EGU22-4385
https://doi.org/10.5194/egusphere-egu22-4385
EGU General Assembly 2022

Diagenetic carbonates from deep sub-seafloor organic-rich sediments influenced by magmatic sill intrusions (IODP Exp 385-Guaymas Basin, Gulf of California)

Swanne Gontharet[1], Catherine Pierre[1], Ewan Pelleter[2], Sandrine Caquineau[1], Omar Boudouma[3], Jérôme Demange[1], Andreas P. Teske[4], Daniel Lizarralde[5], Tobias W. Höfig[6], and the Expedition 385 Scientists[*]

[1]Sorbonne University, LOCEAN UMR 7159, France (swanne.gontharet@locean.ipsl.fr)
[2]Ifremer- Géosciences Marines, Plouzané, France
[3]ISTeP, CNRS-SU, Sorbonne Université, Paris, France
[4]Department of Earth Marine and Environmental Sciences, University of North Carolina at Chapel Hill, USA
[5]Department of Geology and Geophysics, Woods Hole Oceanographic Institution, USA
[6]International Ocean Discovery Program, Texas A&M University, USA
[*]A full list of authors appears at the end of the abstract

During the International Ocean Discovery Program (IODP) Expedition 385, diagenetic carbonates were recovered at different depths (from 10 to 534 mbsf) in six drilling sites (U1545, U1546, U1547, U1548, U1550 and U1552) distributed from the northern spreading segment of the Guaymas Basin (Gulf of California) to ~52 km away from the axial graben. As this basin is a site of active sea floor spreading, hemipelagic diatomaceous and organic-rich sediments rapidly accumulating at all these drilling sites are influenced by magmatic intrusions, at depths greater than 90 mbsf. The geothermal gradient observed ranges from 135 °C/km to 682 °C/km. Except in sites U1547 and U1548, both located close to a circular hydrothermal mound (called Ringvent), sills are in thermal equilibrium with the surrounding sediments.

Carbonate samples (over fifty) collected during this expedition are composed of fine-grained micritic sediments and weakly to strongly lithified carbonate concretions. The petrographic observations and XRD analyses show that stoichiometric dolomite is the dominant authigenic carbonate phase, with minor contribution of Fe-rich dolomite, and low- to high-Mg calcite. Centimeter-sized concretions composed of ankerite and Mg-calcite also occur in the sediments collected from the northern axial graben (site U1550) and a site with subsurface gas hydrates (U1552), respectively. Other authigenic minerals are often associated with these carbonates including pyrite, barite, anhydrite, zeolites and crystalline opal (opal-CT). The carbon isotopic compositions of the bulk carbonate from these samples exhibit large variations ranging from -28.9 to +12.0‰ VPDB. Very low d ^{13}C values, only measured in a centimetre-seized concretion associated with cold methane seepage (site U1552), indicate that the bicarbonate used for carbonate precipitation is derived from anaerobic oxidation of methane (AOM) coupled with bacterial sulfate reduction (BSR). The very high d^{13}C values of diagenetic carbonates indicate the

use of biogenic ^{13}C-rich CO_2 reservoirs related to active methanogenesis or other autotrophic microbial pathways. The oxygen isotopic compositions of these carbonates cover a large range from -5.3 to +4.0‰ VPDB. The decreasing $d^{18}O$ values with increasing depth reflect the effect of high geothermal gradients due to the close proximity of magmatic sills.

Expedition 385 Scientists: Andreas P. Teske; Daniel Lizarralde; Tobias W. Ho□fig; Ivano W. Aiello; Janine L. Ash; Diana P. Bojanova; Martine Buatier; Virginia P. Edgcomb; Christophe Y. Galerne; Swanne Gontharet; Verena B. Heuer; Shijun Jiang; Myriam A.C. Kars; Ji-Hoon Kim; Louise M.T. Koornneef; Kathleen M. Marsaglia; Nicolette R. Meyer; Yuki Morono; Raquel Negrete-Aranda; Florian Neumann; Lucie C. Pastor; Manet Peña-Salinas; Ligia L. Pérez Cruz; Lihua Ran; Armelle Riboulleau; John A. Sarao; Florian Schubert; S. Khogenkumar Singh; Joann M. Stock; Laurent M.A.A. Toffin; Wei Xie; Toshiro Yamanaka; Guangchao Zhuang