Li Isotopic Composition of Arc-Related Lavas from Viti Levu, Southern Fiji

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Isotopics composition of Li in volcanic arc lavas reflects the composition of their sources and can be potentially used to determine the relative contributions of subducted oceanic crust, sediments and material derived from the overlying mantle wedge (Moriguti and Nakamura 1998, Tomascak et al. 2000, Chan et al. 2002).

Li was extracted from samples of mid-Miocene (15–10 Ma) early-arc tholeiites collected from the southern shore of the Viti Levu Island (southern Fiji) and from the late-arc rift-related calc-alkaline basalts and shoshonites of late Miocene – Pliocene age (5.5 to 3 Ma) from the northern coast of Viti Levu. We have used a two-stage ion exchange chromatography to separate Li from the matrix prior to the analysis on ICPMS to avoid the matrix induced bias of isotopic data. We have utilized low volume (2 mL) polyethylene and PFA columns and conventional ion exchange techniques (Dowex anion 1-X8 and cation 50W-X8 ion exchangers) to achieve quantitative separation of Li. Isotopic composition of Li was measured by quadrupole (VGE PQ3) ICPMS. The external correction for instrument mass bias utilized measurements of the NBS lithium carbonate L-SVEC standard before and after each sample.

Li isotopic composition of the studied lavas from the southern Fiji Island varies between −19.7‰ and +0.2‰ δ^6Li. The large range of Li isotopic composition reflects, to some extent, a strong post-magmatic alteration of some lava samples. There is, however, a clear zoning in the Li isotopic composition across the Fiji volcanic arc from the isotopically heavier early-arc tholeiites to the calc-alkaline basalts and shoshonites which have isotopically lighter Li. Assuming a normal chemical zoning of magmas across the volcanic arc (tholeiitic–calc alkaline–shoshonitic), the observed Li isotopic composition of lavas suggests a shift towards lighter Li sources with increasing depth of the subducted slab. This zoning is also consistent with progressively less contribution of the subduction component to the arc magmas at higher depths of the Wadati-Benioff zone.

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Magnetic Susceptibility as an Indicator of Tectonic Setting of Granitic Rocks of the Bohemian Massif

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The bulk magnetic susceptibility of granitic rocks is very variable. It ranges from the order of 10^{-6} (SI of units is used) in leucocratic granites to the order of 10^{-1} in some granodiorites or tonalites. However, the susceptibility is not distributed homogeneously, but displays a bimodal distribution. One mode corresponds to the values of 10^{-3} to 10^{-2} and the other one to those of 10^{-5} to 10^{-4}. In the petrophysical literature, the former mode granites are simply referred to as magnetic, while the latter as non-magnetic or weakly magnetic. The susceptibility of the magnetic granites is carried by magnetite, while in the weakly magnetic granites it is carried mostly by paramagnetic minerals (mafic silicates, ilmenite).

From the point of view of their composition, granitic rocks do not also create a homogeneous group, but can be divided into different types, originated in different tectonic settings. Two of the types are of particular importance: an I (igneous) type, broadly corresponding to the biotite hornblende tonalite association, and an S (sedimental) type, broadly corresponding to the two-mica granite association. These two types can be accomplished by another two: an M type corresponding to the most calc-alkaline plagiogranites and an A type corresponding to anorogenic alkali granites.

From the point of view of magnetic minerals, granitic rocks can be divided basically into two series, one being characterized by the occurrence of magnetite and the other one by the occurrence of ilmenite. Studies of granite spatial distribution show rough coincidence of I type with Magnetite Series Granites on one hand and S type with Ilmenite Series on the other. Consequently, it is highly likely that the magnetic granites correspond basically to the I and/or A types, while the weakly magnetic granites correspond to the S types and the susceptibility can therefore be used as an indicator of granite tectonic setting. However, as the occurrence of magnetite or ilmenite is primarily controlled by the oxygen fugacity in the magma source, the correlation between the above granite types and granite series need not be very close.

In addition, the magnetic mineral assemblage may reflect not only the conditions of granite generation, but also processes of its later development when disintegration or new-formation of magnetic minerals may take place. Consequently, the susceptibility must be used as tectonic setting indicator with great caution, after a thorough study of the origin of magnetic minerals. Nevertheless, as the susceptibility measurement is several orders of magnitude faster and cheaper than the investigation of oxygen and strontium isotopes used for the discrimination of the granite type in geochemistry, the susceptibility survey can be recommended despite all its disadvantages.

An overview of magnetic susceptibility of granites of the Bohemian Massif is presented and the results are discussed from point of view of the known geochemical data of the tectonic setting.

CELEBRATION 2000: P-Wave Velocity Models of the Bohemian Massif

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Deep structure of the Bohemian Massif (BM), the largest stable outcrop of Variscan rocks in Central Europe, was studied along two refraction profiles: CEL09 that traverses the whole massif in the NW–SE direction, and CEL10 that extends along its eastern edge almost perpendicular to CEL09. Good-quality recordings with clear first arrivals of crustal and upper-mantle phases show apparent velocity 5.9 km/s for the upper crust with slightly higher gradient in the NW part of the BM and app. velocity 8.0 to 8.1 km/s for the upper mantle. Decrease of amplitudes of crustal phases visible in some sections may be connected with a specific upper crustal structure (zero to negative velocity gradient zone). Pronounced Moho reflections in the central part of the BM suggest well-defined Moho in that part and not so clear Moho with a smaller velocity contrast in other parts of the BM.

For interpretation, the tomographic inversion routine of Hole (1992) was used as an efficient tool to determine seismic P-wave velocity distribution in the crust using first arrivals. Tomographic models were verified by forward ray tracing modelling based on well-established algorithm developed by Červený and Pšenčík (1983), where further phases were also included besides the first arrivals. 2-D velocity models of first arrivals and reflected phases show high P-wave velocity-gradient zone reaching the depth of 5-7 km followed by low-gradient and laterally homogeneous P-wave velocity distribution in the middle crust. Differences in velocity distribution in the lower crust delimit the central part of the BM (sharp Moho discontinuity) from other tectonic units within the BM (lower crust high-gradient transition zone). Position of Moho discontinuity ranging from 32 km to 40 km and reflectors within the crust complement the P-wave velocity distribution. The presented models also show the contact of the BM with its neighbouring units: the Carpathians, Paleozoic Platform, Vienna Basin and the Alps.

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Confirmed Transtensional Slip in the Area of the Svratka Anticline

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This study is focused on the contact zone of three tectonic units: the Svratka Unit in the centre, the Polička Unit in the north and east, and the Hlinsko Zone in the west. This area had not been mapped in detail until a new mapping was carried out by a student of the Masaryk University in Brno in 2001. Interpretation of the structural data acquired during this mapping is presented in this paper.

The foliations form a brachyanticlinal structure, the eastern limb of which is formed by an old foliation dipping approximately 45° NE. In the western limb, the foliation is re-orien-