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XRF analysis of turbidites in the Japan Trench: Evidences of provenances?

Tobias Schwestermann (1), Hiske G. Fink (2), Gerold Wefer (2), Timo Fleischmann (2), Cecilia M. McHugh (3), Ken Ikehara (4), Toshiya Kanamatsu (5), Arata Kioka (1), Michael Strasser (1), and the SO-251A Science Party Team

(1) Institute of Geology, University of Innsbruck, Innrain 52, 6020 Innsbruck, Austria, (Tobias.Schwestermann@uibk.ac.at), (2) MARUM – Center for Marine Environmental Sciences and Department of Geosciences, University of Bremen, Klagenfurter Str., 28359 Bremen, Germany, (3) Earth and Environmental Sciences, Queens Collage, City University of New York, 65-30 Kissena Boulevard, Flushing, New York 11367, USA, (4) Geological Survey of Japan, National Institute of Advanced Industrial Science and Technology (AIST), Tsukuba Central 7, 1-1-1 Higashi, Tsukuba, 305-8567, Japan, (5) Research and Development Center for Earthquake and Tsunami, Japan Agency for Marine-Earth Sciences and Technology (JAMSTEC), 2-15 Natsushima-cho, Yokosuka, 237-0061, Japan

Since the Mw 9 Tohoku-oki earthquake in 2011, intensive research is going on, in order to analyse earthquake-related changes and fingerprints in the sedimentological record of the Japan Trench. Many turbidites were detected within small depositional trench basins in the central part of the trench by means of high-resolution sub-bottom profiles and sediment cores. There, distinct thick turbidite sequences have been dated by tephra and radiocarbon analyses and correlated to historic earthquakes. However, information on the turbidites′ source areas and, thus, inferences on their causing earthquake characteristics, is so far lacking. For this purpose, this study performs turbidite provenance analyses by detailed petrographic and XRF core scanning analysis on cores retrieved during cruises of R/V Sonne SO-219A and R/V Sonne SO-251A, covering the entire along-strike extent of the Japan Trench from 36° to 40.3°N.

Cores were measured on the Avaatech x-ray fluorescence (XRF) core scanner at MARUM, Bremen, with a sampling interval of 1cm with 10kV and 30kV for the elements Al, Si, K, Ca, Ti, Mn, Fe and Rb, Sr, Zr, respectively. First results show distinctly different chemical fingerprints of the various spatially and temporally distributed turbidite sequences. In particular, the fine grained (silt to clay) upper parts of the turbidite sequences have partly distinct trends in elemental ratios, indicating either (i) various source areas, (ii) sorting processes along the turbidite′s pathways and/or (iii) post-depositional alteration processes. Furthermore, also the coarser basal sequences (mostly composed of multiple fine sand layers and beds) show various trends of elemental ratios. In particular the Fe/Rb vs. density trends can be indicative for the event deposits in the central part of the trench, which have been linked to historic earthquakes. Although, XRF core scanning data from the sand fraction needs to be interpreted with care, also sediment petrographic data (heavy mineral analysis) may suggest various turbidite provenance, the temporal vs. spatial variability of which will be further investigated in this study.