

Tracing subduction erosion through arc chemistry in the central Mexican Volcanic Belt

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Continental crust recycled via subduction erosion has been suggested to be a quantitatively important component that may overshadow the crustal contributions from subducted trench sediment to arc magmas at erosional convergent margins [1]. However, unlike the trench sediment that can be measured directly and linked to arc chemistry [2], the composition of eroded lower continental crust is essentially unknown. Hence, its identification in arc magmas poses a real challenge as signals of the eroded crust must be distinguished from those of the trench sediment and also from contamination by the overlying crust.

Here we present results of a comprehensive geochemical study from two Holocene high-Nb monogenetic arc volcanoes (Texcal Flow and V. Chichinautzin) that were erupted within ~1100 year and within only 6 km from each other. Major and trace element and Sr-Nd-Hf-Pb-He isotope systematics demonstrate that the basaltic and basaltic-andesitic magmas are mixtures of mantle and crustal materials. High ³He/⁴He of 6-7 R_a in equilibrium olivines, however, and high and increasing melt Nb (from 17 to 36 ppm) and Nb/Ta (from 16 to 19) with increasing melt SiO₂ preclude substantial assimilation of the overlying crust. Combined Sr-Nd-Hf isotope data and trace elements argue against the trench sediment as an isotopic end member as this would require an unreasonably large loss of Nd (~50%) relative to Hf in the trench sediment. Alternatively, we propose that Sr-Nd-Hf-Pb isotope and trace element systematics may best be explained through melting of a subarc mantle that was infiltrated with crustal components recycled via subduction erosion from the lower Mexican forearc crust. The data suggest for this region a model in which the recycled eroded crust may dominate arc chemistry together with fluids released from the subducted igneous oceanic crust while the signals of the subducted trench sediment are largely eclipsed. This may be explained by the low volumetric flux of sediment in this region owing to the young age of the subducting plate.

[1] Clift & Vannucci (2004) *Reviews of Geophysics* **42**(2), 1-31. [2] Plank & Langmuir (1993) *Nature* **362**, 739-743.

The diagenetic history of marine sediments as revealed by C-S-Fe systematics

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Marine sediments archive the products of primary productivity, subsequent mineralization of the sedimentary organic matter through microbial and/or inorganic processes, the input of detrital components, and the authigenic mineral formation within the sedimentary column. The C-S-Fe system constrains respective depositional as well as diagenetic aspects within marine sediments, frequently occurring under changing redox conditions. A diverse set of petrographic, geochemical, and isotopic proxy signals has evolved during the past fifty years with an ever increasing specificity. These proxy signals allow distinguishing between local/regional phenomena and perturbations of global geochemical cycles, both in modern sediments as well as for sedimentary rocks in the geologic record. Hartmann and Nielsen [1] were among the very early researchers applying some of these proxy signals in their study of marine coastal sediments from the Kiel Bight, Baltic Sea, northern Germany.

Abundances of carbon, sulfur, and iron, organic and inorganic carbon isotopes, multiple sulfur isotopes of sulfides and sulfates, and oxygen isotopes for sulfate were measured in pore waters and sediments collected during a revisit of these Baltic Sea sediments some 45 years after the original study. Respective proxy signals reveal a complex diagenetic evolution that is largely governed by bacterial sulfate reduction. Key features include a sizeable sulfur isotopic fractionation of up to 64‰ between sulfate and sulfide. The downcore evolution towards ³⁴S-enriched sulfur isotope values for both sulfur species in the pore waters suggest the development of sulfate limiting conditions. Disproportionation of sulfur intermediates cannot be excluded and would be consistent with the observed large fractionations in δ³⁴S as well as from a combination of δ³⁴S and Δ³³S. Conclusions derived here overall confirm interpretations made by [1]. At the same time, an expanded analytical approach allows for more detailed information about microbially driven processes in the pore water realm and the sediments.

[1] Hartmann & Nielsen (1965) *Geologische Rundschau* **58**, 621-655.