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On using the Kaapvaal Craton to naturalise the International Chronostratigraphic Chart for the Precambrian

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With three exceptions, the International Chronostratigraphic Chart for the Precambrian uses ages given as apparently arbitrary round numbers (GSSA, Global Standard Stratigraphic Age) to subdivide Precambrian time. The first exception is the Ediacaran, defined by a Global Boundary Stratotype Section and Point (GSSP) and representing the time from the end of Marinoan glaciation to the appearance of the Ediacaran fauna (635 Ma to 541 Ma). The second exception is the Cryogenian, etymologically bound to the inferred onset of global glaciation, and recently shifted from 850 Ma to 720 Ma to accommodate changes in the interpretation of this event. The third exception is the Orosirian, the start of which is tied to the termination of Rhyacian magmatism in the Bushveld Complex. There the final magmatic event is now dated at 2054.89 ± 0.37 Ma [1], necessitating a shift in the Rhyacian-Orosirian boundary from 2050 to 2055 Ma.

The Kaapvaal Craton presents additional opportunities to provide GSSAs for boundaries which have correlatives in the Huronian and Yellowknife Supergroups of North America, and the Hamersley Supergroup and Warrawoona Group of Australia. If these GSSAs were adopted (Table 1), the largest shift would be for the Paleoproterozoic, redefined to coincide with the first appearance of stromatolites in the Warrawoona Group on the Pilbara Craton at 3481 Ma [2].

Eon

Era

Period

ICS2015

SACS

Supercontinent

Paleoproterozoic

Orosirian

2050

2055

Columbia

Paleoproterozoic

Rhyacian

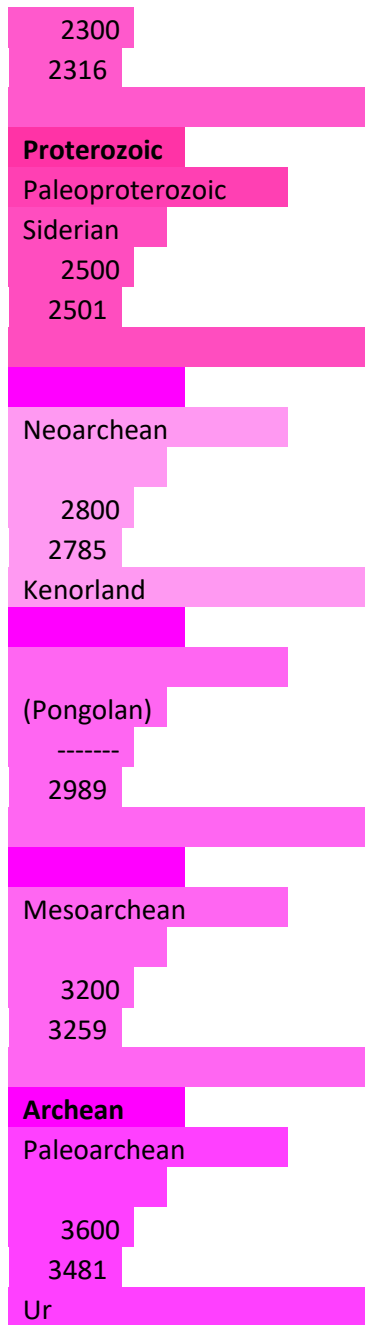


Table 1: Ages (in million years) of chronostratigraphic units in the 2015 INTERNATIONAL CHRONOSTRATIGRAPHIC CHART, compared with ages of natural breaks identified on the Kaapvaal Craton (SACS column-new GSSAs currently under consideration by the South African Committee for Stratigraphy). Supercontinents to which the breaks can be related, are listed in the last column.

The major magmatic events in the early Precambrian are the Paleoproterozoic onset of komatiitic magmatism in the Komati Formation, the Neoproterozoic onset of Ventersdorp magmatism and the Rhyacian-Orosirian termination of Bushveld magmatism. The 700-800 Ma interval between these events matches the 700-1000 Ma supercontinent cycle; both are here related to 90° shifts in lower mantle convection [3,4].

References:

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- [2] van Kranendonk MJ et al (2012) *Precambrian Research* 167:93-124.
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