AL-AUGIT AND CR-DIOPSIDE ULTRAMAFIC NODULES IN EUROPEAN ALKALI BASLATS.

E. Jagoutz, V. Lorenz* and H. Wänke
(Max-Planck-Institut für Chemie, Abteilung Kosmochemie, 65 Mainz, FRG)
(*Institut für Geowissenschaften der J.-Gutenberg-Universität, 65 Mainz,FRG)

Ultramafic nodules from West-Eifel/Germany, Massif Central/France and Kapfenstein/Austria were analyzed by micro-probe, X-ray fluorescence and instrumental neutron activation analysis.

To improve the relative accuracy of the micro-probe measurements we placed clinopyroxenes from different nodules and different locations in the same sample preparation.

The nodules of the pyroclastic deposit from the Dreiser Weiher Maar (West-Eifel/Germany) are in most cases unaltered. Two main classes of ultramafic nodules are found: wherlitic nodules (clinopyroxene, olivine and minor phases) and the more abundant lherzolitic nodules (clinopyroxene, orthopyroxene, olivine and spinell). The textures of the wherlitic nodules are granoplastic and of the Cr-diopside bearing lherzolitic nodules are metamorphic. In both cases the modal composition varies over a wide range. From the analyses of the bulk samples and of mineral separates it is shown that the major part of the REE resides in the clinopyroxene. The REE abundance pattern of the spinell shows a remarkable enrichment in light REE.

The temperature of equilibration is plotted in Fig. 1. Lherzolites from Massif Central are equilibrated at lower temperatures than the lherzolites from the Dreiser Weiher.

The clinopyroxenes from wherlitic nodules (from Dreiser Weiher) contain significantly more Fe than the clinopyroxenes from the lherzolites. The evolution of the wherlitic clinopyroxenes along the dashed lines resembles the evolution of the magma. This assumption is also supported by the trace element concentration.

Beside this trend the REE content of the Al-augit from wherlitic nodules is nearly constant (Fig. 2). The clinopyroxene concentrations of these nodules vary from 10 % to 90 %.

Nodules in which wherlite and lherzolite are in contact with each other were analyzed also. The Al-augit of the wherlitic portion has a wherlitic REE abundance. In the lherzolitic portion of these samples the lanthanum is enriched by a factor of 2.

From these investigations we favour a cumulate origin of the wherlitic nodules. All these cumulates are derived from the same magma. The evolution of this magma is demonstrated.

The lherzolitic nodules show a considerable variation in the REE content of their clinopyroxene within one location (Fig. 3).

From the Al-content of the co-existing orthopyroxene and the temperature the pressure is calculated (McGregor, 1974). From the REE content and the

P-T conditions the lherzolitic nodules can be divided in different groups.

In one group the pressure varies from 20 - 30 kb at nearly constant temperature (1100°C). Samples with less than 20 kb show a variation in temperature from 800° to 1100°C.

The first type seems to be derived from near the magma chamber with nearly constant temperature along its depth. The second type could be interpreted as the overlying country rock which was fragmented by the ascending magma.

The REE pattern of the clinopyroxene in these samples can be explained by partial melting and later contamination with strongly fractionated liquids (Frey and Green, 1974).

Comparing the clinopyroxenes from the lherzolitic nodules of different locations it can be shown that the major element chemistry is very similar. The sample with the highest Tschermak's component from the Dreiser Weiher/ Eifel is not contaminated in light REE and is very similar to clinopyroxenes from the Massif Central/France and Kapfenstein/Austria (Fig. 4).

References:

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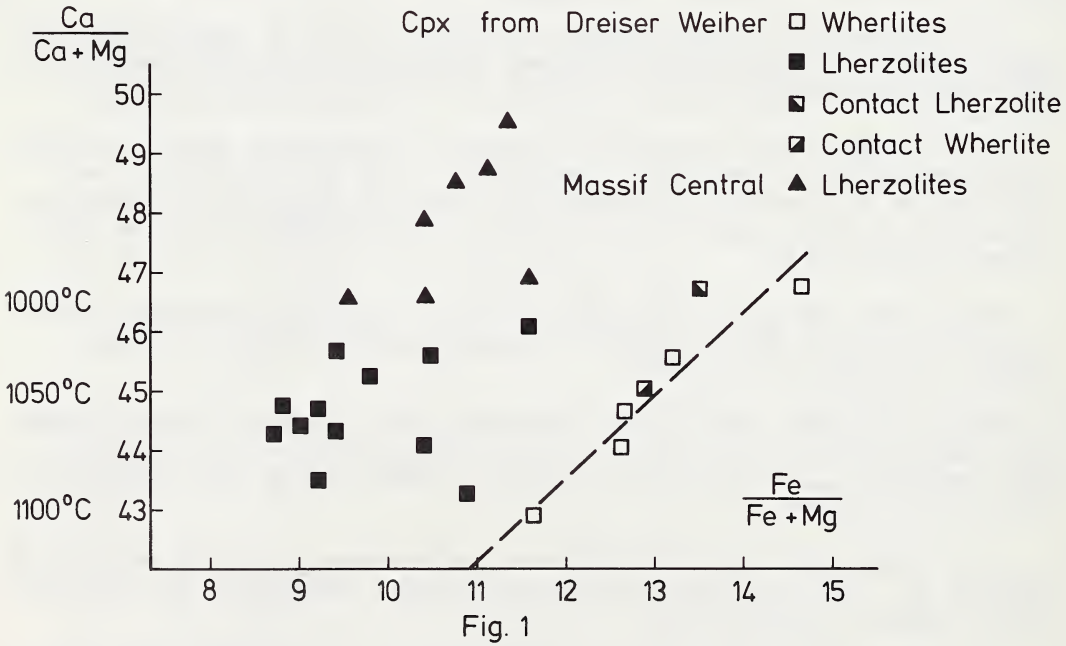

Fig. 1

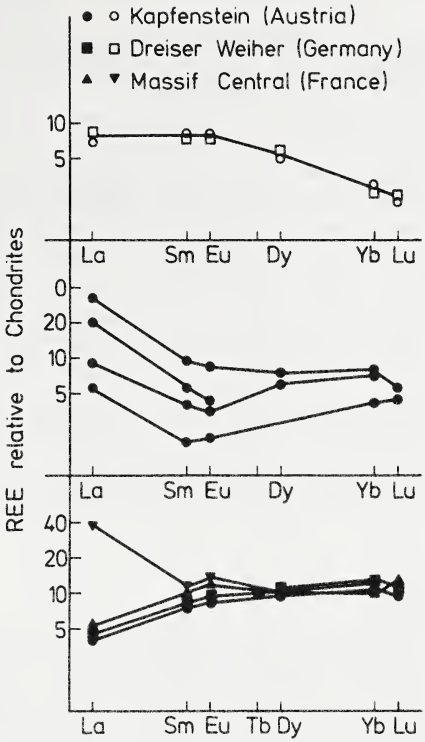

Fig. 2

Fig. 3

Fig. 4