crystallization are not considered reliable.

The ultimate product of magmatic evolution is the segregation of a water-saturated, very mobile, residual liquid in the final level of intrusion of the pluton. The consequence is the emplacement of leucogranite masses and dikes and the exsolution of a supercritical fluids phase, leading to a slight autometasomatism with recrystallization of some mineral phases (muscovite, albite, quartz, tourmaline, topaz) and the geochemical remobilization of some trace elements.

This solvus late process of fluid-solid interaction is directly linked with the formation of periplutonic wolfamite-arsenopyrite-quartz veins.

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GHOSE S.*, WEBER H.P.**, MCMULLAN R.K.*** - *A dynamical model for the $P\bar{1}$-$I\bar{1}$ phase transition in anorthite, $CaAl_2Si_2O_8$: evidence from neutron structure refinements above and below T_c*

We propose a dynamical model for the $P\bar{1}$-$I\bar{1}$ phase transition in anorthite at 514K, which is first order (nearly second order), driven by: (a) a soft mode mechanism (most likely involving a zone boundary phonon) causing the aluminosilicate framework to approach $I\bar{1}$ symmetry as $T \rightarrow T_c$, followed by (b) an order-disorder mechanism, which involves dynamical interchange of the Ca atom configurations [Ca (ooo) ↔ Ca (oio); Ca (zoo) ↔ Ca (zio)] due to breathing motion type fluctuation of the framework. The $I\bar{1}$ structure above T_c is a statistical dynamical average of the very small anti-phase c domains of $P\bar{1}$ anorthite with ordered and anti-ordered Ca atom configurations related by 1/2 $[a+b+c]$. The residual intensity of c reflection (X-ray, neutron, electron) above T_c is due to the presence of very small dynamically mobile c domains and is elastic in nature.

Strong evidence for the soft mode mechanism is found from a neutron structure refinement of pure anorthite (Val Pasmeda) at 493K ($P\bar{1}$, 9827 reflections, $R = 0.025$), where the framework atoms closey approach the $I\bar{1}$ symmetry. The calcium atoms and the surrounding oxygens show unusually high anharmonic thermal vibrations (3rd and 4th rank tensor components) confirming the breathing motion type lattice fluctuations just below T_c. A nuetron refinement at 534K ($I\bar{1}$, 3489 reflections) indicates a virtually body-centered aluminosilicate framework, where the calcium atoms related by the pseudo body-center still show considerable splitting. An averaged $I\bar{1}$ structure calculated from the $P\bar{1}$ data at 493K yieds a structure virtually identical to the $I\bar{1}$ structure at 534K. Research supported by NSF (Geochemistry) grant no. EAR 8417767 and DOE (Div. Mat. Sci.) contract no. DE-AC02-2T6CH 00016.

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GIOBBI ORIGONI E.*, BOCCHIO R.*, BORIANI A.*, CARMINE M.*, DE CAPITANI L.* - *Appinites and mafic dyke swarms of Serie dei Laghi*

The extensional regime, established in Late-Hercynian times near the «CMB» (Cossato-Mergozzo-Brissago Line, tectonic boundary between Serie dei Laghi and Ivrea-Verbano Zone), allowed the emplacement of small calcalkaline basic-to-intermediate intrusive bodies of two main types:

1) a row of stocks and dykes, very similar to the Appinites of Scotland and Ireland, occurring along the CMB mostly on the Serie dei Laghi side. Pseudo-brecciated dykes are present in the Brissago and M. Cerano areas; the Appinites of Val d'Ossola consist of stocks of medium-grained hornblende bearing gabbrodiorite with acidic differentiates, whilst in Valsesia they show more anhydrous parageneses and contain restitic minerals. The heat carried by their intrusion induced a partial melting of the gneissic country rocks of Serie dei Laghi between Val d'Ossola and Valsesia, which implies a rather deep seated environment;

2) Several dyke swarms intruded before, during and after the emplacement of the granite batholith of Serie dei Laghi. The dykes are dark coloured and very fine grained (they were therefore described in literature as «lamprophyres»), rarely composite dykes are present. In some cases the dykes show chilled margins or evidence of partial melting of the adjacent rock indicating a very high intrusion temperature.

On the basic of structural evidence, it is possible to distinguish a subgroup of vertical N-S dykes connected with the N-S fault system of Valle Intrasca, probably emplaced at the same time as the Appinites, in the compressional regime that produced the Pogallo Line.

Another subgroup of dykes with more dispersed orientation, but with dominating NE-SW direction, is intruded in the schists NW of the Montorfano pluton (Valle San Bernardino), in structural continuity with the granitic batholith of the Serie dei Laghi. Their intrusion occurred in an extensional regime as suggested by the coincidence of the attitude of the dykes with the planar discontinuities of the schists. These dykes could represent the penetration of mafic magma through fissures into the roof of the ascending batholith; this is suggested also by the presence of a deep hydrothermal alteration, which witnesses a conspicuous fluids circulation above the granite bodies.

