North American Craton and Canadian Shield

By

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Composition

- (a) in the northern part, the unusually large Canadian Shield with buried extensions beneath the Hudson, Arctic, Interior and St Lawrence lowlands
- (b) the comparatively small Wyoming Uplift to the west; and
- (c) substantial buried basement in southcentral (midcontinent) USA. Numerous Precambrian inliers crop out in the enclosing Phanerozoic fold belts.
- Additionally Includes: Guiana, Central Brazil and Atlantic shields, with buried basement beneath (a) the intervening Amazon, Parnaiba, and Paranfi basins; (b) the Sub- Andean Foredeep to the west; and (c) the Atlantic margin deposits to the east. Precambrian inliers are scattered along the length of the Andean Chain to the west, including the substantial Arequipa-Cuzco Massif exposed on the Pacific coast at 15-20 S

- **North America Craton (excl. Greenland Shield)**
- Precambrian composite cratons component cratons, shields, blocks, belts,
- (1) **Canadian Shield** and buried extensions, (2) Wyoming uplift, (3) Central (US) Belt (buried) and
- Neighbouring median massifs, inliers
- buried extensions of Grenville Belt Inliers in the (a) Cordilleran, (b) Ouachitan, (c) Appalachian and (d) Innuitian fold belts
- ***South America*** **-Patagonian Craton**
- Precambrian composite cratons component cratons, shields, blocks, belts,
- (1) Guiana Shield, (2) Central Brazil Shield, (3) Atlantic Shield, and buried extensions
- Neighbouring median massifs, inliers (a) Cordilleran inliers

The Canadian Shield, including the eastern Nutak segment, Labrador, illustrates with unusual clarity the cyclic development of Precambrian crust

