

OROGENIES AND TECTONIC CYCLES

NORTH AMERICAN CRATON¹ LESS GREENLAND SHIELD

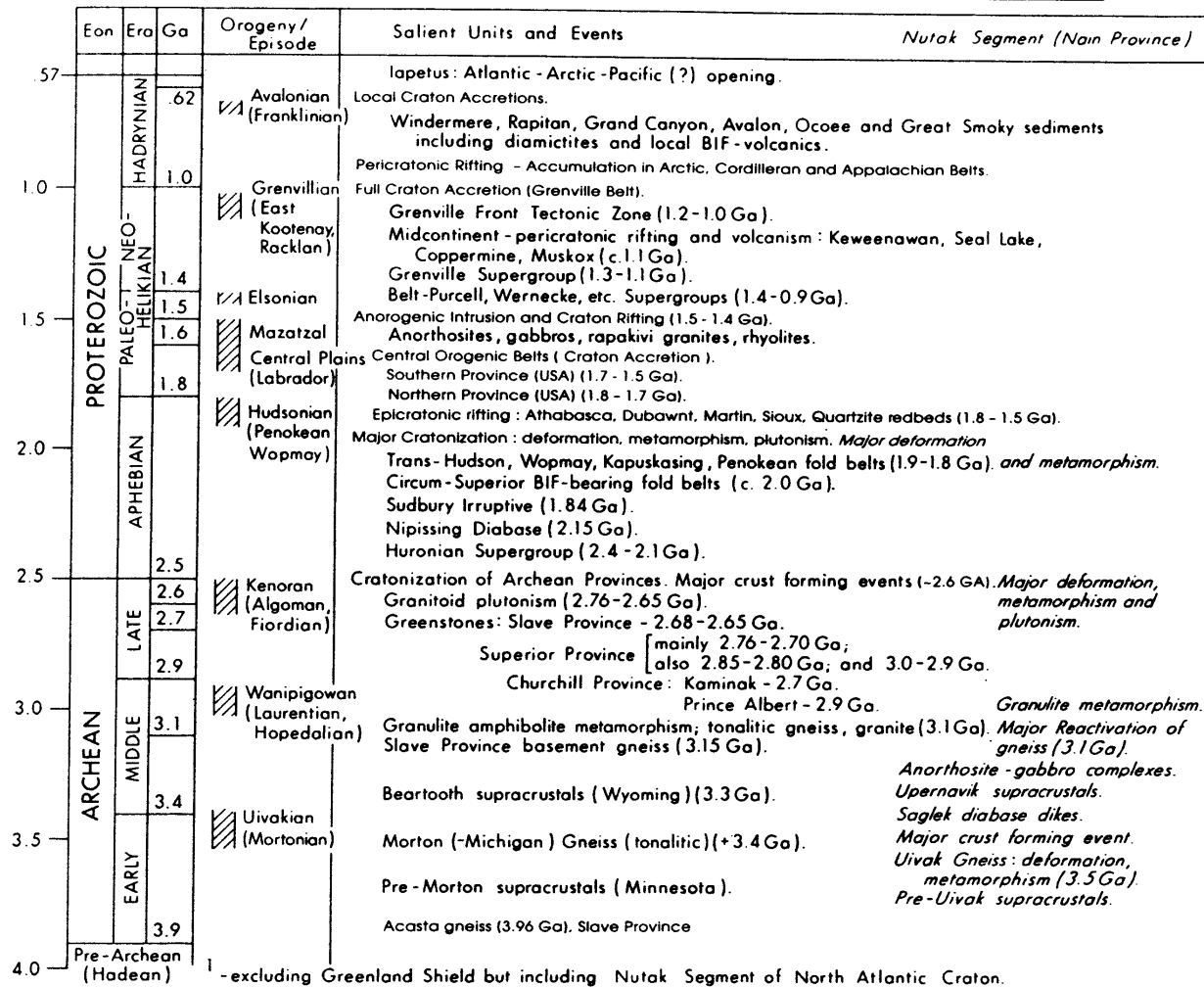


Fig. 1-3d(ii). Summary chrono-stratigraphic development of Precambrian crust of the North American Craton excluding Greenland Shield. Salient crustal units and events are arranged in relation to internal orogenies and resulting tectonic cycles.

