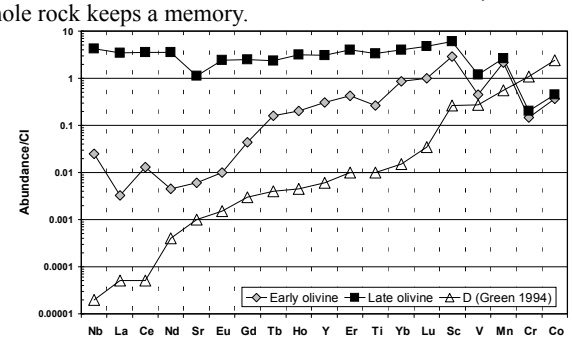
LARGE PLATES OF ANORTHITE-OLIVINE INTERGROWTHS IN THE D'ORBIGNY ANGRITE. G. Kurat[1], M. E. Varela[2], E. Zinner[3] and F. Brandstätter[1], [1]Naturhistorisches Museum, Postfach 417, A-1014, Vienna, Austria, [2]CONICET-UNS, Dpto. Geologia, San Juan 670, 8000, B. Blanca, Argentina, [3]Laboratory for Space Sciences and the Physics Department, Washington University, St. Louis, MO 63130, USA.

Introduction: The shape, structure and texture of D'Orbigny and its mineral and bulk chemical compositions indicate an unusual genesis under changing redox conditions [1-3]. Empty shells, large plates, very high porosity, druses with augite and abundant glasses are outstanding peculiarities of this rock. Here we report on a study of a huge plate consisting of anorthite-olivine intergrowths.

Results and Discussion: The anorthite-olivine plate, 12 mm long and 200-800 μm thick, crosscuts the dense lithology of the investigated sample D'Orbigny G (PTS, NHM, Vienna). The center of the plate consists of large anorthite grains that are intimately intergrown with mostly anhedral olivines (up to 100 μm), commonly in a graphic way, and rare euhedral Al-Mg-Fe spinel. At the surface of the plate, subhedral to euhedral anorthite and anhedral olivine crystals (both > 300 μm in size) form abundant off-springs of short branches that, in some places, resemble a fish-bone structure. The interstitial space outside the plate contains large augite-hedenbergite and olivine-kirschsteinite with sulfides and ulvöspinel.

Anorthite is chemically pure, olivine in the plates is mostly ~$Fa_{35}La_1$ – rarely metasomatized to $Fa_{80}La_{19}$ as is common outside the plate – and spinel is Cr_2O_3-poor (7.5 wt%) but rich in FeO (22 wt%). Trace element (TE) contents of all phases are high and variable. In particular, olivines have highly variable TE contents (Fig.) with olivines inside the plate being much poorer in TEs than those outside the plate [4]. The trapped olivines indicate an origin from a system that was enriched to about 10 x CI in Sc, Sr, Nd and Eu, about 20-50 x CI in the HREE and > 100 x CI in La, Ce and Nb (partition coefficients from [5]). The latter two groups of elements are far out of equilibrium between olivine and angrite bulk. The first group seems to be in equilibrium as are the elements V, Mn, Cr and Co. TEs have high (2-3 x CI) abundances in late olivines, except Sr, and are far out of equilibrium with the bulk rock, except for V, Mn, Cr and Co. This situation leaves us with the following scenario: anorthite-olivine intergrowths precipitated from a fluid, covered spheres of an unknown, now vanished mineral, and formed large freely floating plates. A change in redox conditions caused the phase constituting the spheres to decompose, ultimately leaving hollow shells. This process liberated large amounts of TEs and Ca and consequently, late olivines and augites, kirschsteinite and hedenbergite grew from an environment very rich in TEs and Ca. Therefore, it is likely that CaS, a major host phase of TEs under reducing conditions [6], was constituting the spheres. The unfractionated pattern, similar to that of some olivines of carbonaceous chondrites [7-9], suggests a reservoir with chondritic relative TE abundances, of which the whole rock keeps a memory.



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