

Sediment drifts at the eastern Kerguelen Plateau: Archives of climate and circulation development

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The Kerguelen Plateau, southern Indian Ocean, which rises up 2000 m above the surrounding seafloor, forms an obstacle for the flow of the Antarctic Circumpolar Current (ACC) and Antarctic Bottomwater (AABW). The ACC is strongly deviated in its flow towards the north. A branch of the AABW flows northwards along the eastern flank of the plateau and in its path is steered by several basement highs and William's Ridge. Seismic data collected during RV Sonne cruise SO272 image sediment drifts shaped in the Labuan Basin, which document onset and variabilities in pathway and intensity of this AABW branch in relation to the development of the Antarctic ice sheet and tectonic processes, e.g., the opening of the Tasman gateway.

The eastern flank of the Kerguelen further

shows strong erosion of the post-mid Eocene sequences. In places, the Paleocene/early Eocene sequences are also affected by thinning and erosion. A moat can be observed along the Kerguelen Plateau flank indicating the flow path of the north setting AABW branch. Sediment drifts and sediment waves are formed east of the moat. Similar features are observed at the inner, western flank of William's Ridge thus outlining the re-circulation of the AABW branch in the Labuan Basin. The chronological and spatial development will be reconstructed via the analysis of those sedimentary structures to provide constraints on climate and ocean circulation variability since the onset of Antarctica's glaciation.