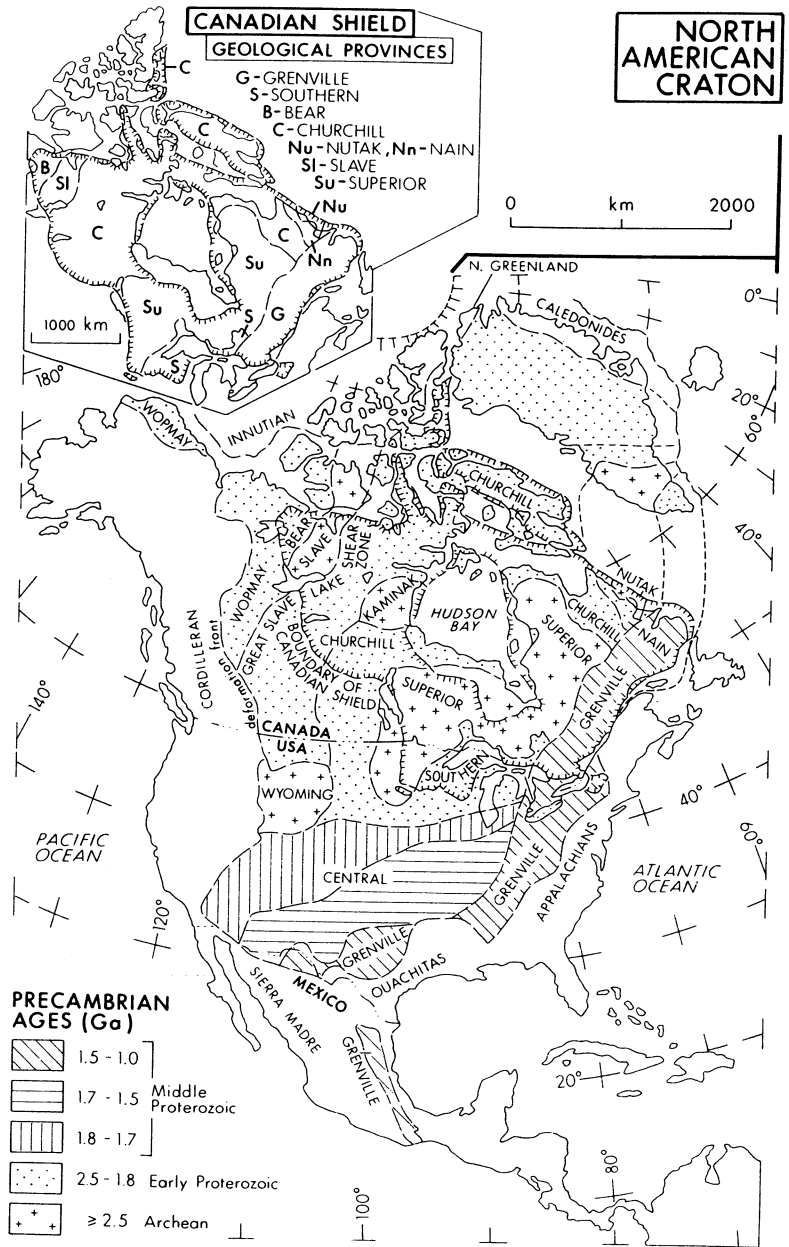








Fig. 1-5d(ii). Main geologic outline and divisions of the North American Craton with Greenland Shield in pre-drift position (Hoffman 1989, and published with permission of the author).

ARCHEAN SUBPROVINCE TYPE

-  Plutonic
 -  Volcanoplutonic
 -  Metasedimentary
 -  High grade gneiss
 -  Proterozoic, Phanerozoic rocks
 -  Subprovince boundary
- 300 km

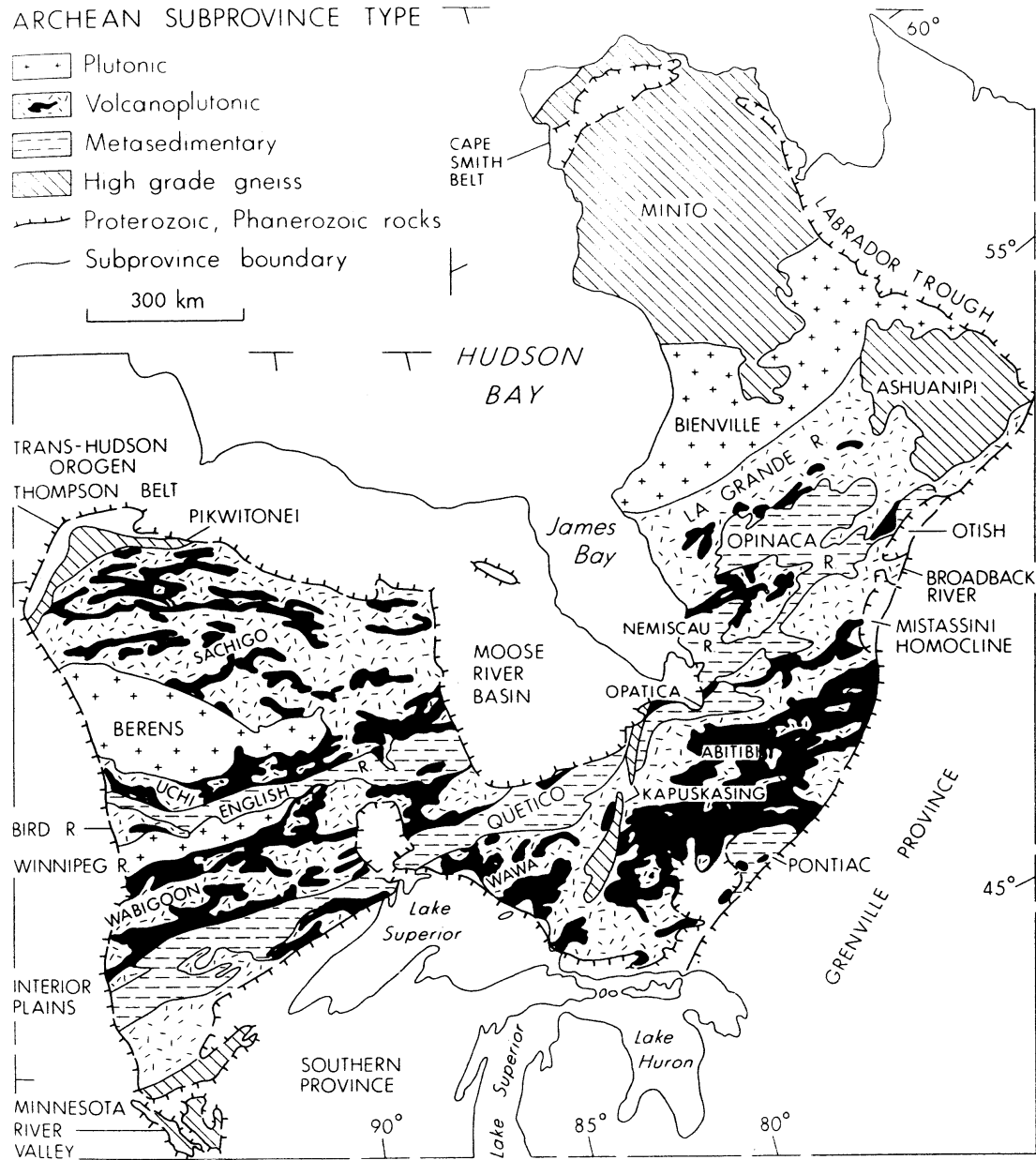


Fig. 2-5. Map of Superior Province showing volcanic-plutonic, metasedimentary-gneiss and plutonic subprovinces or superbelt and other subdivisions. (From Card, 1990. Published with permission of the author).

