Geophysical Research Abstracts
Vol. 17, EGU2015-11520, 2015
EGU General Assembly 2015

Early diagenetic quartz formation at a deep iron oxidation front in the Eastern Equatorial Pacific

Patrick Meister (1), Bernhard Chapligin (2), Aude Picard (3), Hanno Meyer (2), Cornelius Fischer (4), Daniel Rettenwander (5), Georg Amthauer (5), Christoph Vogt (6), and Ivano Aiello (7)

(1) University of Vienna, Geodynamics and Sedimentology, Wien, Austria (patrick.meister@univie.ac.at), (2) Alfred Wegener Institute for Polar and Marine Research, Research Unit Potsdam, Telegrafenberg A 43, 14473 Potsdam, Germany, (3) Department of Organismic and Evolutionary Biology, Harvard University, 16 Divinity Avenue, Cambridge, MA 02138, U.S.A., (4) MARUM, Center for Marine Environmental Sciences, Leobener Strasse, 28359 Bremen, Germany, (5) Material Sciences, University of Salzburg, Hellbrunnerstrasse 34, 5020 Salzburg, Austria, (6) Department of Geosciences, University of Bremen, Klagenfurter Straße, 28359 Bremen, Germany, (7) Moss Landing Marine Laboratories, 8272 Moss Landing Road, Moss Landing, CA 95039-9647, U.S.A.

The mechanisms of early diagenetic quartz formation under low-temperature conditions are still poorly understood. We studied lithified cherts consisting of microcrystalline quartz recovered from ODP Site 1226 in the Eastern Equatorial Pacific. The cherts occur near the base of a 420-m-thick Miocene-Holocene sequence within unlithified nannofossil and diatom ooze. Palaeo-temperatures reconstructed from δ18O values in the cherts are near to present porewater temperatures and a sharp depletion in dissolved silica occurs around 385 mbsf indicating that silica precipitation is still ongoing.

Also a deep iron oxidation front occurs at the same depth, which is caused by upward diffusing nitrate from an oxic seawater aquifer in the underlying basaltic crust. Sequential iron extraction and analysis of the X-ray absorption near-edge structure (XANES) revealed that iron in the cherts predominantly occurs as illite and amorphous iron oxide, whereas iron in the nannofossil and diatom ooze occurs mainly as smectites. Mössbauer spectroscopy confirmed that the illite iron in the cherts is largely oxidized.

A possible mechanisms that may be operative is quartz precipitation initiated by adsorption of silica to freshly precipitated iron oxides. The decrease in porewater silica concentration below opal-A and opal-CT saturation then allows for the precipitation of the thermodynamically more stable phase: quartz. We suggest that the formation of early-diagenetic chert at iron oxidation fronts is an important process in suboxic zones of silica-rich sediments. The largest iron oxidation front ever occurred during the great oxidation event ca. 2.5 Ga ago, when large amounts of iron and chert beds were deposited.