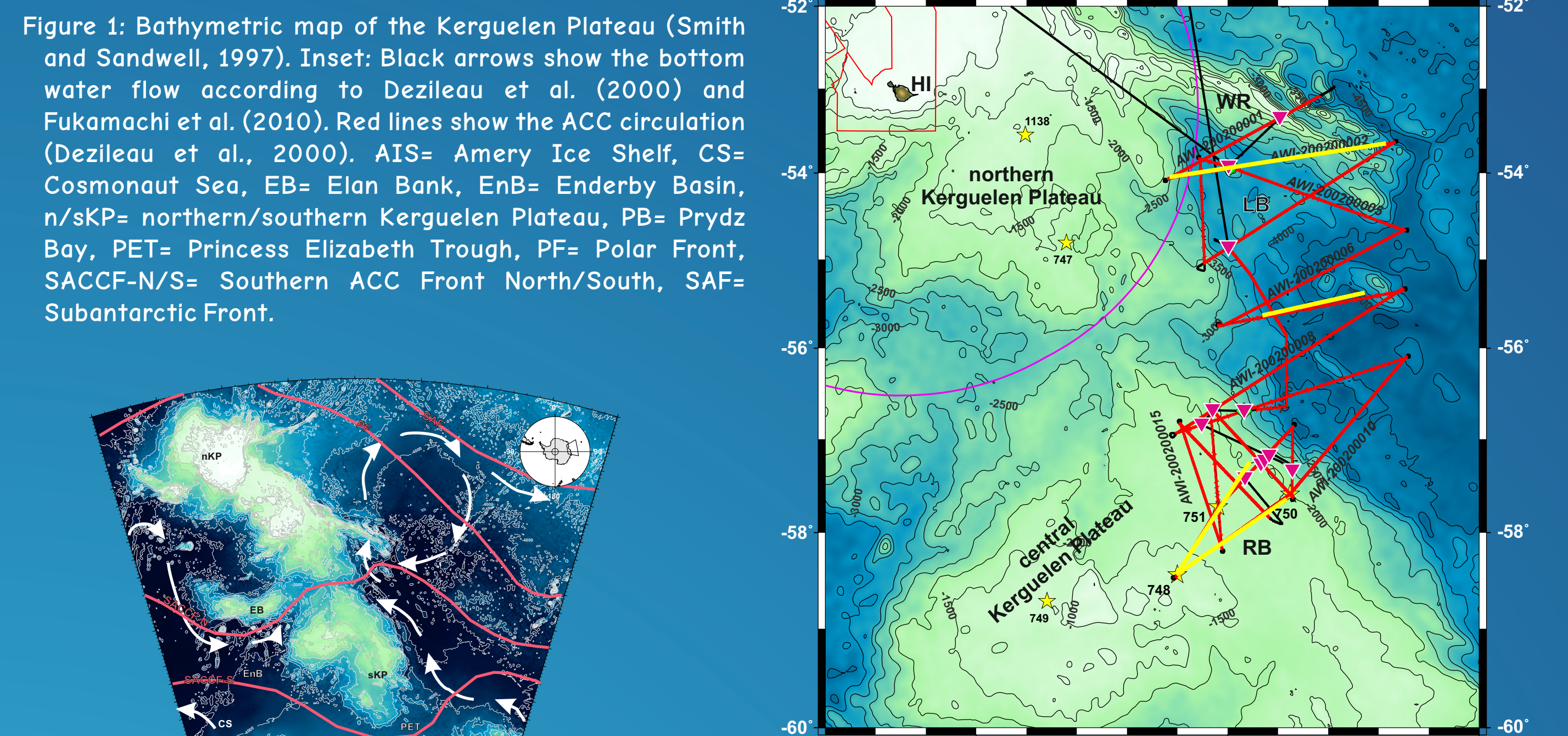


Figure 1: Bathymetric map of the Kerguelen Plateau (Smith and Sandwell, 1997). Inset: Black arrows show the bottom water flow according to DeZileau et al. (2000) and Fukamachi et al. (2010). Red lines show the ACC circulation (DeZileau et al., 2000). AIS= Amery Ice Shelf, CS= Cosmonaut Sea, EB= Elan Bank, EnB= Enderby Basin, n/sKP= northern/southern Kerguelen Plateau, PB= Prydz Bay, PET= Princess Elizabeth Trough, PF= Polar Front, SACC/N/S= Southern ACC Front North/South, SAF= Subantarctic Front.

