THE SIMPSON DESERT DEPRESSION - AN ANCIENT GIANT IMPACT BASIN - PART 2.

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A previous discussion of mainly geophysical, but also of geochemical and geological aspects associated with the area of the Simpson Desert Depression in Central Australia suggested that this basinal structure could be the product of a gigantic impact event of possible Proterozoic age (1). Now we can report additional structural geological data for this region that lends further support to the impact hypothesis for the Simpson Desert basin structure. The main observations are:

(A) RADIAL SHEAR ZONES AND RELATED MULTIPLE PHASES OF REACTIVATION

Collation of all relevant structural components of the central Australian desert region is presented in Figure 1. The Colona Fault, Karari Fault and Weldon Tectonic Zone in particular are long-lived structural lineaments which began with vertical and/or horizontal tectonics in the early- to mid-Proterozoic. These and other fault zones remained periodically active, often until the Carboniferous. The exact times of movement on certain structures, such as the Diamentina Lineament, remains in doubt, but these structures too, have frequently a radial disposition to the Simpson Desert Depression.

(B) POLYMETAMORPHIC AND POLYCYCLIC TECTOGENESIS IN THE CENTRAL AUSTRALIAN PROTEROZOIC BLOCKS

The Early to Middle Proterozoic Arunta Inlier to the NNW of the Simpson Desert is typical for the cratonic relict blocks surrounding the basin in being a polydeformed metamorphic terrane that is extensively disrupted by shear zones which mainly trend towards the basin. These zones are considered by some Australian workers (e.g. (2)) to be the loci for "polycyclic tectogenesis" resulting in reactivation of the same crustal faults up to 5 times. Multi-disciplinary geochemical and geological studies by BMR and ANU workers in the Proterozoic blocks (see PRECAMBRIAN RESEARCH, v. 40/41, 1988) predict a plate-tectonic (model-dependant), crust-forming event at circa 1.8-2.0 Ga (see observation D below).

(C) MINERAL DEPOSITS ASSOCIATED WITH THE SIMPSON DESERT DEPRESSION

In our first discussion (1) we noted the coincidence in the location of some of Australia's largest base-metal deposits with the radial and peripheral fractures in the "hinterland" of the Simpson Desert Depression. In addition we now report that the opal fields of South Australia, the on-shore oil and gas fields (Jackson and Moomba), as well as several smaller U and base-metal occurrences (Figure 1) are located on the southern rim of the Simpson Desert Depression. In the northeastern and southwestern sectors of the structure the circular rim is also defined by prominent breaks in the Tertiary and Cretaceous outcrop patterns, as evident from any detailed geological map of Australia.

(D) LACK OF COMPELLING EVIDENCE FOR COMPRESSIONAL TECTONICS AS A RESPONSE TO CONVENTIONAL PLATE TECTONICS WITHIN CENTRAL AUSTRALIAN PROTEROZOIC BLOCKS

By far the most important geodynamic evidence for non-conventional plate tectonics in the central Australian Proterozoic can be found summarized in a recent issue of PRECAMBRIAN RESEARCH (v. 40/41, 1988). This compendium demonstrates a complete lack of ophiolitic facies, a predominance of acid to bi-modal igneous suites, and a narrow time-span for particular tectonic events (i.e., recycling of crust etc.) over the continent as a whole for the Early Proterozoic. This igneous suite forms a polygonal array within the Australian continent (3); such geometry is not characteristic of magmatism at plate margins near suduction zones, as according to (3) too many plate margins would be required.

The above aspects are additional, compelling evidence for the existence of an extensive Proterozoic basin defined by the present-day Pedirka-Warburton Basin. Considering the disagreement of available observations on the Proterozoic blocks of Central Australia with the currently debated plate-tectonic models - which also led to considerable dissent among Australian geologists on how to explain the present disposition of Proterozoic terranes -, we feel that the impact hypothesis for the Simpson Desert depression deserves further attention.

