LIQUID IMMISCIBILITY PROCESS OF THE EXPERIMENTAL MELTED ORDINARY CHONDRITE TSAREV (L5); N.G.Zinovieva, O.B.Mitreikina and L.B.Granovsky, Department of Petrology, Faculty of Geology, Moscow State University, Lenin Gory, Moscow, 119899, Russia.

The goal of this research was the detailed petrological study on the sample (2x2x4 cm) of the partially melted (by microwave-heating, run at vacuum, $T=1400 \pm 100^oC$, t=20 min. [7]) ordinary chondrite Tsarev (L5) for understanding the specific character of the sulphide-metal-silicate melt differentiation. This research showed that there was the liquid immiscibility of silicate and sulphide-metallic melts, with the later separation of the silicate melt into two coexisting silicate melts and the sulphide-metallic melt into sulphide and metallic melts.

The outer part of the sample has a original chondrite structure, while the inner part has a taxite structure. It's necessary to note that shapes and sizes of Fe-Ni metal and troilite are quite different in the both structures.

Troilite and Fe-Ni metal grains of the outer not melted part (chondrite structure) of the sample have the irregular, interstitial, xenomorphic shape depended on the boundaries of the chondrules or depended on the silicate crystals inside the chondrules. Sometimes these grains form small (up to first μm) drop-like separations inside the olivine crystals.

Troilite and Fe-Ni metal of the inner melted part (taxite structure) of the sample form only drop-like (from some μm to some mm-size) separations. On fig. 1 we see the separation of the sulphide-metallic drop into troilite and Fe-Ni metal parts. Such things can be formed as a result of the crystallization of the immiscible sulphide and metallic melts.

The inner taxite part of the sample consists of areas of porphyritic (APT) and intersertal (AIT, sometimes with areas of barred texture) textures. The boundary between APT and AIT is sharp and they are different in both the texture and their chemical composition. It's necessary to note that these areas (APT and AIT) form as layer-like as drop-like (Fig. 2) separations one in another. Comparing electron microprobe analyses of bulk compositions of APT and AIT we see that these compositions are different in contents of almost all petrogenic elements (APT[AIT]: SiO_2 - 45.0 [47.3]; Al_2O_3 - 2.4 [3.3]; Cr_2O_3 - 0.6 [0.7]; FeO - 17.3 [18.8]; MnO - 0.3 [0.4]; MgO - 31.2 [24.9]; CaO - 2.0 [2.57]; Na_2O - 0.2 [0.8]; P_2O_5 - 0 [0.4]; S - 0.5 [0.7]) and we can make a conclusion that there were two coexisting silicate melts MP and MI forming during crystallization APT and AIT accordingly. MI is rich in Si, Al, Fe, Ca and alkalis and poor in Mg in comparison with MP. In spite of MI is rich in Si and Al, the ratio Si/Al of MP is higher than MI. We showed [4] that this ratio is important for understanding of the different texture formation.

It's known [6] that even a little (up to 1.0 weight % of P_2O_5) amount of P is favorable for the liquid immiscibility and the decreasing temperature of the crystallization of the melt. MI has a little but constant content (~ 0.4 weight %) of P_2O_5. This fact testify to higher crystallization of MP (poor in P) than MI. It has been confirmed by the mineral compositions and textures of APT and AIT [8]. It's necessary to note that both APT and AIT contain sulphide-metallic drops (from the first μm up to some mm-size) later separated into metallic and sulphide phases (Fig. 1).

Process of the liquid immiscibility of silicate, metallic and sulphide melts is well known [3; 5; et al.]. The experimental research on the melting of the ordinary chondrite Tsarev (L5), run at water-hydrogen fluid pressure [1], showed that there was liquid immiscibility of the chondrite melt into silicate, metallic and sulphide melts. The liquid immiscibility of the silicate part of the chondrite melt is less studied, however examples of the basic - ultra basic layering in the earth rocks are well known [2]. Types of separated (layered) rocks are unusual for the intrusive facies because the crystallization of the phase equalizes the compositions of the coexisting melts and the phase boundary disappears. The situation in the volcanic conditions is quite different because the variolitic structures of the komatiitic formation are wide-spread as in the lava flows as in the dikes. Varioles often consist of boninites or marianites and the matrix consists of komatiites.

The existence of two distinct types of the areas distributed across the melted part of the sample of the ordinary chondrite Tsarev and different in texture (APT and AIT) and their chemical composition lead us to conclude that there were two immiscible silicate melts. We found that the boundary between these melts is sharp and there were two types of the silicate melt separations: layer-like and drop-like separations.

The conclusions made as a result of the petrological research of the vacuum melting of the ordinary chondrite Tsarev are:

the process of the liquid immiscibility of the sulphide-metallic and silicate melt took place;

the silicate melt later separated into two coexisting silicate melts;

the sulphide-metallic melt later separated into sulphide and metallic melts.

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FIGURE CAPTIONS: Fig. 1. The drop of sulphide-metallic melt separated into the sulphide and metallic melts. Fig. 2. The drop-like intersertal texture separation inside the area of the porphyritic texture.

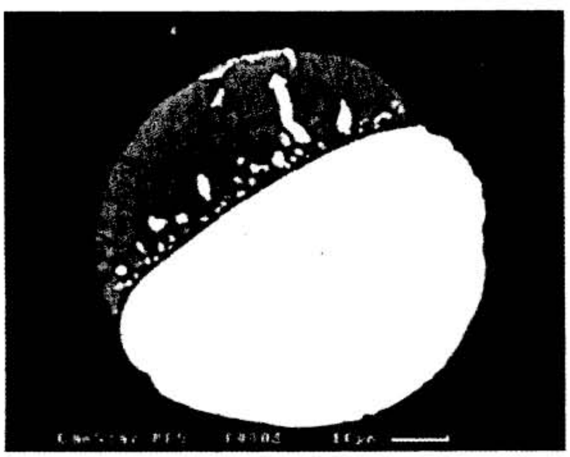

Fig. 1

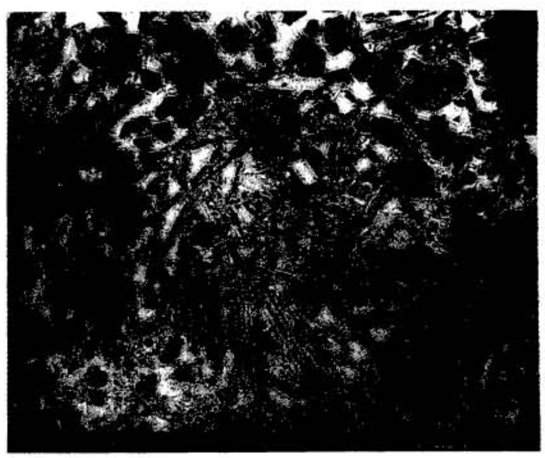

Fig. 2