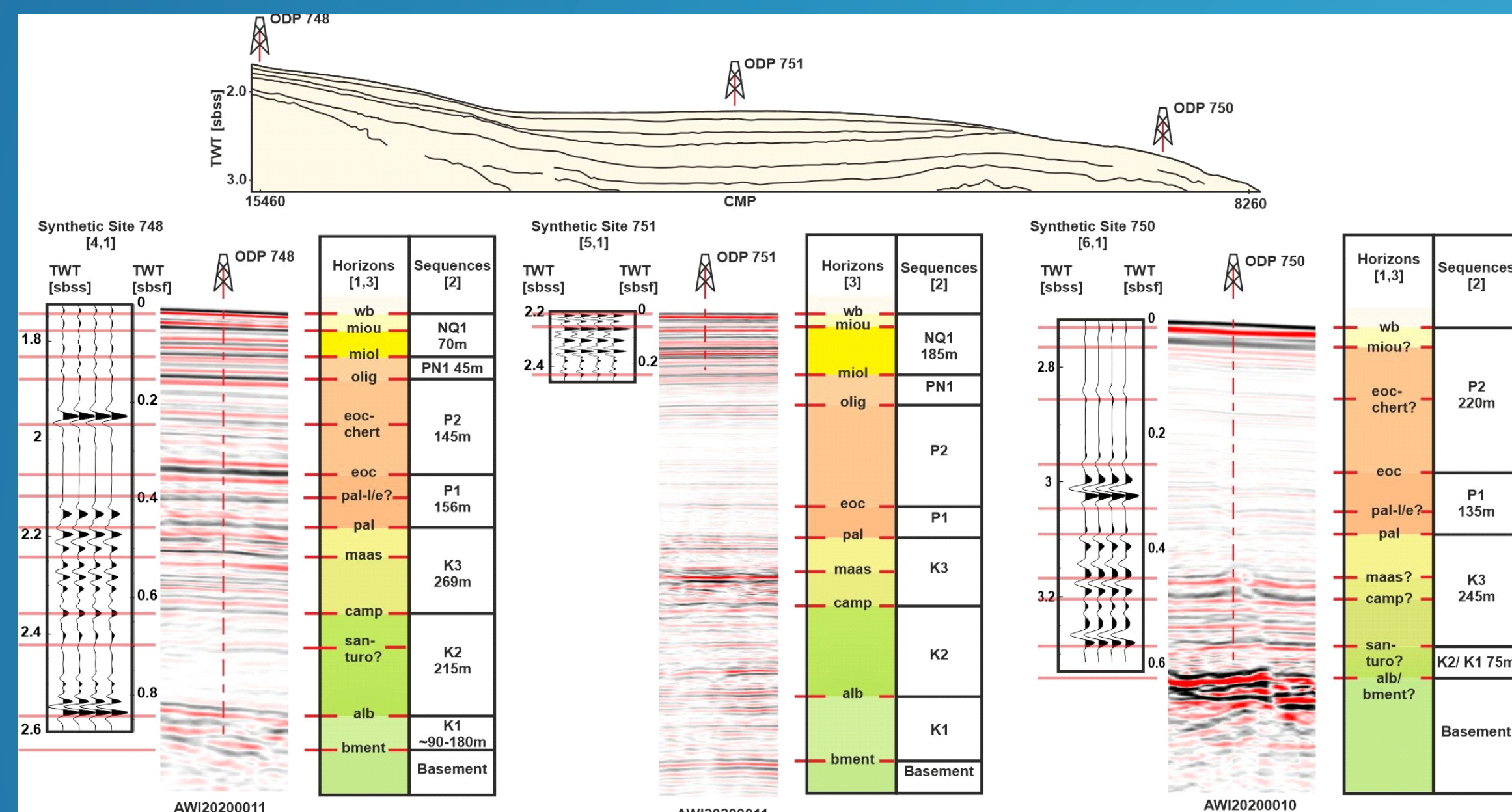


Figure 3: Revised seismostratigraphic model (1- Fritsch et al., 1992, 2- Coffin et al., 1990, 3- Borissova et al., 2002) for the Kerguelen Plateau using the new high-resolution seismic reflection data tied to ODP Leg 119 Sites 748, 750, and 751.

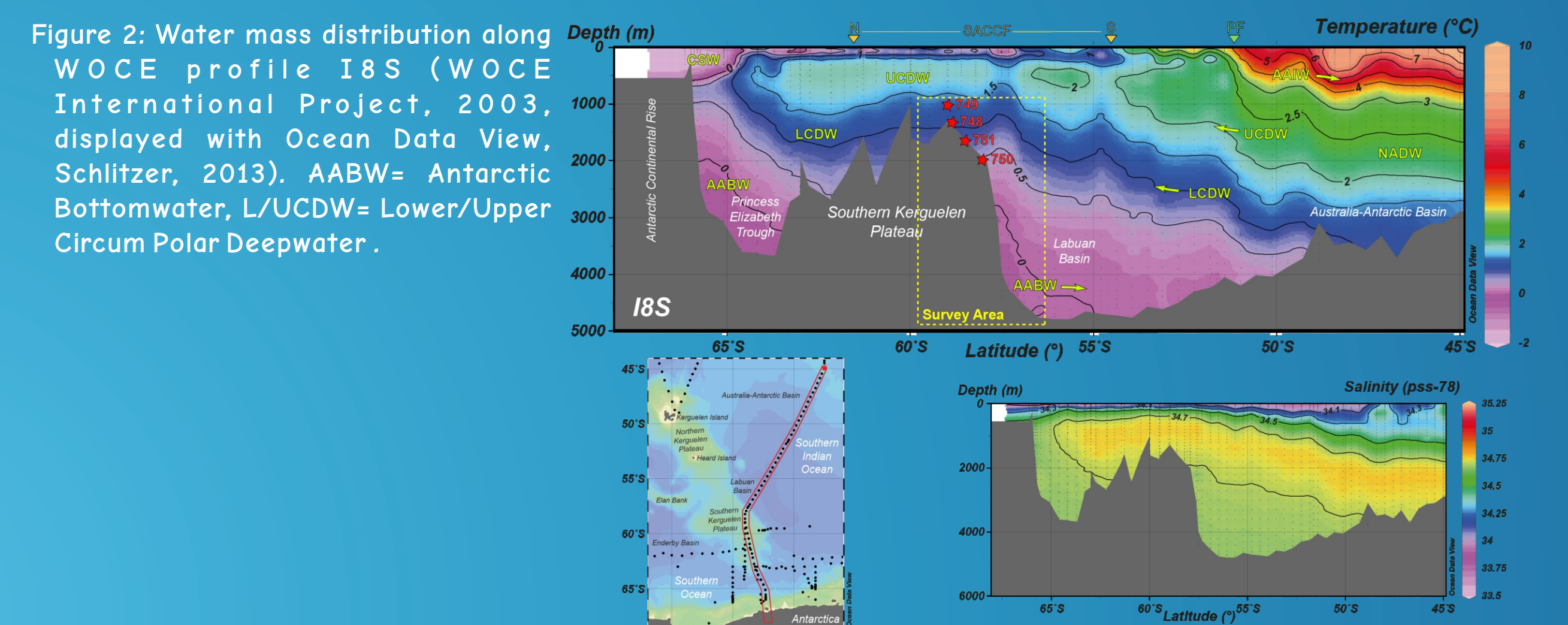


Figure 2: Water mass distribution along WOCE profile I8S (WOCE International Project, 2003, displayed with Ocean Data View, Schlitzer, 2013). AABW= Antarctic Bottomwater, L/UCDW= Lower/Upper Circumpolar Deepwater.

