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First year of routine measurements at the AWI MICADAS ^{14}C dating facility.

Introduction

In November 2016, the first Mini-Carbon-Dating-System (MICADAS) manufactured by Ionplus AG was delivered and installed at the Alfred-Wegener-Institute (AWI), Germany.

The **main goal** for the facility at AWI is the precise and independent dating of carbonaceous materials in **marine and terrestrial sediments**, **sea-ice**, and **water**. A wide range of in-house research topics address various processes of **global carbon cycling**. A particular focus is on sediments from high latitude oceans, in which radiocarbon-based age models are often difficult to obtain due to the scarcity of carbonate microfossils or organic matter. The wide range of applications encompass **gas analyses of small-sized samples of foraminifera, specific (biomarker) compounds and other organics** as well as analyses of **graphite targets containing ~1mg to 250µg carbon.** This requires establishing routine protocols of various sample preparation techniques utilizing state of the art peripheral prepping systems. In this context, it is important to know if the results of different sample introduction techniques are comparable to each other and to international standards.

Results

A comparison of gas (EA/CHS-GIS) or graphite (EA/CHS-AGE) measurements was performed on organic and inorganic material with varying $F^{14}C$ values between 0.22 – 0.95. International standard materials (IAEA) as well as a carbonate (established as internal standard by Ellen Druffel at the University of California, Irvine) were used. Gas samples were analyzed at a standard size of ~100 µgC, graphite samples ~ 1000 µgC. A conservative target scatter of 0.5 % was calculated for graphite samples and 1 % to 1.5 % for gas samples.

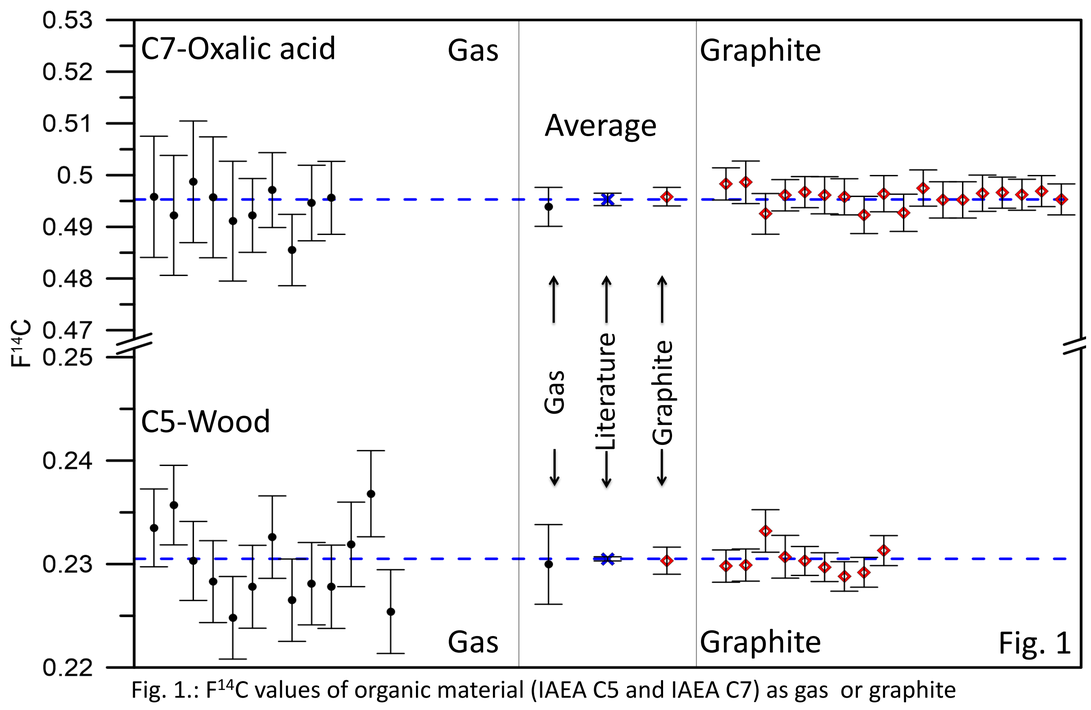

Fig. 1.: $F^{14}C$ values of organic material (IAEA C5 and IAEA C7) as gas or graphite measurements .

