

4.1.P11

Early diagenetic control on Lower Paleozoic K-bentonite composition in Baltic Basin

R. HINTS^{1,2}, K. KIRSMÄE¹, T. KALLASTE³ AND T. KIIPLI⁴

¹Institute of Geology, University of Tartu (arps@ut.ee)

²Estonian Museum of Natural History (rutt@loodusmuuseum.ee)

³Inst. of Geology, Tallinn Technical Univ. (kallaste@gi.ee)

⁴Geological Survey of Estonia (Tarmo.Kiipli@egk.ee)

Bentonites are altered pyroclastic deposits. Their composition has been widely used for paleovolcanic and diagenesis studies. Transformation of metastable clay minerals is a valuable tool for dating and characterization of burial/petroleum diagenesis. However, composition of bentonites is, despite prominent late diagenetic changes also controlled by early diagenetic *in situ* devitrification and recrystallization of volcanic ashes. This process depends on volcanic ash interaction with seawater and host rock. The original composition of devitrified ash is, in most cases, masked by later diagenesis. In this contribution we present data on K-bentonite evolution in Lower Palaeozoic sediments in Baltic Basin. The BB has passed through a long-term diagenesis at a shallow burial and low P-T conditions, which enables tracing of bentonite evolution back to early stages. Today, a thermodynamically unstable mineral assemblage of illite-smectite – K-feldspar – kaolinite characterizes the Llandovery and Wenlock K-bentonites from SW Estonia. The ratio of these minerals varies greatly between individual layers as well as laterally. Comparison with mineral stability and transformation in recent marine pyroclastic diagenetic systems suggest that the early evolution of these K-bentonites comprised at least two metastable phases, early smectite and zeolite, which were in later stages replaced by I-S and Kfs, correspondingly. The transformation of ash to either primary zeolite or smectite was controlled by Al⁺ and Si⁺ activity in pore water. The low pH needed for kaolinite stabilization was probably locally induced by the decomposition of organic matter as the occurrence of kaolinite coincide with higher content of organic matter in the rock successions. Early diagenetic composition of individual bentonite layers affected also the late diagenetic smectite-to-illite transformation. The I-S in kaolinite rich beds contains more smectite layers compare to I-S and Kfs dominated bentonites. We suppose that the individual bentonite layers acted like half-opened microsystems during diagenesis. The appearance of high compositional heterogeneity in studied K-bentonites was determined by the internal variables of sediments, such as the ash and the host-rock composition, seawater and pore-water composition and rock permeability.

4.1.P12

Fluid-sediment interaction in a low-temperature off-axis hydrothermal environment (Cocos plate, Costa Rica margin)

S. BODEI¹, M. STEINMANN¹, M. BUATIER¹ AND C.G. WHEAT²

¹Département de Géosciences, Université de Franche-Comté, 25030 Besançon cedex, France (mabb@voila.fr; marc.steinmann@univ-fcomte.fr; martine.buatier@univ-fcomte.fr)

²Global Undersea Research Unit, P.O. Box 757220, University of Fairbanks, Fairbanks, AK 99775, USA (wheat@mbari.org)

We present data from sediment cores collected during the Ticoflux II cruise offshore Costa Rica in 2001.

All samples presented here originate from the direct vicinity of the so-called “Dorado high”, which is based on heat flow data, an area of localized low temperature hydrothermal discharge. Active discharge is based on local high measurements of heat flow and systematic variations in pore water chemical profiles. Chemical data include phosphate and alkalinity profiles that decrease with depth in contrast to pore waters collected away from the outcrop that have increasing concentrations with depth consistent with normal microbially mediated diagenetic processes. We analyzed sediment from core 50GC, which was collected from the northwest slope of Dorado outcrop. This core presents altered yellowish brown mud composed by authigenic clays, zeolites, Fe and Mn oxides and phosphates.

The chondrite normalized REE patterns of sediment samples are characterized by a strong negative Ce anomaly at the base of the profile that decreases upward. The REE concentrations are positively correlated with P₂O₅ from 50-100 cm depth (r² = 0.969, n=6) suggesting REE scavenging by phosphate precipitation during upward migration. In contrast, at the base of the profile where dissolved phosphate concentrations are the lowest, no direct link between REE and phosphate can be observed.

In summary, our preliminary data show that the 50GC core is well suited for a detailed study of the chemistry and the mineralogy of fluid-sediment interaction in a low temperature hydrothermal environment.