Table 2-6. Lithologic proportions of Archean crust in Superior Province, Canadian Shield.

Lithologic unit	(1) Ungava Domain (%)	(2) Western Superior Province ¹ (%)	(3) Average Superior Crust (%)
(1) Banded gneiss, granitic gneiss, migmatite	66	36	50
(2) Massive to slightly foliated granitoids	24	38	31
Tonalite-granodiorite	24	32	28
Granite-leucocratic	0.4	6	3
(3) Paragneiss, veined gneiss, migmatite	9	9	9
(4) Mafic to ultramafic intrusions	0.1	1	1
Metasupracrustal rocks	1	16	9
Volcanic rocks	—	11	6
(5) Sediments	—	5	3
Size of area (km ²)	498 000	~231 000	1 572 000

¹Weighted average of (a) Red Lake-Landsdowne, (b) Geotraverse and (c) Berens-Sachigo areas
Adapted from Goodwin (1978)

Table 2-7. Average proportions of metamorphic facies in Superior Province, Canadian Shield.

Metamorphic facies	Percentage of total area (1 572 000 km ²)
Granulite	22
Amphibolite	66
Greenschist	11
Subgreenschist	1
	100

Adapted from Goodwin (1985)

Ungava Craton

Our knowledge of this large region (498 000 km² extending from Hudson Bay on the west to the Labrador Trough on the east and from Cape Smith Bay on the north to East Main River (James Bay) vicinity on the south (Fig. 2-5), is based on reconnaissance studies (Eade 1966, Stevenson 1968) supplemented by recent local studies (Skulski et al 1984, Avramtchev 1985, Percival and Girard 1988, Percival et al 1992, 1994, Stern et al 1994). Bed rock geology is dominated by granitoid rocks of at least five plutonic suites, both foliated and massive

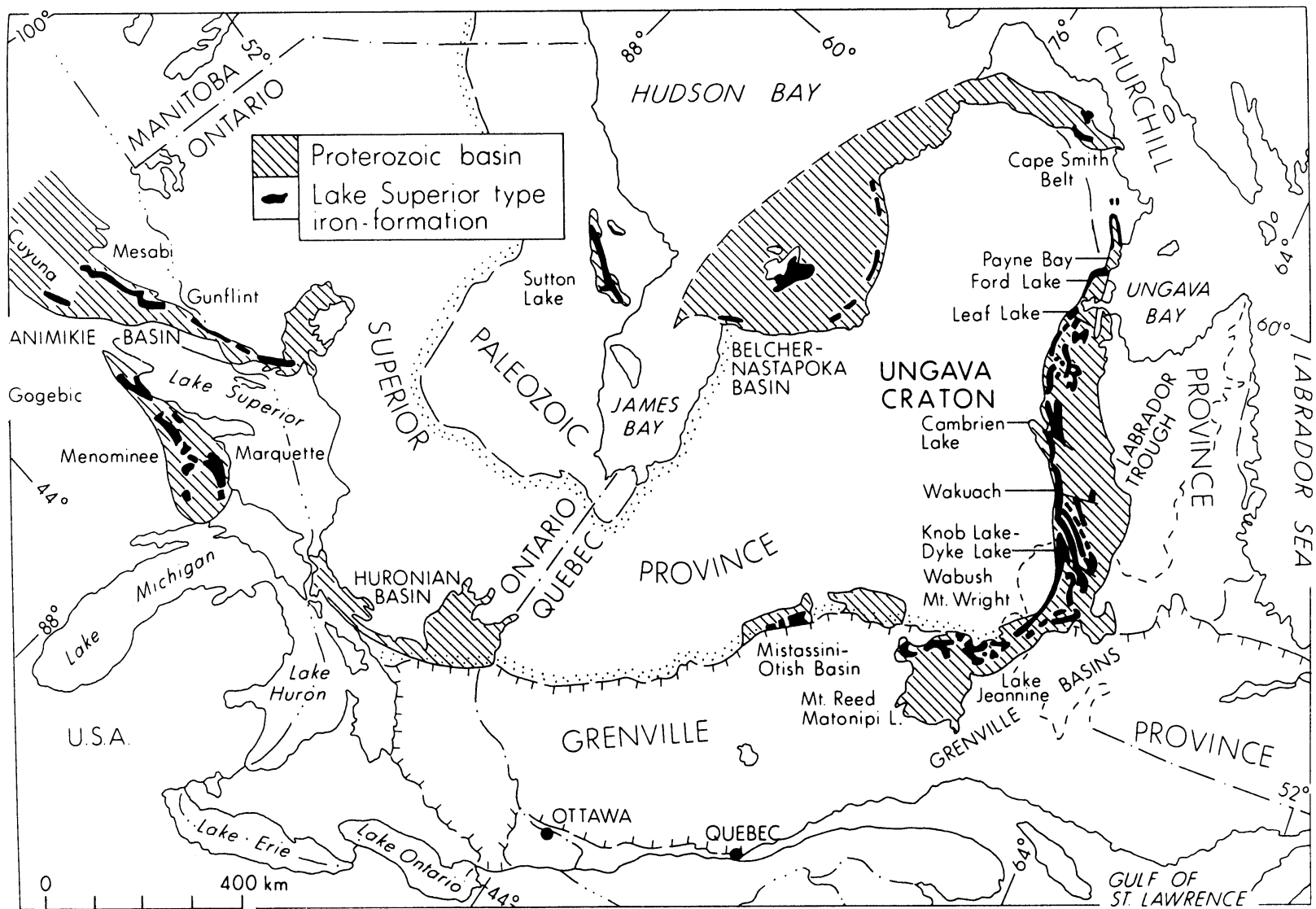


Fig. 3-8. General distribution of iron formation in early Proterozoic fold belts marginal to the Ungava Craton. (After Gross and Zajac 1983, Fig. 6-1, and reproduced with permission of the authors and of Elsevier Science Publishers).