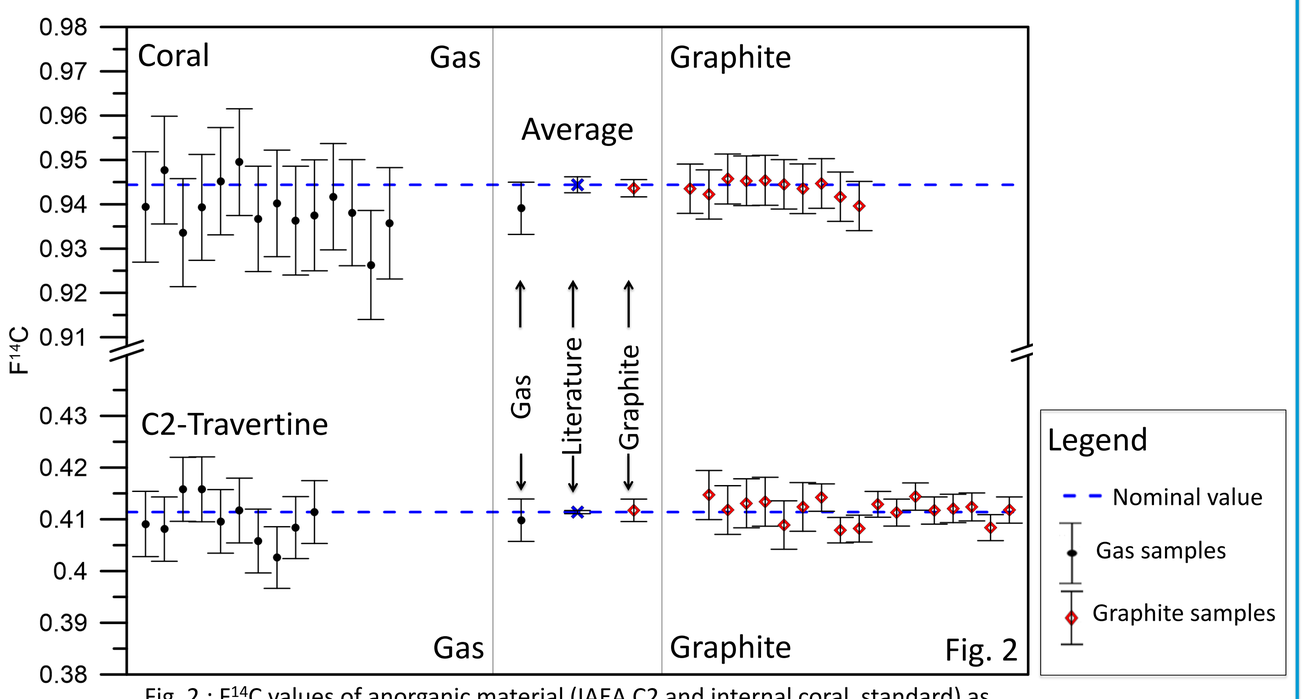

Fig. 2.: $F^{14}C$ values of anorganic material (IAEA C2 and internal coral standard) as gas or graphite measurements.

		EA-GIS			EA-AGE				
Organics	Material	measured value [$F^{14}C$]	±	n	measured value [$F^{14}C$]	±	n	reference value [$F^{14}C$]	±
IAEA-C5	wood	0.2300	0.0039	13	0.2303	0.0013	9	0.2305	0.0002
IAEA-C7	oxalic acid 2	0.4939	0.0038	10	0.4958	0.0017	18	0.4953	0.0012
Messel Shale	blank sediment	-0.0063	0.0032	10	0.0006	0.0014	29	no	
Kuhgraben	modern sediment	0.8468	0.0102	10	0.8563	0.0121	12	no	

Tab. 1.: $F^{14}C$ values of organic material. C5 and C7 are shown in Fig. 1. Messelshale and Kuhgraben are internal standards.

		CHS-GIS			CHS-AGE				
Carbonates	Material	measured value [F14C]	±	n	measured value [$F^{14}C$]	±	n	reference value [$F^{14}C$]	±
IAEA-C1	marble	0.0001	0.0007	10	0.0013	0.00058	12	0	0.0002
IAEA-C2	travertine	0.4098	0.0041	10	0.4116	0.0023	15	0.4114	0.0003
Blank Forams	foraminifera	0.0049	0.0011	140	0.0025	0.0004	9	no	
CAHI coral	coral	0.9391	0.0059	9	0.9412	0.0049	11	0.9444	0.0018

Tab. 2.: $F^{14}C$ values of anorganic material. C2 and CAHI coral (internal standard by Ellen Druffel) are shown in Fig. 2.

Conclusions

- The results show a comparison in between the errors amoung both introduction techniques and reference material.
- The target scatter can be lowered significantly for future measurements.
- In the first year of routine operation we established several analysis techniques with different pre-instruments with special focus on forams and specific compounds (biomarkers). Further information can be seen on the poster *„Low blank compound specific radiocarbon analysis at the AWI-MICADAS facility“ (Session G1; Nr. 38).*

Routine operations at AWI-Facilities

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