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Origin, distribution and glaciological implications of Jurassic high heat production granites in the Weddell Sea rift, Antarctica

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The distribution of heat flow in Antarctic continental crust is critical to understanding ice sheet nucleation, growth and basal rheology and hydrology. We identify a group of High Heat Production granites intruded into Palaeozoic sedimentary sequences which may contribute to locally high heat flow beneath the central part of the West Antarctic Ice Sheet. Four of the granite plutons are exposed above ice sheet level at Pagano Nunatak, Pirrit Hills, Nash Hills and Whitmore Mountains. A new U-Pb zircon age from Pirrit Hills of 177.9 $\pm$ 2.3 Ma confirms earlier Rb-Sr dating that suggested an Early-Middle Jurassic age for the granites, coincident with the Karoo-Ferrar large igneous province and the first stage of Gondwana break-up. Our recently-acquired aerogeophysical data indicate that the plutons are distributed unevenly over 1000 km2 and were intruded into the actively extending, locally transcurrent, Jurassic Weddell Sea Rift [1]. In the NW part of the rift, the Pirrit Hills, Nash Hills and Whitmore Mountains granites form small isolated intrusions within weakly deformed upper crust. In the SE part of the rift, where granite intrusion was strongly structurally controlled within transtensional structures, the Pagano Nunatak granite is the only outcrop of a probably multiphase, ca 180 km long granite intrusion. The granites are weakly peraluminous, S-type and have Th and U abundances up to 61 and 19 ppm respectively. Heat production of analysed granite samples is ca. 2.9-9.1 μWm-3, toward the upper limit of values for High Heat Production granites globally. The granites are thought to have been generated during mafic underplating of the Weddell Rift during eruption of the contemporaneous Karoo-Ferrar magmatism [2]. The high Th and U abundances may be related to fractionation of the high Th-U Ferrar basaltic magmas combined with assimilation of pelitic sedimentary rocks. The granites correspond to an area of West Antarctica that may have heat flow significantly above the Antarctic average, as predicted from satellite magnetic data [3].

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