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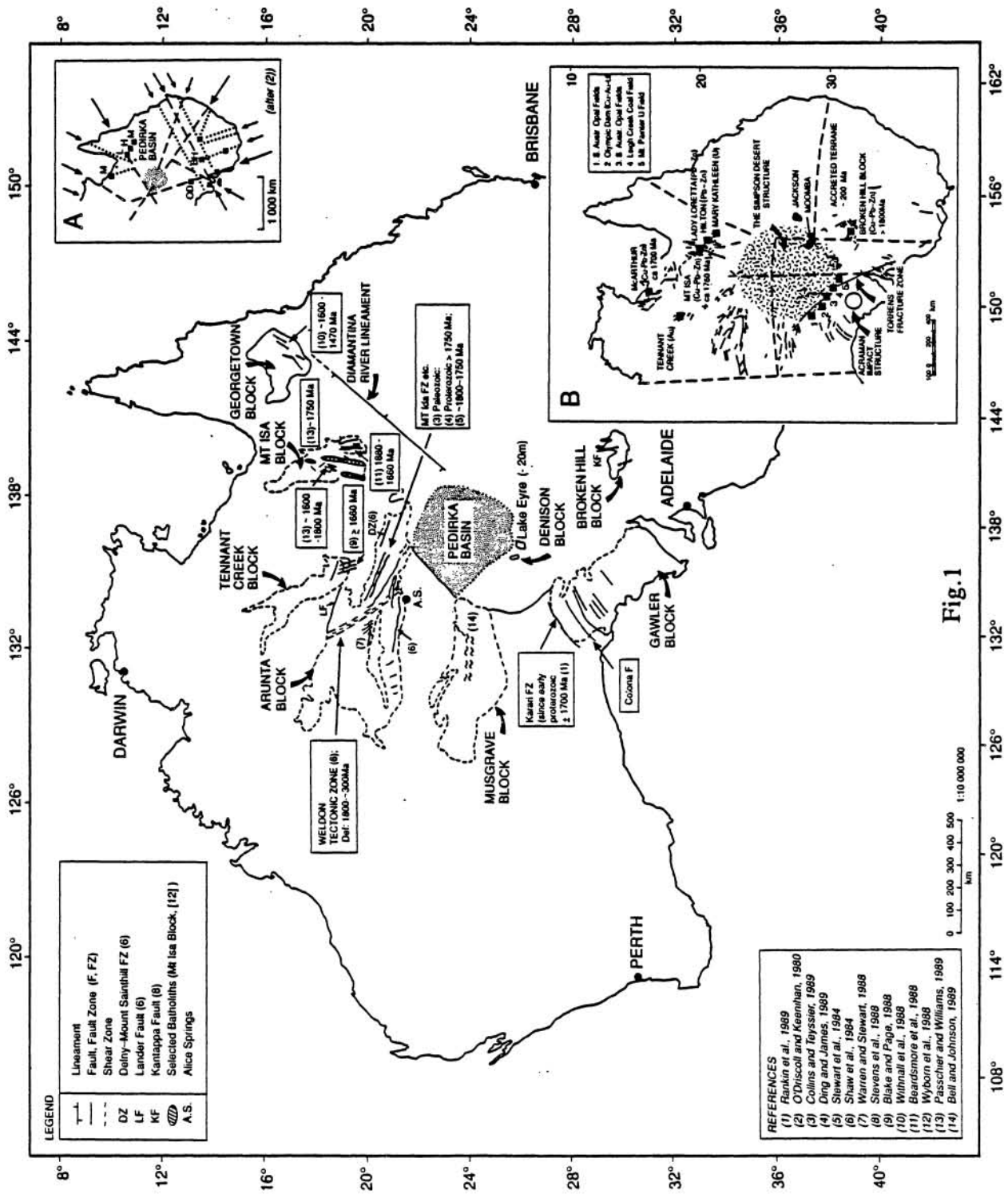

Fig.1

References: (1) Duane, M.J. and Reimold, W.U. (1989) Lunar Planet. Sci., XX, 252-253; (2) Rankin, L.R. et al. (1989) Austr. J. Earth Sci., 36, 123-133; (3) Wyborn, L.A.I. (1988) Precambr. Res., 40/41, 37-60. All references presented as part of Fig.1 can be directly obtained from W.U.R.

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