. S. & WANG, G. C. 2004c. New paleontological evidence on time determination of the east part of the Eastern Kunlun Melange and its tectonic significance. *Science in China Series D-Earth Sciences* **47** (10), 865-873.

New paleontological evidence suggests that the composition of the matrix and slices from the middle and the south of the Eastern Kunlun Melange Belt is very complex, ranging from Proterozoic to Mesozoic in geological time. A Cambrian acritarch assemblage has been discovered from the middle part of the Eastern Kunlun Melange, a Neoproterozoic to the early Paleozoic acritarch assemblage has been discovered from the south of the Eastern Kunlun Melange, and so has been an Early Permian radiolarian from the A'nyemaqen Melange in Buqingshan. In addition, some sporopollen has been obtained from the Mesozoic tectonic slices. The above-mentioned paleontological evidence indicates that the Eastern Kunlun Orogenic Belt experienced two episodes from ocean to continent from the Neoproterozoic to the Early Paleozoic and in the Late Paleozoic respectively. In the process of intracontinent development in Mesozoic, because of heavy thrust-nappe, strike-slip sheer and crust shortening, the Mesozoic formation was intercalated in melange by slices and the Eastern Kunlun Orogenic Belt became more complex.

ZHENG, H. B., POWELL, C. M., REA, D. K., WANG, J. L. & WANG, P. X. 2004. Late Miocene and mid-Pliocene enhancement of the East Asian monsoon as viewed from the land and sea. *Global and Planetary Change* **41** (3-4), 147-155.

The late Miocene onset of the Indian monsoon and the late Miocene and middle Pliocene enhancement of the East Asian monsoon appear to be the result of coeval uplift episodes in the Himalayan-Tibetan region. A decrease of the abundance ratio of planktonic foraminifera *Globigerinoides sacculifer*/*G. ruber* and increase of *Neogloboquadrina* approximately 8 Myr at ODP site 1146 in the South China Sea indicate lowering of the surface temperature and increased productivity, which are interpreted to have been caused by an intensified influence of the East Asian winter monsoon winds. In the Arabian Sea, monsoon-driven upwelling indicated by the appearance and abundance of planktonic foraminifera *G. bulloides* and radiolaria increased remarkably at similar to8 Myr. Wind-blown sediment started to accumulate over a wide area of the Chinese Loess Plateau at similar to8 Myr, about the same time as a pronounced pulse of eolian dust to the North Pacific, as revealed at ODP site 885/886, indicating onset of widespread aridity in the Asian interior. At 3.6 Myr, the accumulation of eolian sediment increased by about an order of magnitude, both at proximal settings in China and in the distal North Pacific Ocean. The planktonic foraminifera *Neogloboquadrina* also underwent a further increase in abundance in the South China Sea at this time. Existing evidence from inland Asia and the surrounding seas suggests a late Miocene onset (or significant intensification) of the East Asian and Indian monsoons, the reason being their link with the uplift of the Himalayas and the Tibetan Plateau. The first increase in mean sediment flux to the Indian Ocean at 11 Myr and strong peak beginning between 9 and

8 Myr indicates the rising of the Himalayas. That rise could have reached sufficient height to produce a rain shadow in Central Asia, causing aridity and providing a source of dust to be transported eastwards into north China and the North Pacific. Further rapid uplift of the entire Tibetan Plateau at 3.6 Myr, as evidenced by the extensive conglomerates of that age on the north flank of the Plateau, resulted in further aridity in the basins of central and eastern Asia, an enhanced East Asian monsoon, and a second, late Pliocene, pulse of terrigenous sedimentation in the Indian Ocean.

ZYABREV, S. V., AITCHISON, J. C., ABRAJEVITCH, A. V., BADENGZHU, DAVIS, A. M. & LUO, H. 2004. Bainang Terrane, Yarlung–Tsangpo suture, southern Tibet (Xizang, China): a record of intra-Neotethyan subduction–accretion processes preserved on the roof of the world. *Journal of the geological Society of London* **161** (3), 523-539.

The Bainang terrane, an intra-oceanic island arc subduction complex into which Tethyan oceanic rocks were accreted during the Cretaceous, is preserved within the Yarlung–Tsangpo suture zone of Tibet. The lithostratigraphic succession established from field mapping records a long history of sedimentation in different portions of the central Tethyan domain from Late Triassic to mid-Cretaceous time. These rocks are preserved within a south-verging imbricate thrust stack of thin (1 km thick) northward younging tectonic slices. Five lithotectonic units were mapped in the terrane and these units are assigned to two distinct tracts. The northern tract, which accumulated on the north side of Neotethys, was probably separated from its southern counterpart by a mid-ocean ridge. Detailed radiolarian biostratigraphy is used to constrain the timing of depositional events within each tract. Oceanic plate stratigraphy of the northern tract records its northward travel and mid-Cretaceous (late Aptian) approach towards a south-facing intra-oceanic subduction zone. Rocks in the southern tract developed closer to the Indian subcontinent and experienced thermotectonic subsidence and Mid-Jurassic basic alkaline intraplate magmatism. They were probably accreted late in the Cretaceous. Variations in structural style across the terrane indicate deformation at different depths and vertical growth of the wedge rather than lateral accretion. The overall tectonostratigraphy of the terrane reflects its development in a remote intra-oceanic setting.

