C20

PREDICTION OF THE CHEMICAL EVOLUTION OF MANTLE MAGMAS AT HIGH PRESSURES

A.B. THOMPSON
Institut für Kristallographie und Petrographie, ETH-Zentrum, CH-8092 Zürich, Switzerland

The experimentally determined compositions of solidus liquids along the basaltic (lherzolitic) solidus to 20 kbar in $CaO-MgO-Al_2O_3-SiO_2$ (CMAS) presented by Presnall et al. (1978, Con. Min. Pet. 66, 203), may be used to constrain the buffered values of aAl_2O_3 and $aSiO_2$ in these melts using the approach of Nicholls and Carmichael (1972, Am. Min. 57, 941). The results obtained for plagioclase- and spinel-lherzolite solidus may be extrapolated to pressures relevant (~ 40 kbar) to solidus melting of garnet-lherzolite in CMAS. Attempts have been made to use the Flory-Huggins formalism for silicate liquids (Bottinga and Richet, 1978, E.P. S.L. 40, 382) to incorporate Na_2O, FeO, Cr_2O_3, H_2O, CO_2, and K_2O into the appropriate mineral phases and the solidus liquids. The predicted melt evolution may be checked against carefully selected melting experiments at high P relevant to mafic, ultramafic, ultrapotassic or kimberlite magma generation. Furthermore, these results may be used to constrain some of the physical properties relevant to magma segregation, accumulation, and ascent.

C21

LAYERED MANTLE GENERATED THROUGH CONVECTIVE PROCESSES. A MODEL WHICH CAN EXPLAIN THE MANTLE HETEROGENEITIES.

M. LOUBET
Laboratoire de Géochimie, I.P.G. 4, Place Jussieu, 75230 PARIS CEDEX 05

The models which attempt to explain the upper mantle nature and evolution are constrained
1) by the high homogeneity of the common CaO-rich lherzolites derived from the mantle
2) by the noticable heterogeneities which must exist as indicated by the OIB characteristics and the nodule diversity.

The orogenic lherzolite-type bodies (upper mantle samples) display a pyroxenite layering, the composition of which indicates that it should result from a rather complex history of the upper mantle with successive partial melting events and crystallization of the melts produced (1).

An evolution model for the upper mantle has been developped explaining the generation of such a layering through the effect of convection processes (generation of melts, crystallization etc.)

It is emphasized that the mantle heterogeneities inferred from the OIB can be explained by the existence of such a layering. In this model, the OIB would result from partial melting of these pyroxenite layers. Geochemical data for MORB and OIB as well as the nodule characteristics tend to support such a model. The kimberlite genesis is discussed, on the basis of this model.

(1) LOUBET M. and ALLEGRE C.J. (1982) submitted to Nature.

C22

KIMBERLITE-CARBONATITE: EVOLUTIONARY LINKS?

R.M. MACINTYRE
Scottish Universities Research and Reactor Centre, East Kilbride G75 0QU.

The meteoritic impact hypothesis, recently revived to explain the demise of the dinosaurs et al., has received considerable attention and publicity. In this, extra-terrestrial intervention culminates in a global climatic warming causing extinction. To many this explanation is unsatisfactory, not least because of the conspicuous lack of preservation of an appropriate crater. Nonetheless the iridium anomaly at the Cretaceous-Tertiary boundary appears well-documented and seems to require explanation by any alternative hypothesis.

Radiometric dating of rocks of the carbonatite-kimberlite clan has indicated that certain times were particularly favourable for their emplacement. A coincidence between these and several Phanerozoic period boundaries is also evident. It therefore seems plausible that an enhanced input of CO_2 to the atmosphere at these times caused global warming and resulted in extinctions. Perhaps these intrusions have, in addition, exhumed from depth and superficially dispersed the platinum group metals, thus accounting for the iridium anomaly observed stratigraphically.

The above proposal may readily be tested by additional accurate age determinations on kimberlites and carbonatites to better define their distribution in time and by radiochemical activation analysis for Group VIII metals, if suitable samples are obtainable. The information presently available and pertaining to this intriguing problem will be discussed and assessed.