

Mechanism of Intracratonic Basin Formation: Insights from the Canning Basin, NW Australia

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The Canning basin of northwest Australia was investigated in order to test a working hypothesis for its initiation and development. The sag development of the Canning basin is interpreted to be a consequence of a regionally distributed, thermal event (possibly plume related) that induced broad-scale uplift, extrusion of tholeiitic basalts, and erosion. The age of tholeiitic basalts of the Antrim and Table Hill volcanics (563±40 Ma) of northern and central Australia indicate that the climax of the thermal event was during late Proterozoic time. Consequent erosion of the uplifted crust and local isostatic re-adjustment allowed up to 11 km of crustal rocks to be stripped off. The deep exhumation of the crust occurring mostly before the cooling of the lithosphere was responsible for the formation a broad basin with a maximum subsidence of ca. 7 km. The prediction of significant late Proterozoic / early Paleozoic erosion that ultimately drove Canning basin subsidence is consistent with erosion estimates in the Paterson province, southern margin of the Canning basin, and the lack of late Proterozoic / Cambrian rocks beneath the basin. Although lower crustal metamorphism is capable to explain intracratonic basin formation, it seems to be a negligible process in the formation of the Canning basin because the time scale and the maximum amplitude of the metamorphic-related subsidence are smaller than those observed in the Canning basin.