Geochemistry, U-Pb zircon geochronology, and Sr-Nd isotopic study of the Pirrit Hills granite in West Antarctica

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West Antarctica can be divided into five crustal blocks. The blocks are separated by deep crustal rift zones and regarded as having moved during the Mesozoic break-up of Gondwana. The Pirrit Hills granite occurs within the Ellsworth-Whitmore Mountains block, which is the center of five blocks in the present configurations.

The Pirrit Hills granite is composed of quartz, perthitic alkali feldspar, and plagioclase with minor amounts of interstitial biotite and muscovite. The granite is a highly homogeneous, strongly fractionated, and mildly peraluminous granite. Although the Pirrit Hills granite has much of the geochemical features of A-type granites, the granite also retains some geochemical features akin to orogenic or post-orogenic granites. In some tectonic discrimination diagrams, the granite is plotted in the post-collisional granite and syn-collisional granite fields as well as within-plate granite field. These geochemical features may suggest that there was an unrecognized orogenic event before initiation of extensional and anorogenic environment to produce the Pirrit Hills granite.

The U-Pb zircon age, the Rb-Sr and Sm-Nd whole rocks ages were 164.5±2.3 Ma (MSWD=1.3), 159±7.5 Ma (MSWD=42), and 169±12 Ma (MSWD=1.7), respectively. These ages are interpreted as the emplacement age of the Pirrit Hills granite and indistinguishable from the age of the first rifting stage of Gondwana break-up (at 165 Ma). The estimated initial Nd and Sr isotope ratios were 0.512207±7.5 Ma (2σ SE) and 0.711±0.025 (2σ SE), respectively, and suggest that the magma source was largely derived from crustal materials. Therfore, the Pirrit Hills granite represents the magmatic event that occurred responding the curstal thinning due to the break-up of Gondwana during the Middle Jurassic in the West Antarctica.