MID-PROTEROZOIC CRUST

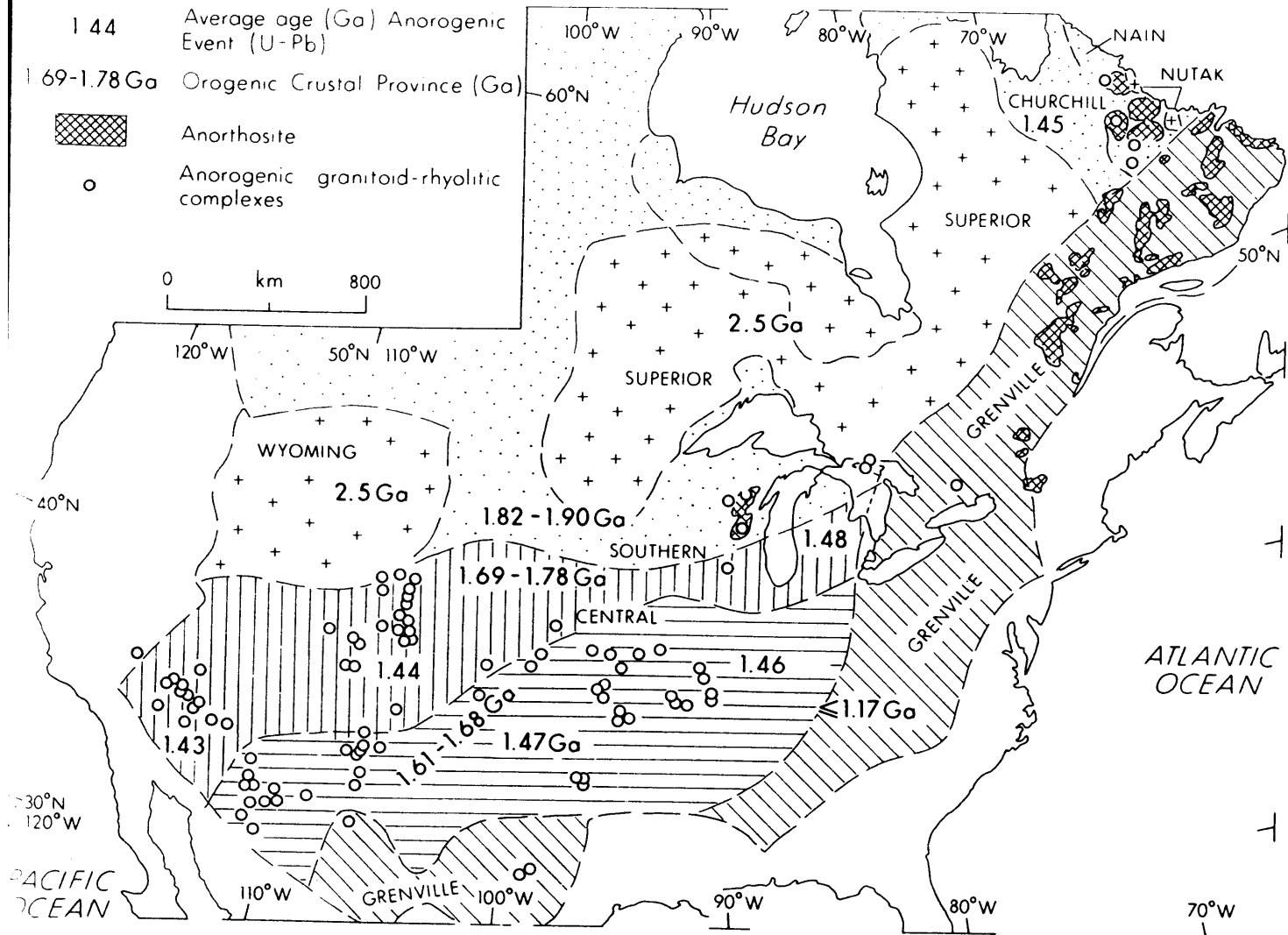


Fig. 4-7. Distribution of mid-Proterozoic orogenic provinces (Central Belts and Grenville Belt) and of anorogenic intrusions, (anorthosites and granitoid-rhyolitic complexes) in relation to older Precambrian subdivisions of North America. (Adapted from Anderson 1983, Fig. 1, and reproduced with permission of the author and of the Geological Society of America).

