

On Sediment Devolatilisation and Preservation in (Paleo-) Subduction Zones.

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In metasediments, nitrogen occurs as ammonium ion, and according to similarities in charge and ionic radius, it follows potassium geochemistry. At depths, nitrogen behavior is thus closely related to the fate of phengite, the HP white mica. Therefore, nitrogen and its isotopes can potentially provide key constraints on the fate and behavior of the main subducted sedimentary volatiles, in particular water. Low- to high- grade (0-90 km) metamorphic sediments from paleosubduction zones however show inconsistent N behavior, with clear indication of either strong (e.g. Haendel et al., 1986; Bebout and Fogel, 1992) or absence (Busigny et al., 2003) of fluid-loss during subduction. It will be argued that this discrepancy can be explained by taking into account geothermal gradient, the "cooler" geothermal gradient (<9°C) being associated with no metasedimentary fluid loss. In contrast, under high geothermal gradient, devolatilisation occurs and less sedimentary water is present at the depth locus of arc magmatism. The amount of volatiles that can pass through arc-basalt volatile barrier remains unclear. Data on volcanic fumeroles from Costa-Rica are compatible with total transfer of sedimentary nitrogen to the surface (Fisher et al., 2002). Yet, the method suffers severe assumptions and recent evaluation of the amount of nitrogen presently brought by the sediments is four times higher than that initially assumed (Li and Bebout, 2004). Using the same computation, the amount of subducted sedimentary nitrogen would increase from 0 to 75%. Evidence for N recycling beyond the depth of arc-magma genesis is demonstrated by the occurrence of high amounts of nitrogen within metamorphic diamonds (Cartigny et al., 2004). Precise estimate of N amount subducted specifically from these samples remains difficult, but the detection of water-bearing fluid inclusions demonstrates that some water was still present at depth > 140 km. We are presently investigating the possibility of identifying similar behavior(s) of sedimentary volatiles within present arc-volcanism.