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Radiation-damaged zircon and its dating: a case study of ca. 1.50 Ga granitoid veins crosscutting skarns in south-eastern Lithuania

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The large Varena Iron Ore Deposit (VIOD) of southeastern Lithuania occurs in the Precambrian crystalline basement of the western East European Craton and has been explored by drilling. Skarns, iron ores and host rocks of the VIOD have been intruded by numerous granitoid veins. Samples of leucogranite (D9-1083) and syenitic granite (V987-387) are of A-type affinity, with low-temperature eutectic assemblages of plagioclase, K-feldspar and quartz, and are typical of extremely fractionated late-stage melts, rich in Nb, Ta, Li, Be, Cs, REE, U and Th. Zircon grains from samples D9-1083 and V987-387 have been analysed by secondary ion mass spectrometer (SIMS) using CAMECA ims1280 large geometry ion microprobe. Zircon of primary igneous origin has moderate to high radiation damage as implied from microtextures and calculated D_α values. Solid-state replacement of high-U zircon led to local U and Th redistribution (resulting in slight discordance) and formation of low-U zircon domains in the leucogranite. Syenite-hosted zircon grains were more extensively altered than those in the leucogranite.

A concordia age of 1497±7 Ma (MSWD = 1.8) was obtained from the least altered domains of sample D9-1083 and is considered to be the crystallisation age of the leucogranite. More altered domains record a slightly younger age, attributed to hydrothermal activity immediately after magma emplacement. Discordance is prominent in analyses of metamict zircon from syenite sample V987-387, but an upper intercept age of 1512 ±13 Ma (MSWD = 2.0) is within error of the age from the leucogranite vein. These ages coincide with the emplacement of the Mesoproterozoic AMCG Mazury complex and Kabeliai granites in southern Lithuania and northern Poland. They may indicate an extension of AMCG complexes further north and, since vein magmatism in ore deposits is often responsible for grain coarsening and enrichment, enhance the potential for mineral resources in the region.