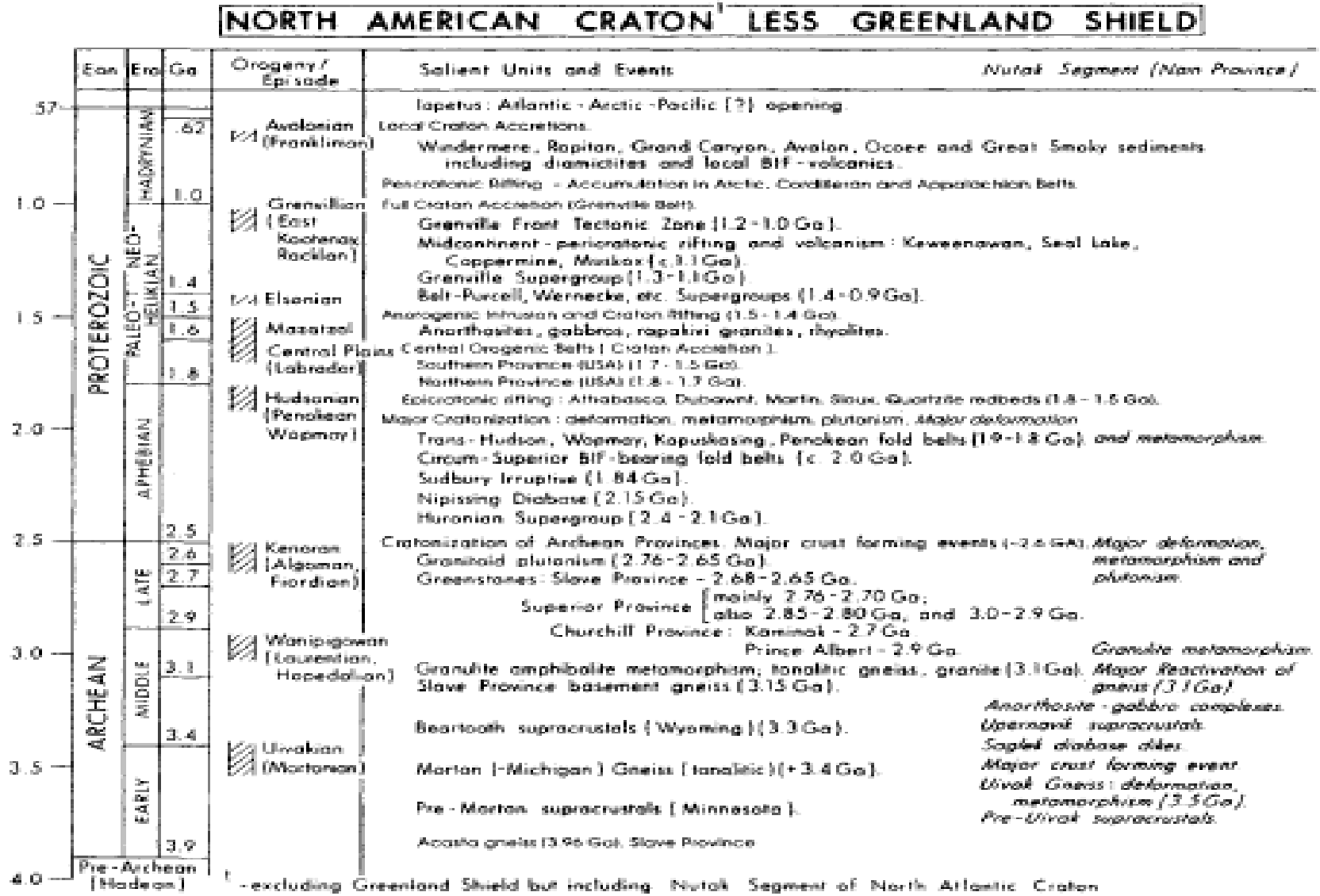

Fig. 1-3d(ii). Summary chrono-stratigraphic development of Precambrian crust of the North American Craton excluding Greenland Shield. Salient crustal units and events are arranged in relation to internal orogenies and resulting tectonic cycles.

The oldest established Archean events (3.5-3.2 Ga) are from the Imataca Complex in Guiana Shield, Goias Massif in Central Brazil Shield, and Boa Vista gneiss and Jequi~ Complex in Atlantic Shield, culminating in the Gurian Orogeny (3.0 Ga)

