

letters to nature

Nature 274, 47–49 (06 July 1978); doi:10.1038/274047a0

Flood basalts, subduction and the break-up of Gondwanaland

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THE hypothesis of Du Toit¹ on a continuous zone of orogeny and sedimentation (the Samfrau geosyncline) along the Pacific side of Gondwanaland in Palaeozoic and early Mesozoic times has been supported by subsequent geological work. As originally conceived, the orogenic zone of the Gondwanide orogeny consisted only of a Triassic fold-belt seen, for example, in the Cape Fold Belt of South Africa and the Sierra de la Ventana in Argentina (see Fig. 1). Fragments of the belt are also known from the Antarctic continent in the Pensacola Mountains, Ellsworth Mountains, and the Antarctic Peninsula². Radiometric dating has established that the Gondwanides also include metamorphic and plutonic rocks, exposed in South America in the Patagonian and Deseado massifs, and in the Cordillera Frontal of Argentina (see ref. 3). These have their Antarctic counterparts in the Antarctic peninsula, Eights Coast and Thurston Island, Maria Byrd Land, and at scattered exposures between the Ellsworth and Thiel Mountains² and in eastern Australia. Several of the occurrences listed are now caught-up within the late Mesozoic–early Cainozoic Andean orogenic zone. In terms of sedimentation, the Samfrau geosyncline consisted of a ‘foredeep’ (for example, the Paraná and Karroo basins) developing from the late Silurian onwards and receiving sediment of a shallow marine or nonmarine nature until at least the end of the Trias. To the north the ‘foreland proper’ showed the transgression of Carboniferous and later sediments on to Precambrian basement. More recent work in West Antarctica has shown the existence of a greywacke–shale facies lying to the Pacific side of du Toit’s foredeep². Craddock⁴ sees the Pacific border of Gondwanaland as an active continental margin showing successive orogenic episodes within the Phanerozoic. The orogenic process is believed to involve the interaction of the Gondwanaland continent with the Pacific plate, and an accretionary process at the continental margin has been suggested. With reference to Antarctica, Stump⁵ has raised the possibility of nearly continuous subduction from the late Precambrian to the Cretaceous. Dickinson⁶ has referred to the ‘Gondwana–Tasman orogenic trend’ as a zone of inferred plate consumption. With the information now available I have examined some of the relationships between the Gondwanide orogeny and its foreland in more detail, and discuss here whether there may be a connection between flood basalt volcanism and orogeny.

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