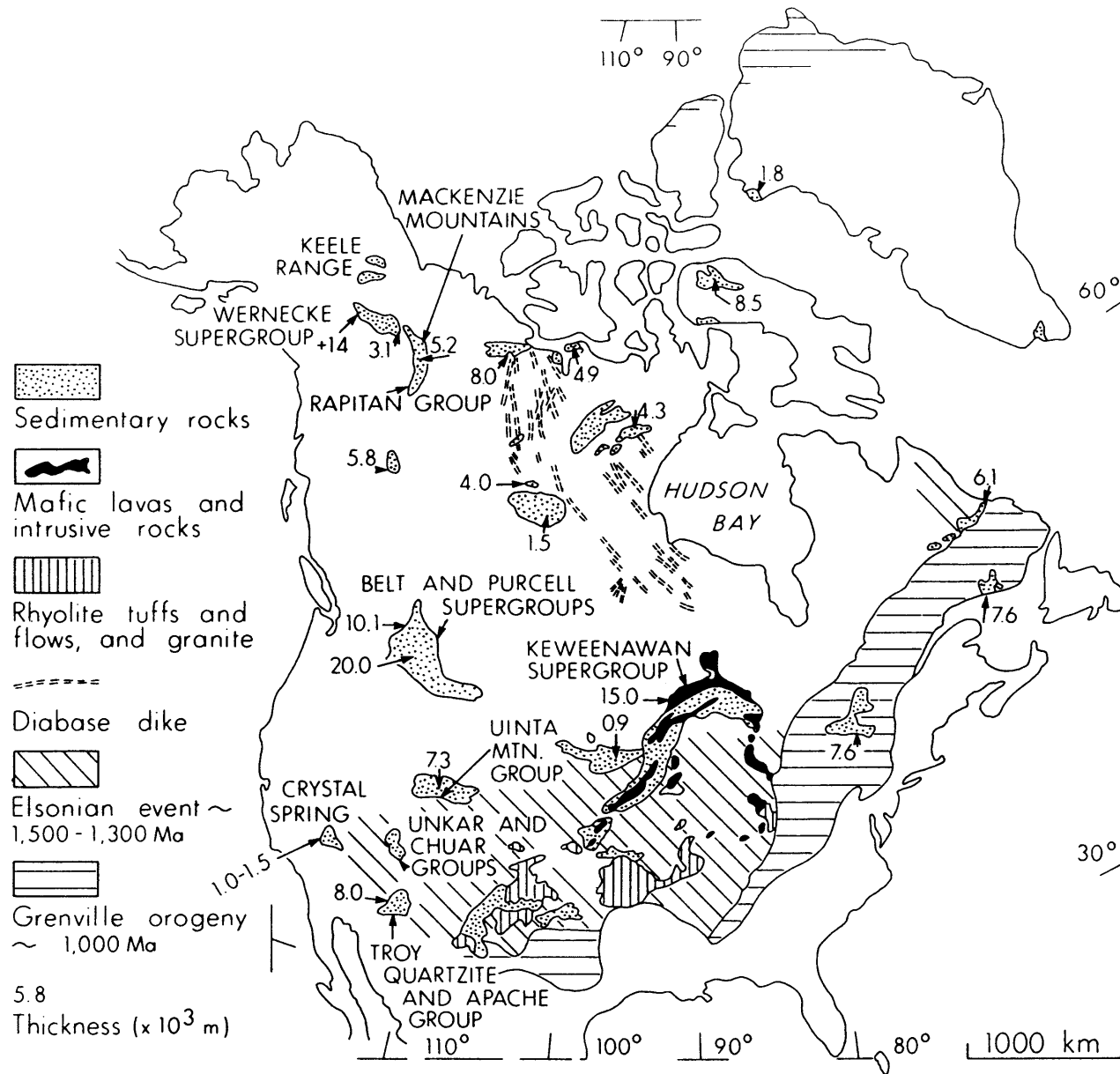


Fig. 4-11. Generalized distribution of mid to late Proterozoic rocks (1700–850 Ma) in the North American Craton. (From Stewart 1976, Fig. 1, and published with permission of the author).

NORTH AMERICAN CRATON (LESS GREENLAND SHIELD)

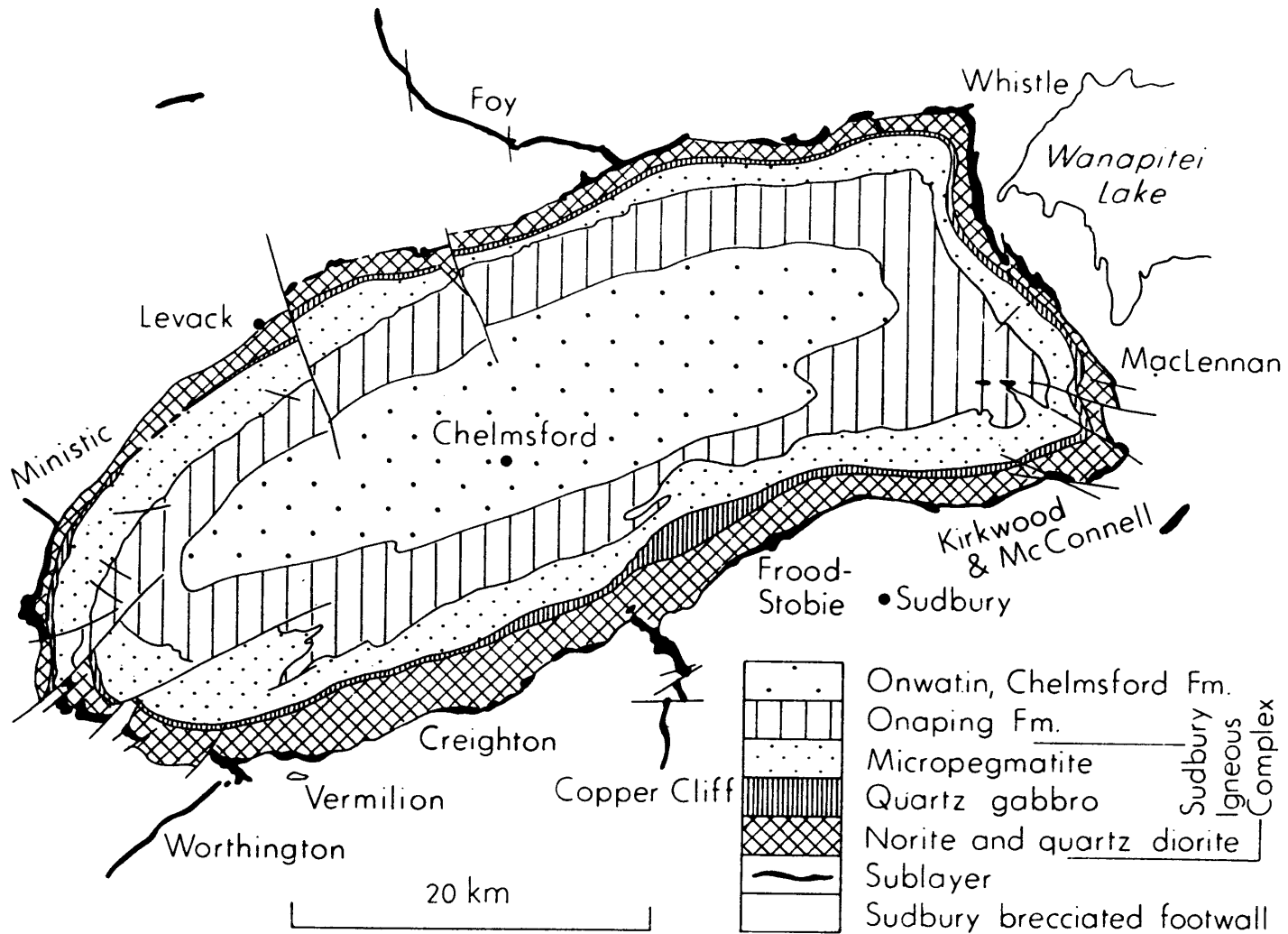


Fig. 3-5. Sketch map of the Sudbury Igneous Complex showing the distribution of the complex, sub-layer, brecciated footwall, and enclosed Whitewater Group. (Adapted from Grand and Bite 1984, Fig. 12.1. and reproduced with permission of the Ontario Geological Survey)