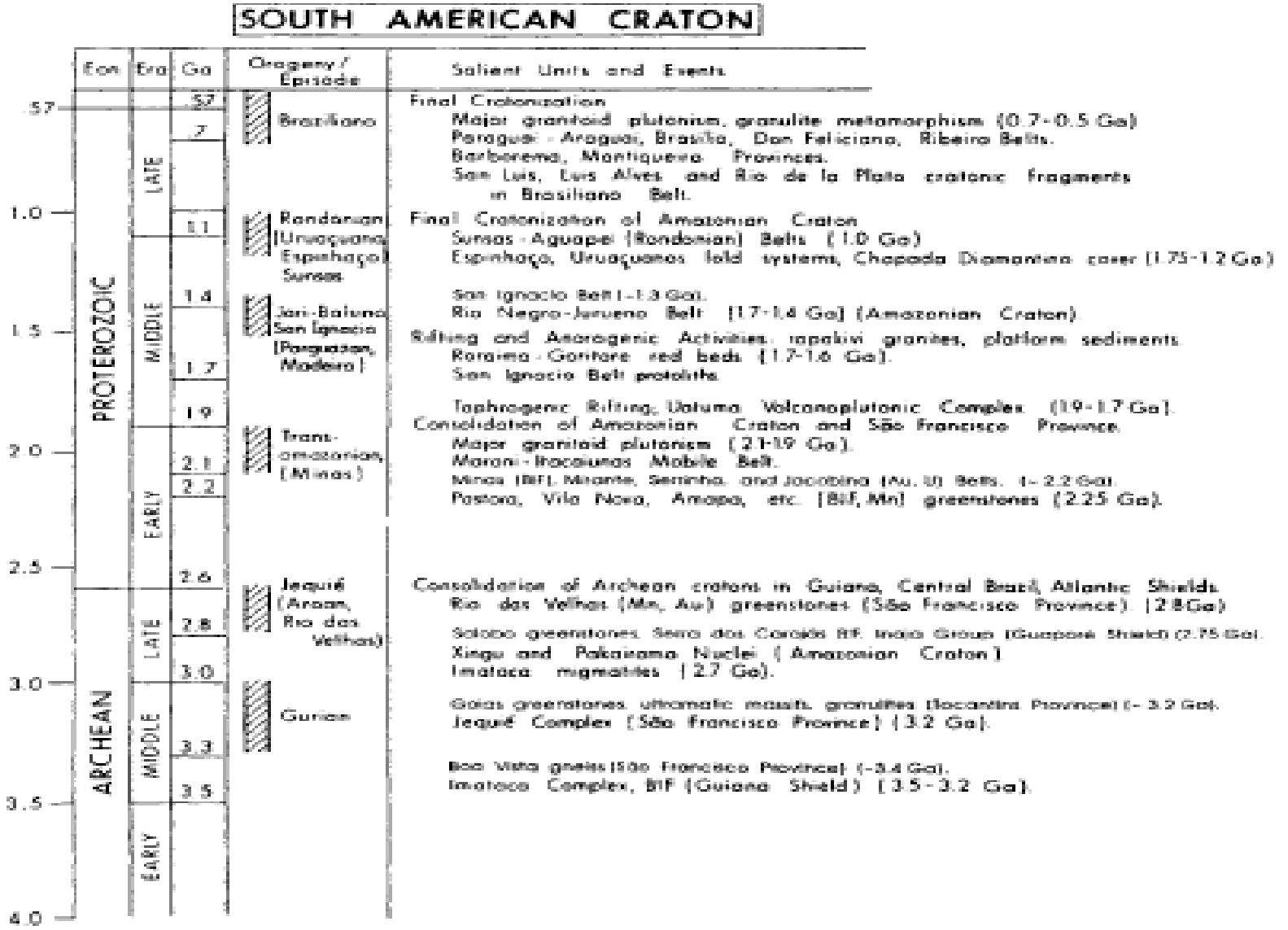

Fig. 1-3e. Summary chrono-stratigraphic development of Precambrian crust of the South American Craton. Salient crustal units and events are arranged in relation to internal orogenies and resulting tectonic cycles.

Geological Setting

- The North American Craton (less Greenland Shield) forms a large ovoid fault-bounded crystalline mass about 5000km in diameter and 17 x 106 km 2 in area.
- This craton is encircled by Phanerozoic fold belts (Innuitian, Cordilleran, Sierra Madre, Ouachitan and Appalachian) but for the rifted northeastern margin facing Greenland
- However, including Greenland, the Phanerozoic encirclement is completed by the Caledonian and North Greenland mobile belts.
- About one-third of the craton is dominated by the uniquely large **Canadian Shield**.
- Numerous Precambrian inliers lie within the surrounding Phanerozoic fold belts.

Canadian Shield

- The Canadian Shield is a large orthogonal craton 3000 km in diameter and 5.5 x 106 km 2 in area
- At its centre lies the 1000 km-wide Hudson Bay Lowlands. The shield is bounded by Phanerozoic sedimentary onlap, rare fold belts and oceanic crust.
- The Canadian Shield is divided into seven structural (tectonic) provinces each of distinctive tectonic imprint.
- Of these, two (Superior and Slave) are mainly Archean with Kenoran (2.5 Ga) imprint.
- Three (Churchill, Bear and Southern) are mainly Aphebian with Hudsonian (1.8 Ga) imprint.
- Two (Grenville and Nain) are mainly Helikian with Grenvillian (1.0Ga) imprint/influence.
- Rare Hadrynian rocks are practically confined to the shield margins. The small easternmost Nutak domain represents a rifted segment of the Archaean Block in Greenland.

