NATIVE IRON, WÜSTITE AND MAGNETITE IN IMPACTITES OF JANISJÄRVI AND GARDNOS CRATERS (THE BALTIC SHIELD). S. A. Vishnevsky[1] and J. Raitala[2], [1]Institute of Mineralogy and Petrology, Novosibirsk-90, Russia, nadezhda@uiggm.nsc.ru; [2]University of Oulu, Oulu, Finland.

Introduction: In searching for high-pressure carbon phases in the Jänisjärvi (a positive result, [1]) and Gardnos (a negative result) impactites, accessory magnetic opaques (magnetite, native iron and wüstite) were derived from the impact melt rocks - tagamites and detected by means of mineralogical, microprobe and SEM study.

Description: All the minerals have regular spherule form, i.e., originated in a liquid state; at this, some magnetite droplets with vesicles were even possibly superheated. Jänisjärvi magnetites separated from 9 samples are shiny and duly spherules, 20-114μ in size. The shiny spherules show fine (<1-2μ grain) texture in polished micro-sections, whereas the duly ones have more coarse (3 to 7μ grain) skeletal-like texture. Gardnos magnetites are duly spherules 75-90μ in size separated from one sample and show zonal texture, more coarse in center (6-15μ) than on the rim (<6 μ). Jänisjärvi native iron (spherules 36 to 500μ in size) was separated from two samples. One native iron spherule 83x121μ in size was found in Gardnos rocks. The iron from both the craters has fine-grained texture and contains tiny, <1 to 4μ, droplet-like wüstite inclusions. Except for Fe (90.4-97.6 wt. %, if re-calculated to Fe_2O_3), Jänisjärvi magnetite has high-temperature isomorphic impurities of MnO (0.07-1.36 wt. %), ZnO (from traces to 6.98 wt. %) and SiO_2 (0.01-0.32 wt. %). Gardnos magnetite contains impurity of MnO (0.79-1.11 wt. %). Except for Fe (up to 100.76 wt. %), Jänisjärvi native iron contains traces (0.01-0.09 wt. %) of Ni, Zn, V and Ti. Wüstite spherules (up to 85.6 wt. % of FeO) were analyzed with addition of the host iron (13.6-43.9 wt. % of Fe) and show impurities of MnO (0.33-0.67 wt. %), Cr_2O_3 (0.07-0.08 wt. %) and traces of Zn, Ni, Mg and Na. Gardnos native iron (98.2-100.37 wt. % of Fe) contains impurity of Ni (0.42-0.43 wt. %) and traces of Mn and Cr. Except for FeO, wüstite droplets here show traces of MnO, V_2O_5 and Na_2O.

Discussion: Nickel-bearing (2-10 wt. %) iron was earlier reported for Lappajärvi [2]. Jänisjärvi and Gardnos native iron, wüstite and magnetite are first described here and can indicate: 1) high temperatures (above FeO, Fe and Fe_3O_4 fusion points: 1370, 1530 and 1590°C, respectively) of the impact melts; 2) rather specific red-ox conditions of the melts (wüstite is stable at μO_2 from -60 to -80, and native iron - at μO_2 <-70). A free carbon could serve as a buffer for so strong reducing conditions. From 0.1 to 0.4 wt. % of carbon is found in Gardnos tagamites [3]; Jänisjärvi target rocks also contain up to 1 wt. % of graphite. Magnetite in both the astroblemes could originate as a result of shock melting of Fe-bearing target minerals, with partial de-oxidation of Fe. Jänisjärvi native iron and wüstite could originate by the similar way or by shock decay of biotite and some other Fe-bearing minerals. Origin of native iron was observed at shock compression of Fe-rich biotite [4]. As for the Gardnos native iron, amount of Ni (0.43 wt. %) does not exclude the meteoritic source of the mineral, but the problem needs further investigation. Anyway, geochemical traces of projectile in Gardnos tagamites [3] are not in contrary with this conclusion.

References: [1] Vishnevsky S. A. et al. (2002) Doklady RAN, 387 (5), 647-677 (in Russian); [2] Fregerslev S. and Carstens H. (1976) Contr. Mineral. Petrol., 55, 255-263; [3] French B. M. et al. (1997), GCA, 61 (4), 873-904; [4] Anikina L. D. et al. (1971) Fizika Gorenija i Vzryva, 3, 436-440 (in Russian).

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