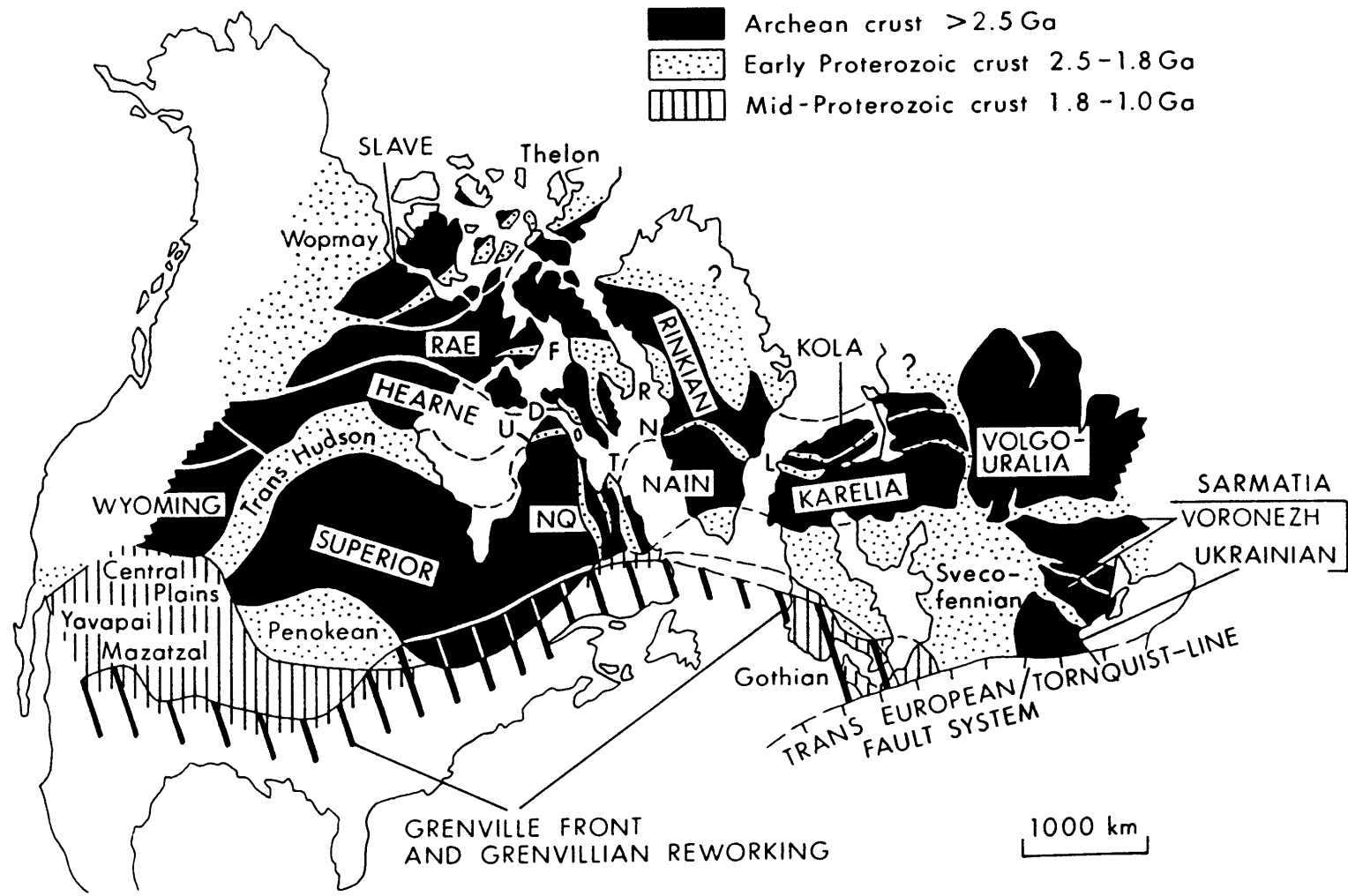


Fig. 3-2. North Atlantic Precambrian reconstruction showing pre-Grenvillian craton configurations as discussed in the text (after Gorbatshev and Bogdanova, 1993, Fig. 4). The letter symbols are: NQ – New Quebec; U – Ungava; D – Dorset; F – foxe; R – Rinkian; N – Nugsugtoqidian; T – Torngat; L – Lapland Granulite Belt.