The general chemical features reveal that both «Appinites» and mafic dykes are typical of orogenic magmatic series, as shown by the calcalkaline trend of the AFM diagram. MgO, Al_2O_3, Cr and Ni, plotted vs D.I, suggest a probable origin from a single parental magma, the less differentiated products being the NS dykes.

The excess of Na, K, Rb and H_2O in most of the mafic dykes is probably due to hydrothermal processes.

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HANSON A.* - *New data on the bertossaite-palermoite series from the granitic pegmatites of the Gatumba field, Rwanda*

The Li-rich pegmatites of the Gatumba field are known for the complexity of their aluminium phosphates associations. During the study of a large number of specimens from the Buranga pegmetite, the wide range of chemical composition for bertossaite samples has prompted us to carry on a detailled investigation.

Bertossaite, $Li_2CaAl_4(PO_4)_4(OH)_4$, is characterized by high Ca = Sr, OH = F and restricted Li = Na substitutions. The unit cell parameters were refined for ten samples and plotted against the Ca/(Ca + Sr) ratios showing a relatively confident relationships. The poor correlations of the optical properties and densities versus fluorine or calcium contents may betray inhomogeneous materials but could also originate from the number of possibile substitutions, and the abundance of fluid inclusions in the minerals. A selected number of analysed samples were also investigated by infrared spectroscopy. As in the case of the amblygonite-montebrasite series (FRANSOLET and TARTE, 1977), the intensites of the high frequency bands (—3598 cm^{-1}) assigned ot free (OH) groups vary as a function of increasing fluorine contents.

These new mineralogical properties compared with those of the literature confirm that there is an isomorphous series between palermoite $Li_2SrAl_4(PO_4)_4(OH)_4$ and bertossaite. It must be stressed that the calcium-rich members of the series are typical of the Buranga pegmatite whereas palermoite is found in the pegmatite, New Hampshire. This could be explained by a very low strontium content in the Buranga pegmatite as we can deduce it from the lack of Sr-rich minerals also from the occurrence of the Sr-poorest amblygonite in this lithium-bearing pegmatite (RILEY, 1970).

In a few sample amblygonite-montebrasite occurs with of bertossaite and corroded remnants of this mineral are found in bertossaite (VON KNORRING, 1969). Therefore this rare species has also a petrological significance and it suggest the following bulk reaction:

$4(LiAlPO_4(OH)) + 1Ca \rightarrow Li_2CaAl_4(PO_4)_4(OH)_4 + 2Li$

This assumption is in good agreement with parts of the evolution of the ironmanganese phosphate associations of the Tsabismund pegmatite: increasinf of the Ca actives and decreasing of the Li contents of the morther phases (FRANSOLET et al., 1986).

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HUBBARD F.H.* - *Basic intrusions and associated charnockite-rapakivi granite crustal depletion, S.W. Sweden*

The emplacement and fractionation of the Proterozoic charnockite-rapakavi granite plutonic complex of Varberg, S.W. Sweden, is bracketed in time by the intrusion of basic magmas. All the mafic rocks have metamorphic mineral assemblages. Those which precede the granites are garnet-amphibolites while those which postdate the granites are garnet-pyribolites in the charnockites and granulite facies country rocks, and garnet-amphibolites, in the granite and amphibolite facies country rock zones.

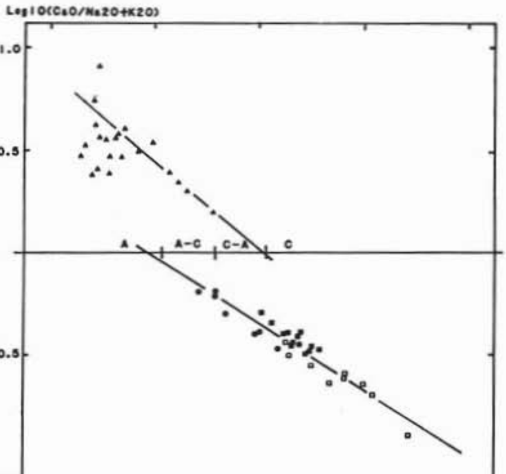

Fig. 1. — Alkali-lime diagram for the basic and acid intrusives. Filled triangles - younger basic, open triangles - older basic, filled circles and squares - charnockite, open squares - rapakivoid granite.

Geochemical parameters suggest that the granitoids are not assimilation-fractional crystallisation (AFC) derivatives from the parent magmas of either of the basic suites (Fig. 1) but rather represent mobilised country rock granite gneisses with accumulation-fractionation of the melt fraction during flow (Fig. 2). *In situ*