SECONDARY ALTERATION FEATURES IN EUCRITES

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Eucrites, the most abundant basaltic achondrites, are basaltic or cumulate gabbroic rocks. Their parent body, with howardites and diogenites, is the asteroid Vesta-4 based on data collected during the Dawn mission [1]. The data have shown that the surface of the asteroid is mostly covered with impact craters and regolith, which is consistent with the brecciated nature of eucrites and howardites. Thermal history of the asteroid and its impact history has been recorded in the mineralogy and the chemical compositions of eucrites. Such processes are indicated by exsolution and equilibration of pyroxenes, clouding of plagioclase and pyroxene in metamorphosed eucrites, with occurrence of shock veins, faulting and deformation of exsolution lamellae in pyroxene.

Processes that occurred after the crystallization of primary magma are not limited to thermal metamorphism and brecciation. In many studies of eucrites, evidence of metasomatism is given. Eucrites with such secondary alteration features have Fe-enriched pyroxenes, olivine veinlets and pure Fe-grains [2] [3] [4] [5] *or[2-5]*. This was initially observed in some polymict breccia clasts that display Fe-enrichment of pyroxene and olivine with fayalitic composition along cracks that cross large pyroxenes [2] [3]. Barrat et al. [4] suggested 3 stage metasomatic alteration in eucrites : - Fe enrichment along cracks in pyroxenes, - growth of fayalitic olivine with minor troilite and Ca-rich plagioclase veinlets, - Al depletion accompagnied with Fe enrichment of pyroxenes. Pure Fe grains were noted in NWA 5738, an evolved eucrite that contains also fayalitic olivine veinlets, anorthositic plagioclase micro-veins and silica-anorthite rosettes. The pure Fe grains were formed by in situ reduction of pyroxenes, and are likely produced by fluid deposition that occurred after the growth of fayalitic olivine veinlets, because no spatial relationship was witnessed [5].

Despite the increasing number of eucrites that contain secondary alteration products, their origin is still not well known and understood. The metasomatic effects have been said to be the result of short duration re-heating and melting caused by shocks [3]. Other authors proposed that the responsible agent for the occurrence of Fe-enrichment in pyroxenes, olivine veinlets and Ca-rich plagioclase micro-veins filling the cracks is an aqueous fluid [4]. The fluid source was probably an impactor such as carbonaceous chondrite, which is consistent with the presence of dark material on the surface of Vesta and xenolithic clasts of carbonaceous chondrite in howardites [1] [5].

Our work focuses on the occurrence of secondary alteration processes in some new brecciated eucrites. An investigation of the mineralogical and chemical composition of clasts and large pyroxene grains was carried out and we did find olivine veinlets, secondary Ca-rich plagioclase micro-veins with minor troilite, Cr-spinel and apatite. Some of those breccias contains also secondary pure Fe metal with low Ni. The olivine in those veins is mostly fayalitic ranging from Fa_{70} to Fa_{81} when approaching the pure Fe grains. The Ca-rich plagioclase is typically An_{95}. Apatites are 2-10µm, occurring inside or near the Fe grains. Our observations will contribute to a better understanding of the origin of these features in eucrite and to unraveling the mechanisms at play, thus furthering our knowledge of the complex evolution of the HED parent body.

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