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A MAJOR UNCONFORMITY IN THE ARCHAEAN, JONES CREEK, WESTERN AUSTRALIA

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A comment on: A major unconformity in the Archaean, Jones Creek, Western Australia

Dr J.E. Glover,
The Editor,
Journal of the Geological
Society of Australia.

Sir - D.W. Durney is to be complimented on his recent contribution (Durney, 1972), which presents the best documented evidence for a post-granite unconformity described to date from the Kalgoorlie System. Unfortunately, exposure does not permit direct observations to be made on the nature of the contact between the 'Western granite' and the 'Western greenstones' in the Jones Creek area. However, because the 'Western greenstones' and the Agnew greenstones display important similarities (Durney, 1972), and the latter are clearly intruded by the 'Southern granite', it is possible that the 'Western greenstones' are intruded by the 'Western granite'. If this inference is correct, the Jones Creek unconformity represents the termination of an early granite-greenstone cycle in which the ultramafic-mafic rocks constitute the oldest phase. Because this unconformity separates two major greenstone successions, i.e., the 'Western greenstones' and the 'Eastern greenstones', it possibly correlates with unconformities described from the base of the upper greenstone cycle in the Kurnalpi Sheet area (Williams, 1970), at Mount Monger (Williams, 1972), and in the Coolgardie-Kurrawang area (Glikson, 1971). Thus, a regional unconformity which postdates the early ultramafic-mafic successions (e.g., Coolgardie, Ora Banda, Bulong), and predates the upper ultramafic-mafic belts (e.g., Yilmia, Red Lake, Mulgabbie Formation, and possibly Kalgoorlie-Kambalda) may exist in the Eastern Goldfields, thus supporting Horwitz & Sofoulis' (1965) division of the Kalgoorlie System into a 'lower sequence' and an 'upper sequence'.

It will be interesting to learn of the results of geochronological analysis of the Western and Eastern granites, as well as of the petrological and geochemical characteristics of these plutons. These may provide

criteria for a recent suggestion according to which granites in the Eastern Goldfields are classified as follows (Glikson & Sheraton, 1972):

(1) Pregeosynclinal granites of predominantly trondhjemitic and tonalitic composition, which may have intruded the early ultramafic-mafic successions about 3 b.y. ago.

(2) Syngeosynclinal sodic porphyries, emplaced as sills, plugs, and flows about 2.7 b.y. ago (O'Beirne, 1968).

(3) Late-kinematic adamellites of the Mungari Granite type, emplaced about 2.6 b.y. ago.

According to this scheme, the Western and Eastern granites of the Jones Creek area could represent sodic granites of phase (1) and adamellites of phase (3), respectively - a possibility awaiting assessment through a petrological study. Because the western granite appears to be representative of the elliptical NNW-elongated granites whose intrusive contacts are confined to greenstone belts, such as the Coolgardie dome and granites east of Ora Banda, its dating may have an important bearing on the age of the other plutonic bodies. Structurally, the anticlinal positions of these granites, whose intrusive contacts are confined to the greenstone belts, are comparable to the oldest tonalites and sodic gneiss domes in the Kaapvaal and Rhodesian shields (Anhaeusser, 1972; Glikson, 1972a).

It is pertinent to compare the Jones Creek unconformity with Archaean unconformities elsewhere, such as at the base of the Moodies Group, Barberton Mountainland (Anhaeusser et al., 1968), the basal unconformity of the Bulawayan System, Rhodesia (Bliss & Stidolph, 1969), and the basal Timiskaming unconformity, Superior Province (Hewitt, 1963). In these examples, unconformable basal conglomerates overlie and contain pebbles derived from both granites and greenstones, as in the Jones Creek conglomerate. In all three cases intrusive relationships between

the early sodic granites and the greenstones have been demonstrated, e.g., Kaapvaal shield tonalites and Onverwacht Group, Rhodesian plagioclase gneiss domes and Sebakwian System, Canadian Laurentian granites and Keewatin volcanics. These systems yield no direct evidence of any pre-greenstone sialic basement. Similarly, the evidence presented from the Jones Creek area does not imply the existence of pre-lower greenstone granitic rocks, and an early granite phase (Durney, 1972) does not appear to be supported. An alternative view on the nature of the basement on which the Kalgoorlie System was deposited is that the lowermost ultramafic-mafic assemblages themselves are relics of an Archaean oceanic crust, a proposition supported by the abundance of basic enclaves in the oldest granites, the chemical similarities between Archaean metabasalts and oceanic tholeiites, the lack of granite-derived sediments in the lowermost greenstone belts, and the abundance of extrusive ultramafic rocks which indicate high geothermal gradients and a thin crust (Engel, 1968; Glikson, 1972a, 1972b; Anhaeusser, 1972).

An important distinction between the Kalgoorlie System and Archaean successions in South Africa, Rhodesia, and Canada is the occurrence of an upper ultramafic-mafic cycle in Western Australia, abounding in oceanic-type metatholeiites, high-magnesia metabasalts (Hallberg & Williams, 1972), and intrusive and extrusive ultramafic bodies (Williams, 1972). The upper greenstones thus differ markedly from the calc-alkaline basalt-andesite-dacite-rhyolite sequences which postdate the Bulawayan unconformity in Rhodesia and the Middle Marker hiatus in the Barberton Mountainland (Hallberg, 1972). The recurrence of oceanic crust-type assemblages at post-early granite stages in the Kalgoorlie System poses a problem, because it suggests a persistence of oceanic crustal structure and/or conditions of magma genesis beneath troughs separated by early intrusive granites. Comparative studies of the

geochemistry of the Western greenstones and Eastern greenstones in the Jones Creek area may shed light on this problem, especially if significant variations in composition between the lower and the upper greenstones can be demonstrated, with implications on the crustal evolution of the Kalgoorlie System.

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