



## **BORON GEOCHEMISTRY OF MUD VOLCANO PRODUCTS AND THEIR SIGNIFICANCE FOR GLOBAL B CYCLING**

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Mud volcanism is a global phenomenon in mostly convergent margin settings, whose nature has long been subject to scientific investigation. However, only recently its significance has been unravelled by quantitative studies in well-investigated submarine environments, like large accretionary complexes. The fluid flux through active mud volcanoes has been estimated to exceed that of the frontal accretionary prism (Kopf et al. 2001, EPSL 189), and may have done so in earlier earth history. We report results from a systematic B geochemical study of pore fluids, muds and clasts of onshore and offshore mud volcanoes all over the world (Kopf and Deyhle, 2002, Chem. Geol., 192). When tied into results from hydrothermal geochemical experiments in the laboratory (You et al. 1996, EPSL 140), the B geochemistry proves to be a powerful tracer to estimate the depth of fluid and mud mobilization below ground. Boron adsorbed to clay minerals is preferably donated to the fluid when either tectonic stress (vertical and/or lateral compaction) or temperature increase. Here, we report variations in B content and B isotopes in mud volcano deposits as a result of different history of the material prior to extrusion. Results reflect the regional geology of the study areas, ranging from dewatering of undercompacted marine sediments in accretionary prisms (Barbados, Makran, Mediterranean Sea) to diagenetic reactions in mud volcanoes of orogenic belts (Malaysia, Pakistan, Georgia, Taman Peninsula, Western Alps). Boron shows maximum enrichment in the fluid phase (owing to desorption in the mud) when faulting roots deepest and deformation is strongest. Mud domes juxtaposing out-of-sequence faults in the Caucasus orogenic wedge show mud B contents 8x marine sediment and fluid B contents up to 25x seawater. Deep-seated, B-rich fluids liquefy clay-bearing strata to facilitate mud extrusion, allowing the clay

to re-adsorb B in the process. B isotopic composition of the mud decreases with incipient stress and mobilization depth. Given the abundance and high discharge rates of mud volcanoes along subduction zones, this process generally affects chemical and fluid budgets in the subduction factory. Given the abundance and high discharge rates of mud volcanoes, it clearly has to be considered a major backflux mechanism in global B cycling from the lithosphere to the hydrosphere.