SOUTH AMERICAN CRATON

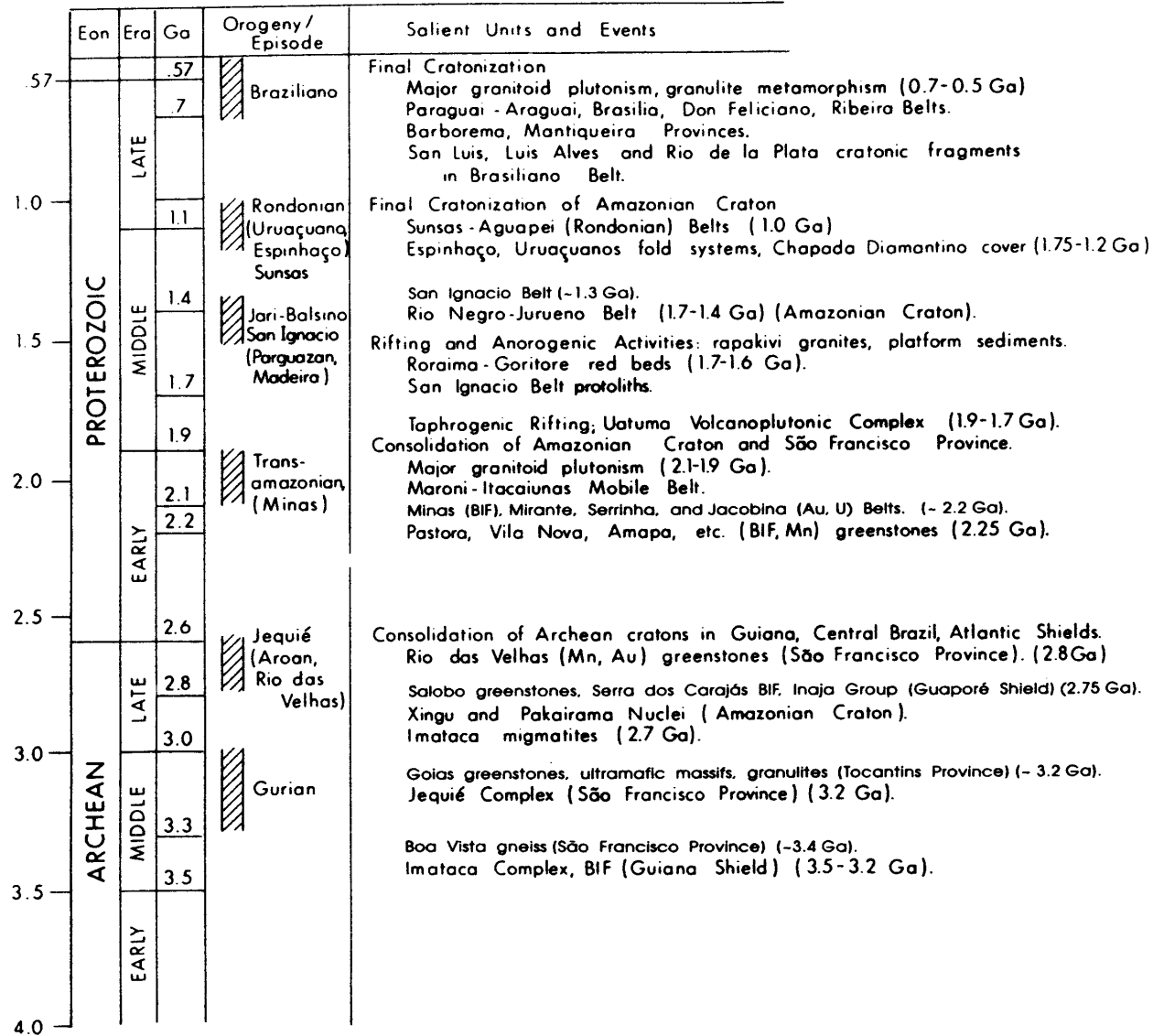


Fig. 1-3e. Summary chrono-stratigraphic development of Precambrian crust of the South American Craton. Salient crustal units and events are arranged in relation to internal orogenies and resulting tectonic cycles.

