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Archean sanukitoid series granitoids and their implications for the plate tectonic theory

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Archean sanukitoid series (high-Mg) granitoids are an exceptional group of granitoid rocks. They have been found in Archean granite-greenstone terrains of the Superior Province of the Canadian Shield, the Karelian craton of the Fennoscandian Shield, the Ukrainian Shield, the Zimbabwe craton in South Africa, the Amazonian craton in northern Brazil, the Dharwar craton in South India, the Pilbara craton in Western Australia, and Greenland. Sanukitoid intrusions are late- to postkinematic and their age range from 3.0 Ga to 2.7 Ga. They intrude voluminous TTG suites that are thought to represent melts from shallow-subducted slabs. The geochemical and isotopic characteristics of sanukitoids are contradictory. Some of the characteristics point to a mantle peridotite source (low SiO_2, high Mg-numbers and high Mg, Ni, and Cr contents, and mantle Nd epsilon values). Other features indicate an enriched (metasomatized) mantle source and a possible crustal contribution (high K, Ba, Sr, P, and LREE abundances and crustal Pb isotope signatures). The origin of sanukitoids has been explained as a two-stage process in an Archean subduction environment. Firstly, a mantle wedge was modified by reactions with slab melts or fluids during subduction. Secondly, the enriched mantle was partially melted by a thermal event in the end of or after subduction. Sanukitoids may be the first indicators of the formation of an enriched mantle wedge due to the deepening of the subduction angle in a cooling Earth. The appearance of sanukitoids during a narrow time span towards the Archean-Proterozoic boundary indicates a unique period of change in crust formation processes, plate tectonics, and mantle geodynamics. Further research on the origin of sanukitoids and the beginning of modern-style subduction at convergent continental margins requires a geochemical and geophysical approach and integrated observational and numerical studies.