HOT, HOTTER, HOTTEST: EXTREME CASES OF ANTHROPOGENIC PYROMETAMORPHISM

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This contribution summarizes the results of petrological investigations concerning extremely high-*T* pyrometamorphism of anthropogenic nature. Three cases will be described: 1.) slags from sacrificial burning sites, 2.) formation of pseudofulgurites and 3.) petrography of slags from the first atomic blasts, the so-called trinitites.

In the first study the occurrence of P-rich olivine and the tri-calcium phosphate (TCP) stanfieldite in partially molten quartzphyllites from the ritual immolation site at the Goldbichl, near Innsbruck in the Tyrol, Austria is reported. The pyrometamorphic rocks contain mostly the mineral assemblage olivine + orthopyroxene + plagioclase + spinel + glass. During the investigation of slag samples from this prehistoric ritual immolation site, extremely P-rich, apatite-bearing micro-domains were found. In these domains phosphoran olivine was found coexisting with plagioclase and a tri-calcium phosphate phase showing stanfieldite $Ca_4(Mg, Fe^{2+}, Mn^{2+})_5(PO_4)_6$ composition. Schematical Schreinemakers analysis in the system CaO-Al_2O_3-FeO-SiO_2-P_2O_5-H_2O shows that P-rich olivine (fayalite-sarcopside solid solution) can form from mineral reactions involving chlorite, apatite and quartz and show that the occurrence of P-rich Fe-olivines spans a large *T*-range but is restricted to domains with high $a(SiO_2)$. The estimated temperatures are in the range of 1000-1200 °C.

In the course of the second investigation an exceptionally well-preserved fulgurite-like aggregate from Kaltenbach, district Vitis, Lower Austria, Austria was analysed. The pseudofulgurite is mainly composed of glass and contains partially- and fully fused and deformed relict fragments as well as newly formed minerals. The presence of mullite, baddeleyite instead of zircon, osumilite and Fe-P, Fe-Si-P, Fe-Si-Ni globuli enable to constrain a lower *T* of formation of 1500-1800 °C. Currently experimental investigations concerning pseudofulgurite formation are being conducted and investigated.

The third investigation deals with the so-called trinitites, glasses that formed in the course of the first nuclear blast at the Trinity site in New Mexico. These glasses contain only relict quartz and zircon fragments. In contrast to the pseudofulgurites abundant baddeleyite was found stemming from the breakdown of zircon indicating temperatures overstepping 1680-1770 °C greatly. Raman-spectroscopic investigations are currently being undertaken to investigate the nature of the baddeleyite modification.

The latter two examples clearly illustrate that the obtained temperatures have to be regarded only as lower temperature estimates since the duration of these processes is extremely short and hence the overstepping of the zircon breakdown temperature must be quite significant.