ZYABREV, S. V., MARTYNYUK, M. V. & SHEVELYOV, E. K. 2005. South-westerly portion of Kiselyovsko-Manominsky accretionary complex, Sikote-Alin: stratigraphy, subduction-related accretion and post-accretional displacements. *Tikhookeanskaya Geologiya = Pacific Geology* **24** (1), 45-58.

Radiolarian biostratigraphic study of an accretionary complex on the south of the Khabarovsk territory reveals its stratigraphic record and refines the regional stratigraphy. On the basis of stratigraphy, the accretionary complex is recognized as the south-westerly continuance of the Kiselyovsko-Manominsky terrane, a mid Cretaceous accretionary complex that is traced from the Lower Amur region. The obtained biostratigraphic data place important temporal constraints on the timing of subduction-related accretion and post-accretional terranes' displacement. The Kiselyovsko-Manominsky accretionary complex formed in the mid Aptian – earliest Albian, as bracketed by the ages of its youngest deposits and the overlaying strata. Subsequent juxtaposition against the Zhuravlevsky terrane occurred along sinistral strike-slip fault. This large-scale along-strike displacement commenced in the Albian and terminated in the Turonian. An average rate of the displacement is estimated at about 3 cm per annum. We reconstruct possible configuration of the mid Cretaceous convergent plate margin.

ZYABREV, S. V., PERESTORONIN, A. N. & ZHAROV, A. E. 2004. Commencement of silicilastic sedimentation in the West Sakhalin forearc, an aspect of the early history of the Sakhalin-Hokkaido accretionary system. *Tikhookeanskaya Geologiya = Pacific Geology* **23** (1), 53-61.

Siliciclastic sedimentation in the West Sakhalin forearc started prior to the end of early Aptian as constrained by radiolarian ages obtained for the lower portion of the forearc deposits. The west-directed subduction beneath the forearc to the east and subduction-related volcanism to the west are inferred to have begun by that time. The earlier siliciclastic sedimentation in the southern continuance of the forearc in Hokkaido corresponds to the earlier development of the volcanic arc to the west and associated accretionary complex to the east. This is explicable by earlier subduction in the accretionary system in Hokkaido. More sophisticated models for the Late Mesozoic tectonic zonation and evolution of the Circum-Japan-Sea regions are required to explain the dissimilarity in the early histories of the accretionary systems in Sakhalin and Hokkaido that later co-evolved.

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Siliceous sinter formation and other geothermal features of the Taupo Volcanic Zone

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A transect across Wellington's Triassic accretionary complex of greywacke, argillite, chert and basalt

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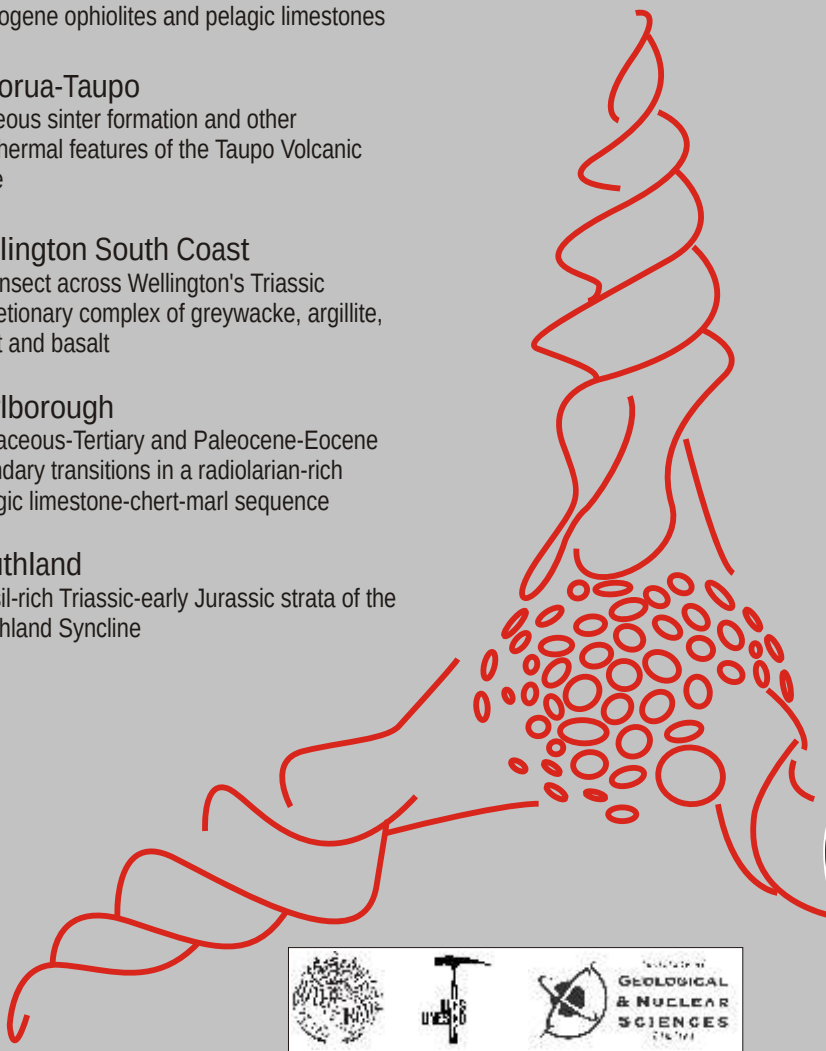

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