The application of Sr – Pb isotopes to dating and tracing ruby formation: The Aappaluttoq deposit, SW Greenland

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Deposits of gem-quality corundum are well distributed all around the world and occur in various different geological settings, within different host rocks, and are generated via several different petrogenetic processes. Radiogenic isotope ratios can potentially provide important information on the relative roles of different source components involved in corundum growth. In addition, they can act as geochronometers, capable of dating crystal growth or recrystallization. So far no radiogenic isotope systematics have been measured for corundum due to difficulties in dissolving the very robust crystal lattice in order to release the relevant elements for pre-concentration and measurement. Consequently, no direct dating method for corundum has been developed and establishing time constraints on ruby formation has been restricted to paragenetic relationships and the dating of mineral inclusions[1,2].

Using offline laser ablation followed by thermal ionization mass spectrometry (TIMS) we were able to precisely measure radiogenic isotope compositions in ruby, the red color variety of gem corundum, for the first time. Linear trends are observed in Pb isotopic compositions on a $^{206}Pb/^{204}Pb$ vs $^{207}Pb/^{204}Pb$ plot, yielding a Pb-Pb isochron age of 2686 +300/-74 Ma for gem formation at Aappaluttoq. We believe this age is the first ever direct age determined on a corundum suite independent of associated minerals and reflects the crystallization, or re-crystallisation and re-setting, of the ruby during the Neoarchean, likely due to a regional granulite to upper-amphibolite facies metamorphism.

Combined Sr-Pb isotope systematics successfully discriminate two distinct populations at Aappaluttoq identified by differences in trace element characteristics, illustrating potential for source discrimination and fingerprinting of gem corundum using radiogenic isotopes.

[1] Garnier et al., 2006. *Can. J. Earth Sci.* **43**, 509–532.
[2] Sorokina et al., 2017. *Miner Deposita* **52**, 641-649.