The interplay between volcanism, tectonics and hydrothermalism on the Mid-Atlantic Ridge 4-11°S and globally

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Hydrothermalism on the slow-spreading Mid-Atlantic Ridge occurs either on-axis in places where excess volcanism has led to the construction of prominent axial highs (Menez Gwen, Lucky Strike, Turtle Pits. Lilliput) or off-axis in other regions (e.g. TAG, Rainbow, Logatchev, Saldanha). Both on- and off-axis systems appear, however, to draw their heat from similar, magmatic sources.

We present a model to explain the distribution of hydrothermalism on mid-ocean ridges, relating the frequency of volcanic events to the depth of the heat source and to the off-axis distance of the hydrothermal systems. Frequent eruptions produce hot crust and a shallow heat-source – fluids heated by this source exit close to its summit, i.e. on-axis (this is the dominant situation on the EPR, for example, where active off-axis hydrothermalism is almost unknown) and off-axis faults serve as recharge channels. When eruptions are less frequent, the shallow crust cools and hydrothermal circulation is only tapped by deeper-reaching faults related to the axial valley walls,; hydrothermal venting migrates off-axis. The cooler the crust (and hence the deeper the isotherms), the farther off-axis venting will occur.

This model has predictive qualities: In areas with no bathymetric or side-scan evidence for abundant, recent volcanism, hydrothermal sytems will be located exclusively off-axis. In areas dominated by tectonic spreading, not only will the hydrothermal systems be far off-axis, they will also be separated by large distances along axis due to aspect-ratio constraints. Satellite-based predicted bathymetry can, on the other hand, be used to identify on-axis highs with good hydrothermal potential.

Chemical weathering processes in sub-Saharan Africa: Evaluating controls at different spatial and temporal scales

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New insights into chemical weathering processes across a wide range of different climatic regimes were obtained from a combination of different methods: (i) long-term (> 50 years), high temporal resolution (monthly) records of river water geochemistry at more than 30 different sites and river systems with catchment scales varying from 625 to 650,000 km^2, (ii) analysis of river bedload material representing contrasting catchment lithologies, for geochemical proxies of chemical weathering intensity and catchment-to-coast geochemical transformations, (iii) geochemical characterization of surface soil samples, collected at ~ 900 km^2 sampling resolution within the catchments of river systems with ancillary river bedload and river dissolved load data records.

Chemical weathering rates as a function of different controls was evaluated in the context of both long-term and seasonal variations in river geochemistry. The data demonstrates the potential pitfallss associated with deducing weathering rates from once-off sampling surveys and provides important insights into which part of the hydrograph is most advantageous for such sampling strategies. Additionally, comparison with the chemical weathering potential of catchment lithologies and soils was made possible with the analysis of a large number of soild samples, with a new laser ablation q-ICP-MS method applied to powder brisquettes, in conjunction with selective leaching experiments. The importance of consideration of the geochemical composition of catchment soils, in addition to that of unweathered bedrock lithologies, when evaluating lithology as a control on chemical weathering characteristics is demonstrated.