Age of magmatism in the Ivrea Zone, NW Italy: a zircon study to test the emplacement model

PERESSINI G.[1, 2], POLLER U.[1], TODT W.[1], QUICK J.E.[3], SINIGOI S.[2], SBISA' A.[2]

[1] Max Planck Institut für Chemie, Abt. Geochemie, Mainz, Germany (peressin@mpch-mainz.mpg.de)
[2] DST, Universita' di Trieste, Italy
[3] U.S. Geological Survey, Reston (VA)

The Ivrea Zone (IZ) is a well known example of under/in-traplating in continental crust, with mafic magmas of mantle origin intruding metasedimentary rocks of the Kinzigite Formation. In the Southern IZ, where the exposed section reaches maximum thickness, it is bounded by the Insubric Line to the NW and by the CMB Line to the SE. The intraplated intrusions are represented by the Mafic Complex, composed of different units, the deeper amphibole gabbro, the Parag-neiss Bearing Belt, the Main Gabbro and the diorites. A sys-tematic sampling within the Complex has been made to deter-mine the magmatic age of each unit, on the basis of a zircon study. The techniques used are morphological study, CL imaging, ID-TIMS analyses and SHRIMP determinations.

Ages reported in literature for the Mafic Complex range in the interval 260-300 Ma and the timing of emplacement is not well constrained. Furthermore, the age data are determi-ned with different isotopic systems, on different rock types, and therefore their interpretation is difficult.

The emplacement model proposed for the Mafic Complex, the so-called gabbro-glacier (Quick, 1994) envisions mafic cumulates transported down and outward from a small magma chamber repeatedly filled by mantle magmas. Due to the great depth of the intrusion (Demarchi, 1998), thermal insulation of the crust implies a slow cooling rate for the complex. A systematic geochronological study might verify this hypothesis and give the time span for the emplacement.

Heat introduced by the mafic magma did not cause the granulite-facies metamorphism nor significant anatexis of the country rock (Barboza, 1998). Granitic melts produced were transported to shallower crustal levels along high temperature shear zones within the Kinzigite Formation (Snoke, 1999). Detailed mapping of these granitic pods and dykes reveals their syn-tectonic nature, since they display the whole range from undeformed ipidiomorphic to strongly sheared fabrics. A microstructural, geochemical and geochronological study is needed to define the tectonic environment during the emplacement. The first single-grain Pb/Pb determinations on magmatic zircons from these granites yielded a Triassic age of 222+/-15 Ma.

Barboza S.A., Bergantz G.W.(1998), *J. Petrol. 41*, 1307-1322
Demarchi G., Quick J.E., Sinigoi S., Mayer A., (1998), *J. Geol. 106(5)*, 609-622
Quick J.E., Sinigoi S., Mayer A., (1994), *J.Geoph. Res. 99(B11)*, 21559-21573
Snoke A. W., Kalakay T.J., Quick J.E., Sinigoi S., (1999), *EPSL. 166*, 31-45

The model of pocket formation in boron-rich granitic pegmatites

I.S. PERETYAZHKO[1], V.YE. ZAGORSKY[1], S.Z. SMIRNOV[2], M.Y. MIKHAILOV[2], V.YU. PROKOFIEV[3], AND I.A. MADYUKOV[2]

[1] Vinogradov Institute of Geochemistry, Irkutsk, 664033 Russia (pgmigor@igc.irk.ru)
[2] United Institute of Geology, Geophysics, and Mineralogy, Novosibirsk, 630090 Russia
[3] Institute of Geology of Ore Deposits, Petrography, Mineralogy and Geochemistry, Moscow, 109017 Russia

Boric acid is one of the most important components of late magmatic fluids and melts of boron-rich pegmatites worldwide (Peretyazhko et al., 2000; Thomas et al., 2000).

Coexisting melt (MI) and fluid (FI) inclusions at the base of pocket quartz were studied in the Oktyabrskaya mine, Transbaikalia. At room temperature, MI's contain aggregate of fibrous crystals, water solution, gas and daughter sassolite. FI's consist of water solution, low-density CO_2 bubble, sassolite and other crystalline phases. Liquid-gas systems of FI's and MI's have rather close salinity (4-8 wt% NaCl-eq), H_3BO_3 content (12–16 wt%) and T_{hom} (256-320°C) to liquid. MI's transform into two types (glass+crystals and solution+gas+minor glass) after quenching. The liquidus-solidus interval is estimated at 615-550°C. After remelting the fluid portion of MI's homogenizes to liquid at 350°C. The quenched MI glasses are compositionally equivalent to H_2O,B,F,Cs-rich melts. Similar glasses can contain up to 21.5 wt% H_2O (Thomas et al., 2000). Available data including results of P-T-V thermodynamic modeling of boric acid solutions (Peretyazhko and Zagorsky, 2002) suggest the pocket formation model for boron-rich pegmatites.

Hyper-aqueous B,F-rich residual melts reside as liquid isolations within quartz-feldspar pegmatite matrix. They become heterogeneous through a fluid effervescence at T>615°C. The heterogeneous melt-fluid isolations served as proto-pockets. Their fluids had the lowest density as water was still partially dissolved in the melt, and the pressure was 2.3 kbar. The further decrease of temperature led to crystallization of residual melts and increase of fluid pressure in pockets up to 3-4 kbar, the solidus temperature. Rise of intra-pocket pressure induced strain and facilitated rupturing within the vein. As the residual melts in different parts of pegmatite body could differ significantly in H_2O, H_3BO_3 and other components, a pressure gradient (~n00 bar) favoured intermixing of the pocket fluids and metasomatic alteration of earliest minerals.

This work was supported by RFBR grants 01-05-64677, 01-05-64675 and UIGGM project VMTK "Boron".

References

Peretyazhko I.S., Prokofiev V.Yu., Zagorsky V.Ye, and Smirnov S.Z. (2000). Petrology. **8**. 214–237.
Thomas R., Webster J.D., and Heinrich W. (2000). Contrib. Mineral. Petrol. **139**. 394-401.
Peretyazhko I.S., and Zagorsky V.Ye. (2002). Doklady Earth Sciences. **383**.