Geophysical Research Abstracts, Vol. 8, 00290, 2006
SRef-ID: 1607-7962/gra/EGU06-A-00290

Forearc devolatilisation and its impact on the boron and lithium cycles in subduction zones

H. R. Marschall

Department of Earth Sciences, University of Bristol, Wills Memorial Building, Queen's Road, Bristol BS8 1RJ, UK (Horst.Marschall@bristol.ac.uk)

Hydrated rocks that compose the subducting oceanic lithosphere are subject to significant devolatilisation induced by compaction and the onset of metamorphism long before the slabs reach subarc depths. This forearc devolatilisation has a major impact on the budget of volatile elements, such as Li and B, as they are significantly mobilised by the released fluids. Moreover, the low-temperature conditions within the slab at this stage of subduction leads to a strong Li and B isotope fractionation between solids and fluids.

The chemical and isotopic composition of island arc magmas probably reflects metasomatic influx of fluids or melts into the mantle wedge. However, the rocks within the slab that release these agents undergo a complex history of metamorphism before they reach the critical depth. The agents themselves are again strongly modified during metasomatism of the hanging wall mantle before they enter the magma source region. It is therefore crucial to unravel the process step by step before we can provide a meaningful interpretation of chemical and isotopic signatures of the final products of the cycle - the island arc magmas.

Available natural rock and fluid samples that represent different reservoirs within active and fossil subduction zones include trench fluids, mud volcanoes, serpentinite diapirs, minerals and fluid inclusions in high-pressure metamorphic rocks, serpentinites, mantle xenoliths and orogenic peridotites, as well as exhumed hybrid rocks formed by tectonic and metasomatic mixing of differnet rock types. The interpretation of metamorphic/metasomatic rocks is difficult and, in cases, ambiguous, and requires in-situ anlytical techniques in order to read their complex history recorded in intramineral zonation patterns. Though, a combination of geochemical and petrological

tools will potentially deliver a number of highly valuable insights. Data obtained on natural rocks can be combined with experimental data on fluid-mineral and fluid-rock trace-element partitioning and isotope fractionation in order to model the evolution of the chemical budget in different reservoirs within subduction zones.

In recent years, the systematics of Li and B have been intensively investigated with respect to all the above mentioned aspects by many different workers. The rsults of these studies allow for an integrative understanding of the effects of forearc devolatilisation and metasomatism on the subduction cycle of light elements and their isotopes.