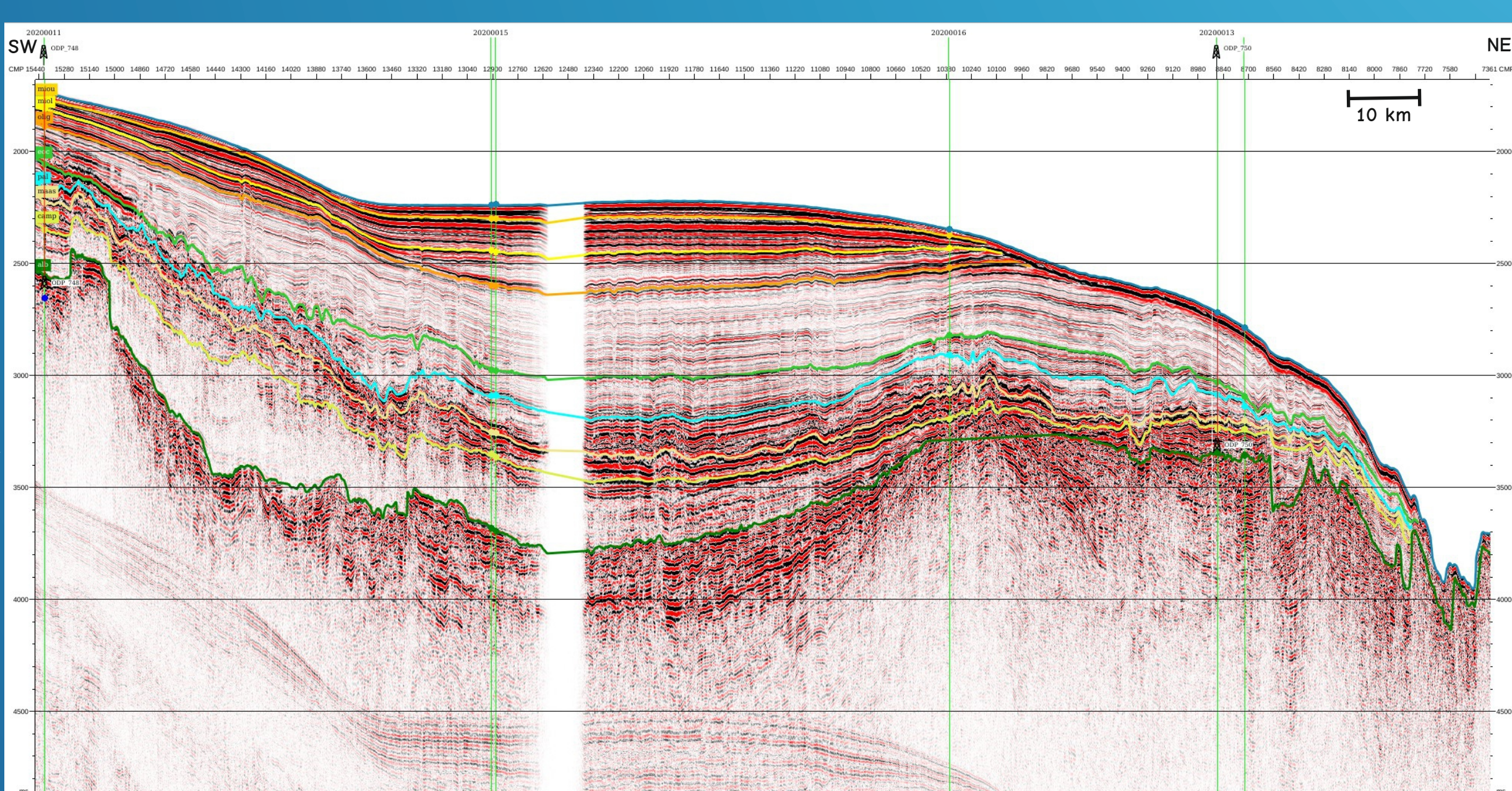


Figure 4: Seismic profile AWI-20200010 from the southern Kerguelen with ties to ODP Leg 119 Sites 748 and 750. Dark yellow reflector= Top Miocene, bright yellow reflector= Oligocene/Miocene, orange reflector= Eocene/Oligocene, green reflector= Paleocene/Eocene boundary, cyan reflector= K/Pg boundary, beige reflector= Campanian/Maastrichtian, light green reflector= Santonian/Campanian. Location shown as yellow line in Fig. 1.

