Geophysical Research Abstracts
Vol. 15, EGU2013-10561, 2013
EGU General Assembly 2013

Deep-sea mud volcanoes - a window to alteration processes in old oceanic crust?

Christian Hensen (1), Florian Scholz (2,1), Marianne Nuzzo (3), Vasco Valadares (3), Pedro Terrinha (3), Volker Liebetrau (1), Norbert Kaul (4), Sonia Manzoni (5), Mark Schmidt (1), and Eulàlia Gràcia (6)

(1) GEOMAR Helmholtz-Zentrum für Ozeanforschung Kiel, Germany (chensen@geomar.de), (2) College of Earth, Ocean and Atmospheric Sciences, Oregon State University , Corvallis, USA, (3) Portuguese Sea and Atmosphere Institute (IPMA) and Dom Luiz Institute (IDL), Lisbon, Portugal [contribution PEST-Oe/ CTE/ LA0019/2011-2012], (4) Department of Geosciences, University of Bremen, Bremen, Germany, (5) Faculty of Science, University of Lisbon and Portuguese Sea and Atmosphere Institute (IPMA), Lisbon, Portugal, (6) Unitat de Tecnologia Marina (CSIC), Barcelona, Spain

A number of deep sea mud volcanoes (>4700 m water depth) were discovered during a recent expedition with the German research vessel Meteor along a prominent WSW-ENE trending strike-slip fault (SWIM 1; Zitellini et al., 2009) in the western extension of the Gulf of Cadiz (NE Atlantic). Mud volcanism was unambiguously related to tectonic activity along the fault and fluids expelled at these sites show a very distinct geochemical composition that has not been reported from any other mud volcano to date. In previous studies on deep-water mud volcanoes in the Western Gulf of Cadiz accretionary wedge it was hypothesized that the discharge fluids were affected by alteration processes occurring in the old (>140 Ma) and deeply buried (>4 km) oceanic crust (Scholz et al., 2009; Sallarès et al, 2011). This hypothesis is supported by recent findings at the mud volcanoes located to the west of the realm of tectonic deformation driven by the accretionary wedge of the Gulf of Cadiz. Pore water geochemical analyses revealed fluid sources from oceanic crust and oldest sedimentary strata. Regardless of the ultimate source, these findings suggest that large strike-slip faults may play a significant, yet unrecognized role in terms of fluid circulation and element redistribution. To date, hot vents and cold seeps occurring at active spreading centers and forearcs of subduction zones have been pinpointed as hotspots of fluid activity. However, bearing in mind that transform-type plate boundaries are equal in length compared to other types of plate boundaries, fluid exchange at this type of plate boundary may provide a similarly important pathway for water and element exchange between the lithosphere and ocean.

Sallarès V., Gailler A., Gutscher M.-A., Graindorge D., Bartolomé R., Gràcia E., Díaz J., Dañobeitia J.J. and Zitellini N. (2011) Seismic evidence for the presence of Jurassic oceanic crust in the central Gulf of Cadiz (SW Iberian margin), Earth and Planetary Science Letters 311(1–2), 112-123.

Scholz F., Hensen C., Reitz A., Romer R.L., Liebetrau V., Meixner A., Weise S.M., and Haeckel M. (2009) Isotopic evidence (87Sr/86Sr, δ7Li) for alteration of the oceanic crust at deep-rooted mud volcanoes in the Gulf of Cadiz, NE Atlantic Ocean. Geochimica et Cosmochimica Acta 73, 5444-5459.

Zitellini N., Gràcia E., Matias L., Terrinha P., Abreu M.A., Dealteriis G., Henriet J.P., Dañobeitia J.J., Masson D.G., Mulder T., Ramella R., Somoza L., and Diez S. (2009) The quest for the Africa-Eurasia plate boundary west of the Strait of Gibraltar. Earth and Planetary Science Letters 280, 13-50.