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MAGMATIC TRANSPORT OF NITROGEN , HYDROGEN AND CARBON CONSTITUENTS FROM REDUCED PLANETARY INTERIORS

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In theories of the Earth's formation, the composition of gases extracted by primary planetary magmas is accounted for the large-scale melting of the early mantle in the presence of the metallic Fe phase The melting should have been accompanied by the formation of volatile compounds, which composition was controlled by the interaction of N, H and C with silicate and metallic melts

In a series of experiments in the system Fe-bearing melt + molten Fe rich metallic phase (0.1-12 % Si) + H_2 carried out at 4 GPa and 1520-1600°C and log fO_2 *(oxygen fugacity)* =2 -5 below IW, we have characterised the nature (oxidised versus reduced) and quantified the abundance of C, H and N-compound dissolved in an iron bearing silicate melt. The speciation of components dissolved in the glass has been determined by Infrared and Raman spectroscopy

The solubility of Si in liquid metal increases with decreasing fO_2 from 0.1-0.55 wt % at $\Delta\log fO_2$(IW)= -(2-3) to 10-12 wt % at $\Delta\log fO_2$(IW)= -(4-5). Carbon content in iron-rich globules to be fixed between 3 and 6 wt %. The amount of H (as H_2O, OH, H_2, CH_4) and C (as CO_2 , CO_3^{2-}, CH_4, Si-C) dissolved in the glasses was measured by ion microprobe and by CNH analysis. Hydrogen content decreases with decreasing fO_2 from 0.3-0.4 wt % at $\Delta\log fO_2$(IW)= -(2-3) to 0.1-0,2wt % at $\Delta\log fO_2$(IW)= -(4-5) as a result decreasing of H_2O in melt (Fig.1). Carbon content increases with decreasing fO_2 from 0.2-0.5 wt% at $\Delta\log fO_2$(IW)= -(2-3) to 1-2 wt % at $\Delta\log fO_2$(IW)= -(4-5) as a result of increasing of CH_4. The nitrogen solubility (as N_2, N^{3-}) reaches 2-3 wt % at $\Delta\log fO_2$(IW)= -(2-4.)

In the light of experimental data we argue that magma in reduced environment in area of the Fe-Si alloy stability could form melts containing dissolved both oxidized, and reduced components of hydrogen and carbon species. We assume that core growth took place under reduced conditions imposed by the pristine terrestrial materials and was accompanied by the emission of CH_4, H_2, N_2 and NH_3 and minor H_2O into the atmosphere.

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