The Effect of Vertical Crustal Fractures on the Rifting Process

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Abstract

In the past, rifts have mainly been identified in terms of sediment troughs. They account for many of the elongate gravity lows distributed in a coherent rectilinear manner over the continent. Other gravity lows can be attributed to granites intruding rift compartments, and some gravity highs can be attributed to basic volcanics in compartments. The total number of rifts which can be thus inferred from gravity and magnetics is very large, and suggests rifting is pervasive over the whole continent and controlled by a systematically distributed "Cardinal" system of ancient vertical crustal fractures.

The extensional concept of rifting is based on a finite number of rifts, all of which have "failed" to split the continent. When a far greater number of rifts is recognised, it becomes difficult to accept that all these rifts have "failed" to reach full opening by extensional processes. In view of the known horizontal compressive forces acting in the crust, it is more probable that rifting is caused by compression. The compartmentalization of rifts, clearly observed in gravity data, also implies compression.

Closely spaced rectilinear dyke systems in shield areas may also represent the pervasive "Cardinal" fracture system. In general, this system of orthogonal fractures poses problems for the detatchment rifting concept which assumes that transfer faults are formed at the time a rift forms, whereas they in all probability predate the rift, and owe their existence to a fundamental process operating when continental crust first formed.

Two types of compressive rift models are discussed. One is associated with shear couples between widely spaced parallel fractures. The other is based on the concept of a crust cut by closely spaced fractures in which compression is propagated along a network of linked blocks. In both cases the development of basement ridges is a key issue.