Geochemical characterization of granitoids of the Seckau Complex (Eastern Alps)

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Recent studies revealed that the granitoids of the Seckau Complex are part of both a late Cambrian to Early Ordovician, and Late Devonian to early Carboniferous (early Variscan) intrusive complex (Mandl et al., 2018). While the older intrusives comprise primarily S-type granitoids, the early Variscan granitoids evolved from I-type to S-type. This study provides new geochemical data on main-, trace and RE elements in order to reveal the evolution of Variscan magmatism, magmatic differentiation, and the influence of pre-Variscan continental crust on Variscan magmatism within the Seckau Complex.

Recent studies revealed a more distinct subdivision of the Seckau Complex based on petrological, geochemical and geochronological criteria (Mandl et. al., 2018). The Glaneck Metamorphic Suite comprises predominantly paragneisses with U-Pb zircon ages in the range between 572 ± 7 Ma and 559 ± 11 Ma and represents the oldest dated rocks within the Seckau Complex. Highly fractionated S-type granites of the Hochreichart Suite indicate a magmatic event between 572 ± 7 Ma and 559 ± 11 that may also have caused migmatisation of distinct domains of the paragneisses. The Hintertal Plutonic Suite displays a second intrusion event ranging from 365 ± 11 Ma to 343 ± 7 Ma and comprises I-type granitoids (Pletzen Pluton) as well as S-type granitoids (Griessstein Pluton). Granitoids of the Pletzen Pluton are characterized by variable SiO_2 contents and a magmatic fractionation trend seen in variable Rb/Sr ratios. Granitoids of the Griessstein Pluton indicate high SiO_2 values and are defined by the dominance of muscovite in contrast to biotite (Mandl et al., 2018).

On the (Y + Nb) vs. Rb tectonic discrimination diagram for granites the metagranitoids of the Hochreichart Plutonic Suite and the Hintertal Plutonic Suite plot both predominantly in the volcanic-arc granites field (VAG), reflecting geochemical signatures of an active continental margin (subduction-related setting). Only few samples are marginally located in the syn-collisional granites field (syn-COLG) and into the within-plate granite field (WPG), respectively. Most likely, these samples also reflect a VAG setting as the same tectonic setting can be assumed for all metagranitoids of the Seckau Complex.

Based on field evidence where the Griessstein Plutone is found between the Late Cambrian/ Early Ordovician Hochreichart Suite and the Late Devonian/ early Carboniferous Pletzen Pluton, a possible assimilation of Hochreichart granitic rocks into the marginal portions of the Pletzen intrusives was tested. By using average major and trace element compositions of Hochreichart and Pletzen plutonic rocks it was not possible to obtain the measured composition of the Griessstein Pluton. The same result was obtained when considering the hosting paragneisses as contaminant for the Pletzen intrusives. Therefore, we conclude that the Griessstein Pluton is considered to be the result of a fractionation process from the Pletzen Pluton where small amounts of wall rock were assimilated or a small portion of a SiO_2-rich melt was incorporated.

References:

Mandl, M., Kurz, W., Hauzenberger, C., Fritz, H., Klötzli, U., Schuster, R.: Pre-Alpine evolution of the Seckau Complex (Austroalpine basement/Eastern Alps): Constraints from in-situ LA-ICP-MS U-Pb single bond zircon geochronology, Lithos 296-299, 412-430. DOI: https://doi.org/10.1016/j.lithos.2017.11.022, 2018.