

Direct observation of gas hydrate formation in a sedimentary matrix on the microscale

K. SELL^{1*}, M. CHAOUACHI², F. ENZMANN¹, W.F. KUHS²,
M. KERSTEN¹, B. PINZER³ AND E.H. SAENGER⁴

¹Gutenberg-University, Mainz 55099, Germany

(*correspondence: sell@uni-mainz.de)

²GZG, University Göttingen 37077, Germany

³PSI, Tomcat Beamline, 5232 Villigen, Switzerland

⁴ETH, Zurich 8006, Switzerland

Gas hydrates (GH) are ice-like solid compounds comprised of gas molecules and water [1]. As it is very difficult to recover natural GH samples due to their fast decomposition under ambient conditions, a lot of open questions are left concerning the microstructure and distribution of hydrates in sediments. This study represents the first direct observation of gas hydrate growth in a sedimentary matrix using time-resolved synchrotron-based tomography leading to first insights on the nucleation and growth of gas hydrates at a high spatial resolution of 740 nm. The time-sequences of the GH formation in the medium reveal that the reaction clearly started at the gas-water interface forming a several μm thick hydrate film (Fig.1). In contradiction to some earlier conjectures a nucleation on the grain surface was not observed. At a later stage the water is replaced by GH of more or less isometric shape with pore space in between. Some of our observations show that water remains as a thin film between grains and hydrate but this needs to be corroborated. Seismic anomalies observed in field studies might be explained by the presence of thin water films in hydrate-bearing sediments. In a next step the full 3D data set will be used as a direct input to model the effective elastic properties.

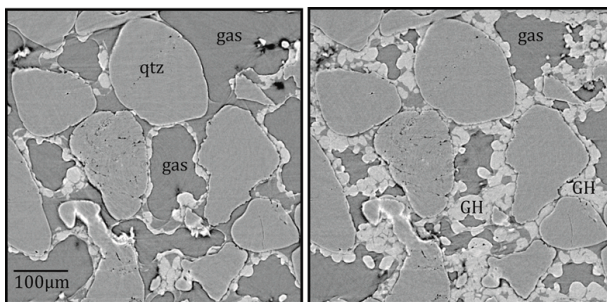


Figure 1: 2D slices depicting the stepwise hydrate growth within the sedimentary matrix.

[1] Sloan & Koh (2008) In: Clathrate hydrates of natural gases. CRC Press, Boca Raton, 752.

Application of mineral thermometers and barometers to shoshonitic-ultrapotassic rocks: The Simav Graben (Western Anatolia, Turkey)

B.SEMIZ

Dep of Geological Engineering, Pamukkale University, 20070, Denizli, Turkey (bsemiz@pau.edu.tr)

The study area is located at the intersection of E–W-trending Plio-Quaternary Simav Graben and NE–SW-trending Neogene Selendi and Uşak-Güre basins in the western Anatolia. Due to their morphological, stratigraphical positions and petrographical features in the field, the investigated shoshonitic-ultrapotassic rocks are called Inceğiz, Gediz, Dereköy, Naşa, Kestel basalts, Saphanedağı and Ilıcaksu Lamproites. All the SHO-UK rocks display similar petrographic characteristics.

Fourteen samples, representing the SHO-UK units in the eastern parts of the Simav Graben have been used for mineral chemical studies and for estimation of the temperature and pressure conditions of magmatic crystallization. These samples are porphyritic, hyaloplitic, pilotaxitic in texture and with the following mineral assemblages; clinopyroxene ($\text{En}_{40-52}, \text{Wo}_{39-48}$), olivine (Fo_{63-92}), rarely phlogopite (Mg# 65-91), plagioclase (An_{62-88}), and sanidine (Or_{52-84}). Ti-magnetite, ilmenite and chrome-spinel (5-18% MgO, 39-54% Cr_2O_3) are common accessory minerals.

Application of clinopyroxene [1] and olivine-spinel [2] geobarometric studies for the SHO-UK, equilibrium pressure between ~ 7.6 -10.3 and ~ 16.2 -16.8 kbar has been estimated, corresponding to 25-51 km depth, respectively. Oxygen fugacity ranges from -11.9 and -13.8. Olivine [3], Olivine-spinel [4], clinopyroxene [5] and magnetite-ilmenite pairs [6] geothermometers have been applied for estimating the crystallization temperatures of minerals. Calculated crystallization temperatures are 1193-1262°C for olivines, 1086-1191°C for clinopyroxene and 793-851°C for magnetite-ilmenite pairs. The estimates of magmatic parameters indicate that the magmas forming the SHO-UK rocks crystallized at different levels, from mantle depths toward deep-level magma chambers.

[1] Nimis, (1995) *Contrib Mineral Petrol.* **121**, 115-125. [2] O'Neil, (1981) *Contrib Mineral Petrol.* **77**, 185-194. [3] Putrika, (2008) *Reviews in Mineral. & Geochem.* **69**, 61-120. [4] O'Neil and Wall, (1987) *J Petrol.* **28**, 1169-1191. [5] Putrika *et al.*, (2003) *Am Mineral.* **88**, 1542-1554. [6] Stomer, (1983) *Am. Mineral.* **68**, 586-594.