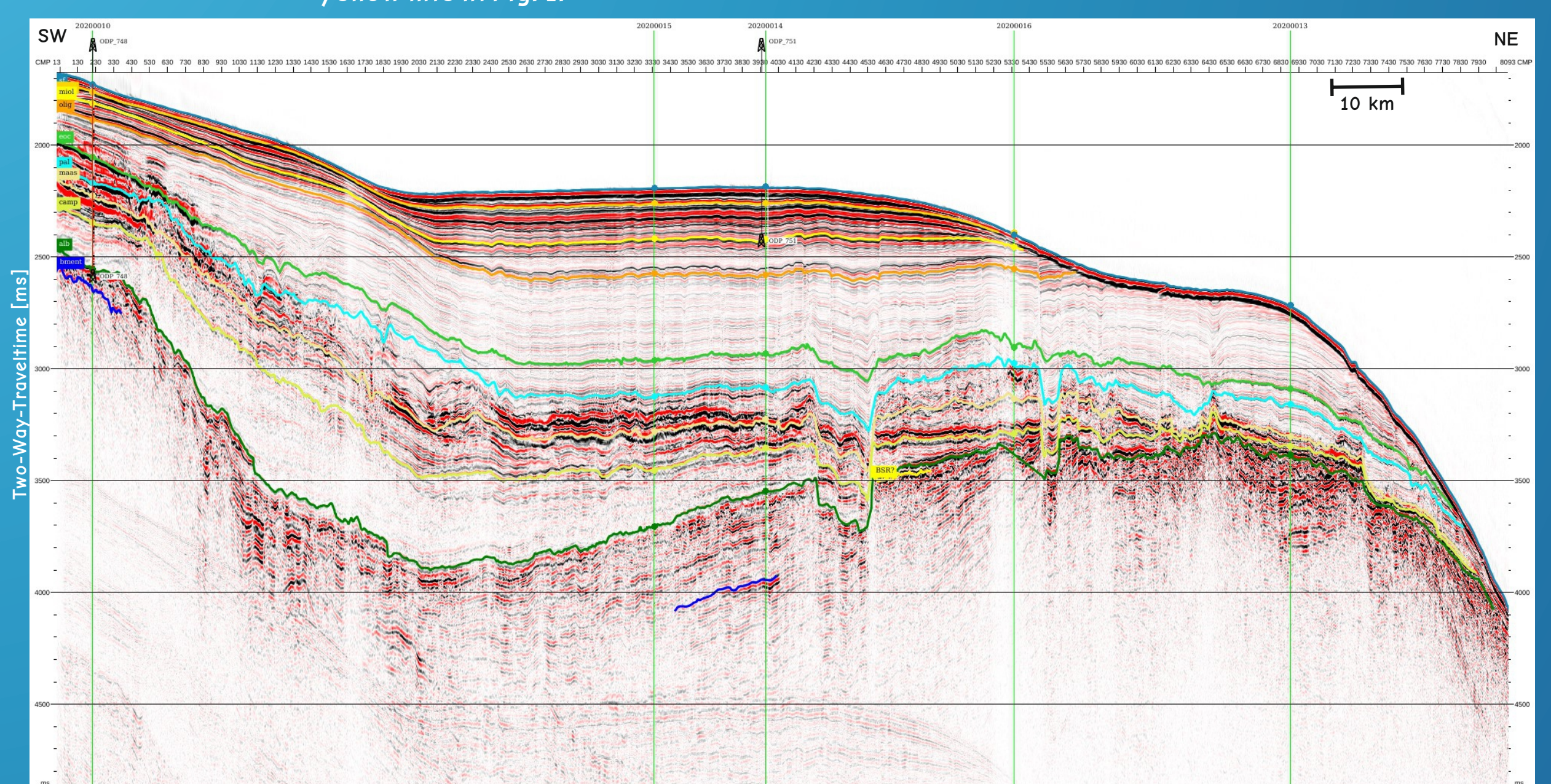


Figure 6: Seismic line across the Labuan Basin showing William's Ridge in the east characterised by very steep inner flanks. A sediment drift is patched onto the western flank of the ridge. A basement high in the Labuan Basin appears to guide deep water masses, which results in the formation of sediment drifts. Location shown as yellow line in Fig. 1.

