X.A.S. STUDY OF TWO INCOMPATIBLE ELEMENTS (Zr,Th) IN SILICATE GLASSES.

FRANCOIS FARGES and GEORGES CALAS.
Lab. Minéralogie-Cristallographie / UA CNRS 09
Universités Paris 6 et 7, 75252 PARIS Cedex 05

Zirconium- and thorium-containing glasses have been quenched from melts with the following compositions: $CaMgSiO_4$, $CaMgSi_2O_6$, $CaAl_2Si_2O_8$, $NaAlSi_3O_8$, olivine basalt, tholeiitic basalt, dacite and calc-alcaline rhyolite. The Zr and Th content varies from 0.45 to 2.9 wt%. EXAFS spectra of these glasses have been recorded either at Zr- K edge or Th-L_{III} edge using synchrotron radiation. These spectra show two contributions: the major contribution is due to O ligands and a minor but significant contribution arises from Si- and/or Zr- atoms.

The immediate surrounding around Zr atoms is a mixing between a major 6-fold coordinated polyhedron (Zr-O=2.07Å, like in alkali-zirconosilicates) and a minor 8-fold coordinated polyhedron (Zr-O =2.18-2.30Å, similar to those observed in zircon). The second contribution to EXAFS originates from both Zr-Si and Zr-Zr interactions and increases with silica content. The former corresponds to the Zr-Si distances observed in alkali zirconosilicates and seems to indicate corner-sharing, cation-bearing polyhedra. On the contrary, the Zr-Zr distance is rather similar to that found in zircon (3.64Å).

Thorium is 6-fold coordinated with a strong radial distribution (Th-O=2.32-2.55Å), clearly distinct from the local order found in thorium silicates. As in Zr-bearing glasses, large Th-Si distances are found as in corner-sharing, cation-bearing polyhedra. No other significant contributions are detected.

Zr and Th local order in glasses is sensitive to the structural modifications of the quenched melts especially for very silicic compositions. Correlations between these results and the geochemical behavior of these elements in magmatic suites will be discussed.

GEOCHEMISTRY OF THE FUSHAN TROUGH FLOOD BASALTS, HAINAN ISLAND, SOUTH CHINA.

M.F.J. FLOWER, M. ZHANG, K. TU, C.-Y. CHEN and G. XIE
(Dept. Geol. Sci., Univ. of Illinois, Chicago, IL 60680, U.S.A.)

Recent flood basalts on Hainan Island, South China, are part of a widespread magmatic episode that followed the cessation of seafloor spreading in the South China Basin (SCB). Post-spreading magmatism distinguishes the SCB from passive margins of Atlantic type where spreading was *preceded* by massive igneous activity. The Hainan basalts comprise a 700-1000m-thick sequence and occupy the Fushan Trough at the southern edge of an oil-rich pull-apart basin. The pile consists of quartz tholeiite (QT), olivine tholeiite (OT), alkaline olivine basalt (AOB), and basanite (BAS), whose chemistry closely matches pull-apart tectonic fabric elements. Tholeiites emanate from east-west extensional fissures while undersaturated magmas erupt from *en echelon* centres along "containing" strike-slip faults.

At least eight eruptive episodes were recognized, four (recorded by drilling) of Tertiary and four of Quaternary age. The lava pile shows general upward increases in magmaphile element content and SiO_2-undersaturation. Tertiary episodes (I-IV) are mostly QT and OT and resemble MORB in terms of major elements and phase equilibria, but not K (0.5-0.75 wt%) and other magmaphile elements. QT gives way upwards to OT and AOB in Quaternary episodes V and VI. Episodes VII and VIII are mostly AOB and BAS but show interlayering of tholeiite and undersaturated lavas, and K-rich and K-poor variants of both. Hainan potassic lavas resemble those of SCB seamounts and K-rich islands elsewhere. Some contain spinel lherzolite xenoliths and abundant CPX, OPX, corundum (sapphire), and zircon megacrysts.

Major and trace element data for whole-rock and mineral samples are used to constrain melting and fractionation models, and evaluate the genesis of megacrysts. Magmaphile element contents are considered with preliminary data for Sr, Nd, and Pb isotopes in models involving mixing of MORB and OIB sources and a third ^{207}Pb-rich component. ϵNd values are relatively uniform (+4.5-5.6) and characteristic of subcontinental mantle. Δ7/4Pb values range -0.5 - +10.3, and Δ8/4Pb, 50.5 - 90.9.

THE RECORD OF MAGMATIC PROCESSES BY CRYSTALLIZATION

C. JAUPART and G. BRANDEIS
Laboratoire de Dynamique des Systèmes Géologiques - Université Paris VII - 2 place Jussieu - 75251 Paris cédex 05

Magma chambers are the site of a host of complex phenomena such as compositional convection due to fractional crystallization and reinjection for deeper sources. The results of these are seen in plutonic complexes which exhibit different kinds of igneous structures and chemical zonation. Deciphering the igneous record requires an understanding of how crystallization proceeds and on which time-scale. In turn, this information yields constraints on what kind of processes can be recorded in an igneous rock and on which scale. The critical and most poorly known process is the nucleation of new crystals out of the melt. We review recent advances which allow constraints on the nucleation and growth rates of crystals in natural conditions. From those, the crystallization time-scale can be estimated to a reasonable degree of accuracy. Typical values range from 10^8 to 10^9 s which are significant compared to the characteristic time of many volcanic and magnetic phenomena.

Chem. Geol., 70, 87, 1988

HYGROMAGMAPHILE ELEMENTS DISTRIBUTION IN BASALTIC AND ANDESITIC MAGMAS AS FINGERPRINTS OF MANTLE MINERALOGICAL AND CHEMICAL INTERACTIONS IN RELATION WITH LITHOSPHERIC PLATES SUBDUCTION.

J.L. JORON AND M. TREUIL.
(Groupe des Sciences de la Terre LPS-CNRS-CEA
CEN Saclay 91191 Gif sur Yvette)

Using Highly Hygromagmaphile elements (H.HYG) properties and distributions in weakly differentiated basaltic and andesitic samples, we point out geochemical fingerprints of mineralogical fractionation and chemical mixing occuring in mantle related to subduction of lithospheric plates and accounting for crustal material recycling.

We have extended here our geochemical method applied to oceanic basalts and which give us the reference of sub-oceanic mantle chemical zonation (Joron and Treuil, 1988).*

The geochemical trends obtained for volcanic suits belonging to different structural and typical tectonic settings of converging plate boundaries, rule out a pure mass to mass mixing of mantle and crustal materials. In the contrary they are consistant, in some cases, with simple fractionation effect during melting due to mineralogical effect of mantle metamorphism under high fluid pressure, in other cases, with metasomatism involving percolation of H.HYG strongly enriched melts generated by mantle-crustal interactions accompanying lithospheric plate subduction. This metasomatism process involve mixing between H.HYG strongly enriched melt and different depleted or plus or less enriched ordinary mantle components. In the different domains, the main differences between the related volcanic suits are due to the geochemical characters of the mantle components affected by metasomatism.

*Magmatism in the Ocean Bassins. Special publication of the Geological Society of London (in press).