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Brittle Structural Architecture of the Lambert Glacier Region (E Antarctica) and its Relation to Gondwana Break-up

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The Lambert Glacier-Amery Ice Shelf system represents the largest ice drainage system in Antarctica. Its ice streams are located within one of the major crustal structures in E Antarctica, the Lambert Graben. This structure extends at least 700 km from the Antarctic coast into the continent and is generally interpreted as a failed rift arm originally connected with the Son-Mahanadi Rift in India. The present structural architecture of the Lambert Graben is thought to be linked to the break-up of Gondwana and the separation of India and Antarctica starting ca. 130 Ma ago, however, still older (i.e. Late Palaeozoic) rifting events are assumed. The Lambert Graben shows a typical half graben structure with rather complicated internal features. The continental crust in the centre is thinned out from an original thickness of 35-40 km to around 25 km and its depocentre is filled with 5-10 km thick sediments. The Phanerozoic rifting processes linked to the Lambert Graben are interpreted to be the main reason for uplift and erosion of the southern Prince Charles Mountains (PCMs), the only region in Antarctica where outcrops are accessable that far inland. It is also assumed that Lake Vostok, the largest subglacial lake in Antarctica, is located in a rift arm branching off the Lambert Graben system. In this study, we present field and structural data to illustrate changes in palaeostress states and kinematics from the Lambert Graben in the southern PCMs. At present stage, our analyses indicate two subsequent brittle deformation events involving strike-slip to oblique-slip faulting, the maximum horizontal palaeostress axes of which are oriented roughly perpendicular to each other. An older event D1 is probably responsible for at least 50-60 km offsets of the metamorphic zonation in the basement along the eastern shoulder of the Lambert Graben (Mawson Escarpment). Corresponding structures are N-S to NE-SW trending dextral-transtensional and sub-

ordinate conjugate sinistral fault systems. Fault sets indicating E-W to WNW-ESE directed extension are at this stage considered to be co-genetic and responsible for the opening of the present Lambert Graben. D1 is tentatively interpreted to be related to the Cretaceous break-up of Gondwana in the Indian-Antarctic sector. A younger fault system (D2) has led to the reversal and inversion of the pristine D1 faults. Related structures are compatible with NNW-SSE to NW-SE directed contraction and contemporaneous NE-SW directed extension. Locally, strike-slip induced inversion caused the formation of transpressive structures and flower structure-like arrays. D2 faults parallel the orientation of some tributary glaciers of the Lambert glacial system and thus play a geomorphologic role in the southern PCMs. For instance, WSW-ENE oriented glaciers run parallel to dextral faults of D2. Similarly, WNW-ESE to NW-SE trending glaciers are oriented parallel to normal and subordinate dextral-transtensional D2 faults. Subice topography shows that these faults strikingly parallel the Gamburtsev Subglacial Mountains front and may be projected roughly into the Lake Vostok area suggesting that the lake could in fact be located within fault arrays related to the Lambert Graben region. The age of D2 is uncertain. It post-dates the presumably Cretaceous D1 event and could thus be of Cenozoic age. Nevertheless, the final separation of India and Antarctica must have caused the development of a new stress field in the area of the Lambert Graben, which is responsible for the formation of the younger D2 structures in the southern PCMs.