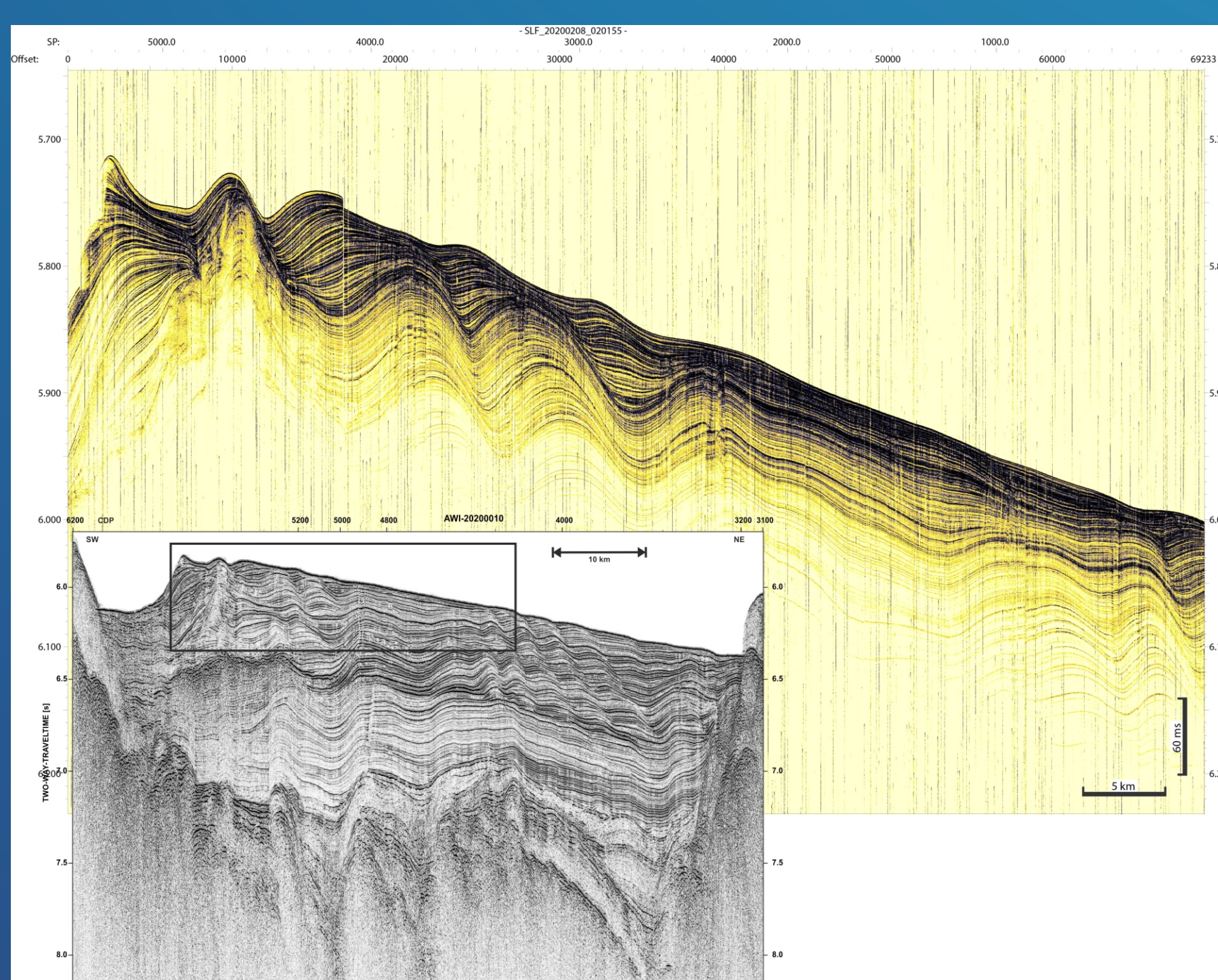


Figure 7: Parasound profile and a section of seismic line AWI-20200007 showing sediment waves in the Labuan Basin, which overlie a sediment drift. Location shown as yellow line in Fig. 1.