Superior Province

- *Superior Province*, the dominant Archean entity, forms a large deeply indented ovoid, 2500 km by 700-1000 km or 1.6 x 106 km^2 in area.
- The province is about equally divided into (1) the northeastern high-grade gneiss-migmatite-rich Ungava Belt (Domain) with unusually large granulitic terrains; and (2) the southern-western low-medium grade metavolcanic-metasedimentary-gneiss-pluton-rich part characterized by E-trending, alternating granitoid- greenstone and metasedimentary-gneiss pluton super belts (subprovinces).
- The volcanic-rich greenstone belts are commonly 2.7-2.8Ga but range to 3.0 Ga, whereas the gneiss terrains, including granulites range to at least 3.35 Ga.
- Granulite rich crust (Pikwitonei) forms the northwestern boundary (Nelson Front) of Superior Province and underlies rare small interior domains.
- The narrow, irregular, NE-trending, 600 km-long Kapuskasing Structural Zone transects the province from Lake Superior vicinity to James Bay (Hudson Bay).
- *Slave Province*, a smaller ovoid craton 1000 km to the northwest and 800km by 400km or 225 000 km 2 in ~rea, comprises prevailing granitoid gneiss (2.6-3.96 Ga) with associated, N-trending, 2.7 Ga metasedimentary-metavolcanic (greenstone) belts.

Churchill Province

- Dominant tectonic trends in this large (2.1 x 106 km^2) structurally varied province are concave to the south about Hudson Bay.

- Predominant gneiss-migmatite terrains include proportionately high reworked Archean basement infrastructure with variable Aphebian cover.

- Northern and western granulite-rich parts have been alternatively reclassified as Archean and renamed Rae and Hearne provinces.

- The Trans-Hudson orogen, a prominent NE-trending zone in the southwest, is characterized by juvenile Aphebian volcanic-turbidite-granitoid accretions including discrete greenstone belts.

- Eastern Churchill Province likewise includes substantial reworked Archean infrastructure, also alternatively reclassified as Archean, and sutured to adjoining Archean provinces by New Quebec, Torngat, Foxe and Dorset orogens respectively.

- A garland of BIF-rich Aphebian foreland foldand- thrust belts (2.0 Ga), including Labrador Trough and Belcher Belt, practically encircles Superior Craton. Helikian quartzite-redbed-rich epicratonic structures (1.7-1.5 Ga) are widely distributed across the province, including Athabasca, Dubawnt, Bathurst and Coppermine basins.

Bear and Southern Provinces

- *Bear Province:* The eastern boundary of this northwestern most province is a high-angle unconformity on basement rocks of Slave province.

- The overlying Aphebian metasedimentary-igneous rocks mainly represent 1.9-1.8 Ga juvenile crustal accretions collectively imprinted by the Wopmay (Hudsonian) orogeny (~-l.8Ga).

- *Southern Province:* This small but complex province is rich in Aphebian rocks but includes both Archean basement inliers and rift-induced Helikian (1140-1120Ma) volcanic rich cover.

- Restricted older Aphebian (2.5-2.2 Ga) off-craton thickening, tillite-bearing, quartzitic wedges are separated from more extensive younger Aphebian (2.2-1.8 Ga) sequences comprising thinner BIF-rich shelf facies and S-thickening, also BIF-rich, volcano-turbidite facies.

- The unique Ni-rich Sudbury Igneous Complex (Irruptive) (1.9-1.8 Ga) is of possible meteorite impact origin. The 250 km-wide, ENE-trending Penokean Fold Belt south of Lake Superior bears the imprint of the Penokean (Hudsonian) Orogeny (1.9-1.8 Ga).

Helkinian Province

- *Nain Province:* This small, mainly N-trending province to the northeast, is subdivided into three gneissic sub-provinces of distinctive structural trends, two of which contain large, discordant anorogenic anorthosite-adamellite intrusions.

- Two small adjoining Archean-rich segments on the Atlantic coast constitute the *Nutak domain*, *a* rifted correlate of the Archaean Block in Greenland.

- *Grenville Province (Belt):* This NE-trending province is 2000 km long and 300-600 km wide. The subsurface extension is at least as long again, reaching to Texas and even Mexico.

- The 4000 km long Grenville Front, on the northwest, one of Earth's great structural discontinuities, marks the junction of the belt with a variety of older Precambrian terrains.

- The Grenville Province represents an eroded orogenic belt distinctive for its widespread high grade metamorphism, complex deep level structures and abundant anorthosites. Grenville rocks carry a pronounced Grenvillian (1.0 Ga) imprint, attributed to collisional tectonics.

Main geologic outline and divisions of the North American Craton with Greenland Shield in pre-drift position