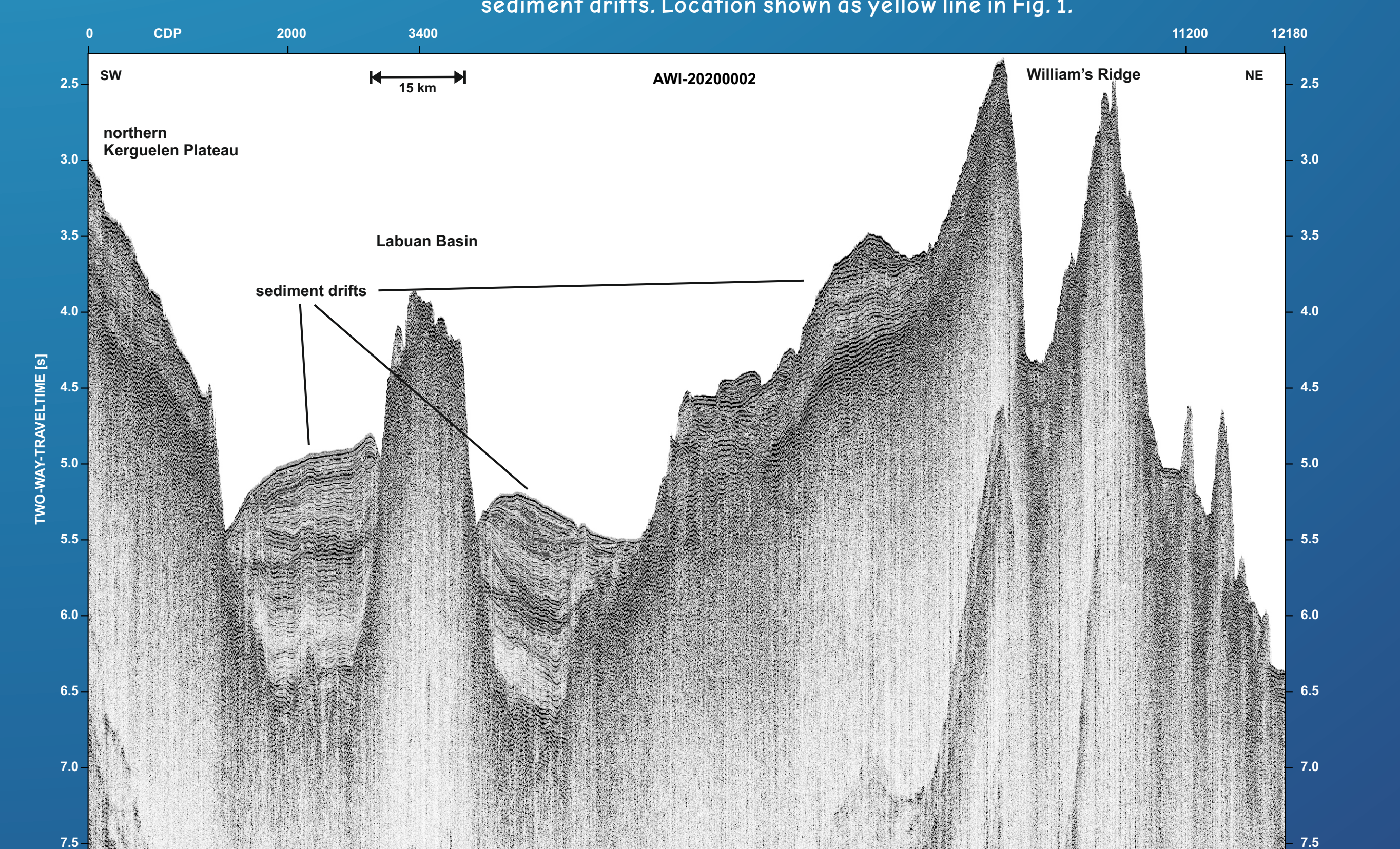


Figure 5: Seismic profile AWI-20200011 from the southern Kerguelen with ties to ODP Leg 119 Sites 750 and 751. Dark yellow reflector= Top Miocene, bright yellow reflector= Oligocene/Miocene, orange reflector= Eocene/Oligocene, green reflector= Paleocene/Eocene boundary, cyan reflector= K/Pg boundary, beige reflector= Campanian/Maastrichtian, light green reflector= Santonian/Campanian. Location shown as yellow line in Fig. 1.