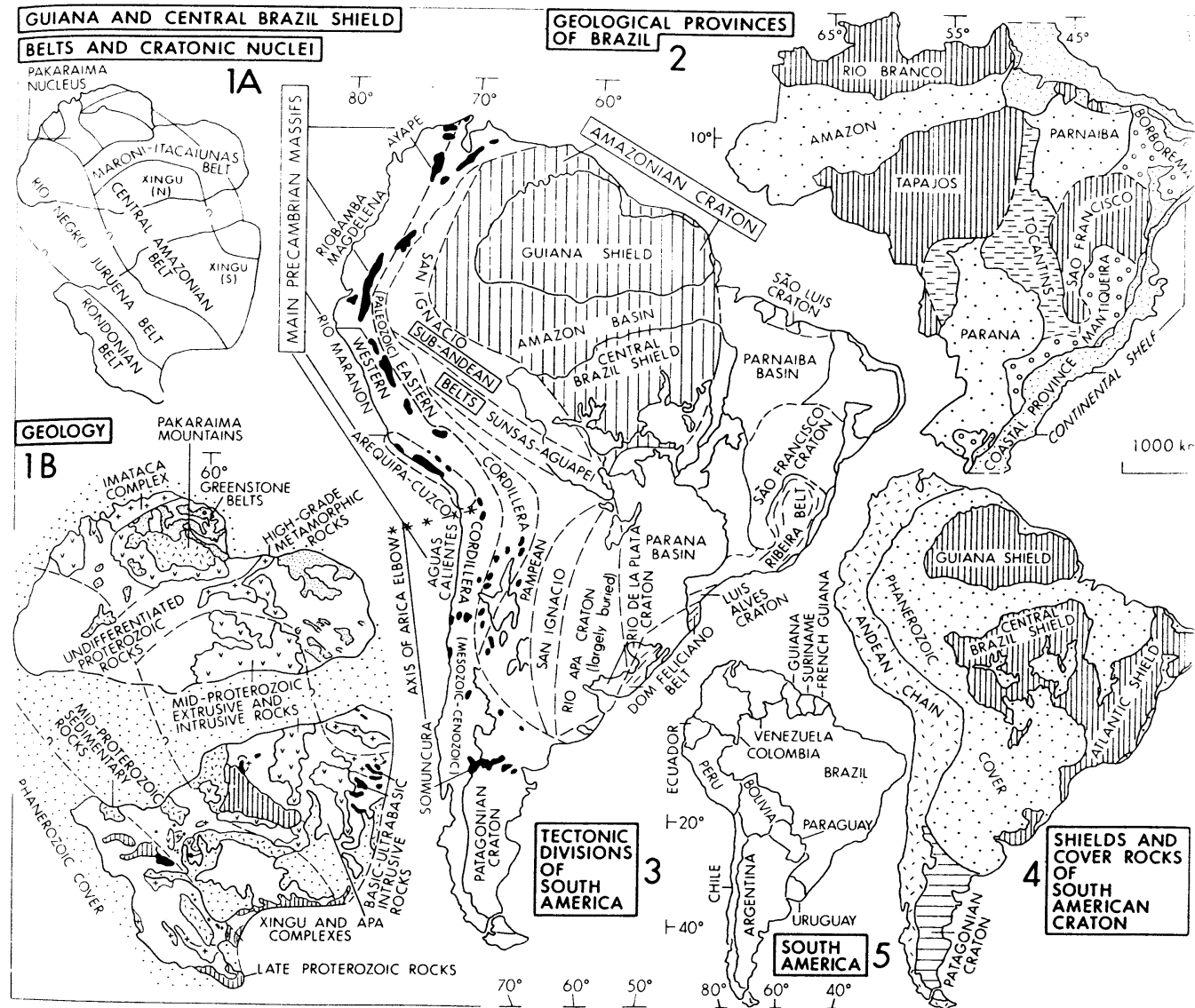


Fig. 1-5e. Main geologic outline and divisions of the South American Craton showing (1) Guiana and Central Brazil shields; (2) geologic provinces of Brazil; (3) tectonic divisions of South America; (4) shields and cover rocks of the platform; (5) political division of South America (adapted from Almeida et al 1981, Figs 1, 2, 3; Litherland et al 1985, Fig. 4; Gibbs and Barron 1983, Fig. 1; and Hasui and Almeida 1985, Fig. 2).

AFRICAN CRATON

(1) SOUTHERN AFRICA

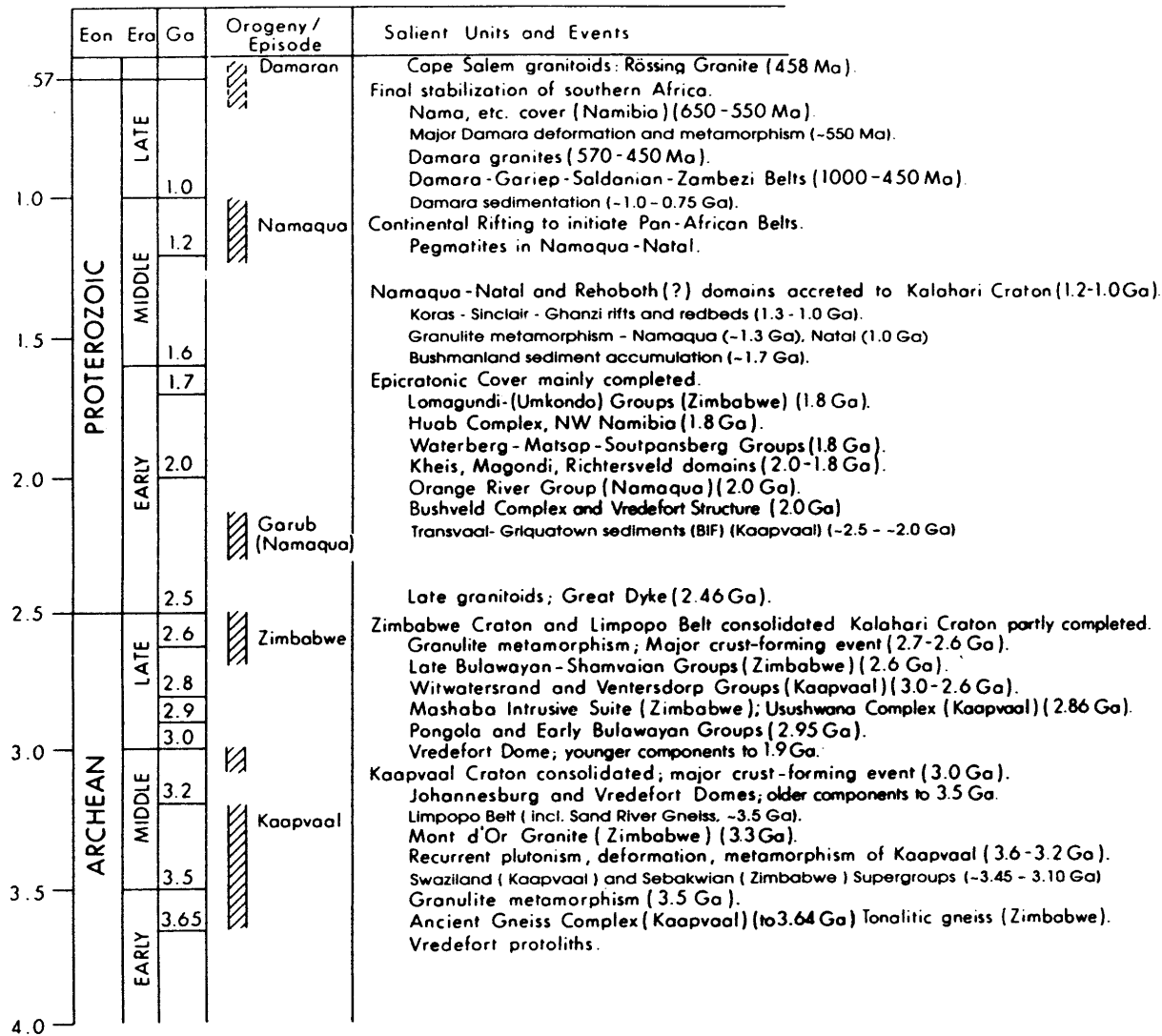


Fig. 1-3f(i). Summary chrono-stratigraphic development of Precambrian crust of the African Craton—southern Africa. Salient crustal units and events are arranged in relation to internal orogenies and resulting tectonic cycles.

AFRICAN CRATON

(2) CENTRAL - NORTHERN AFRICA

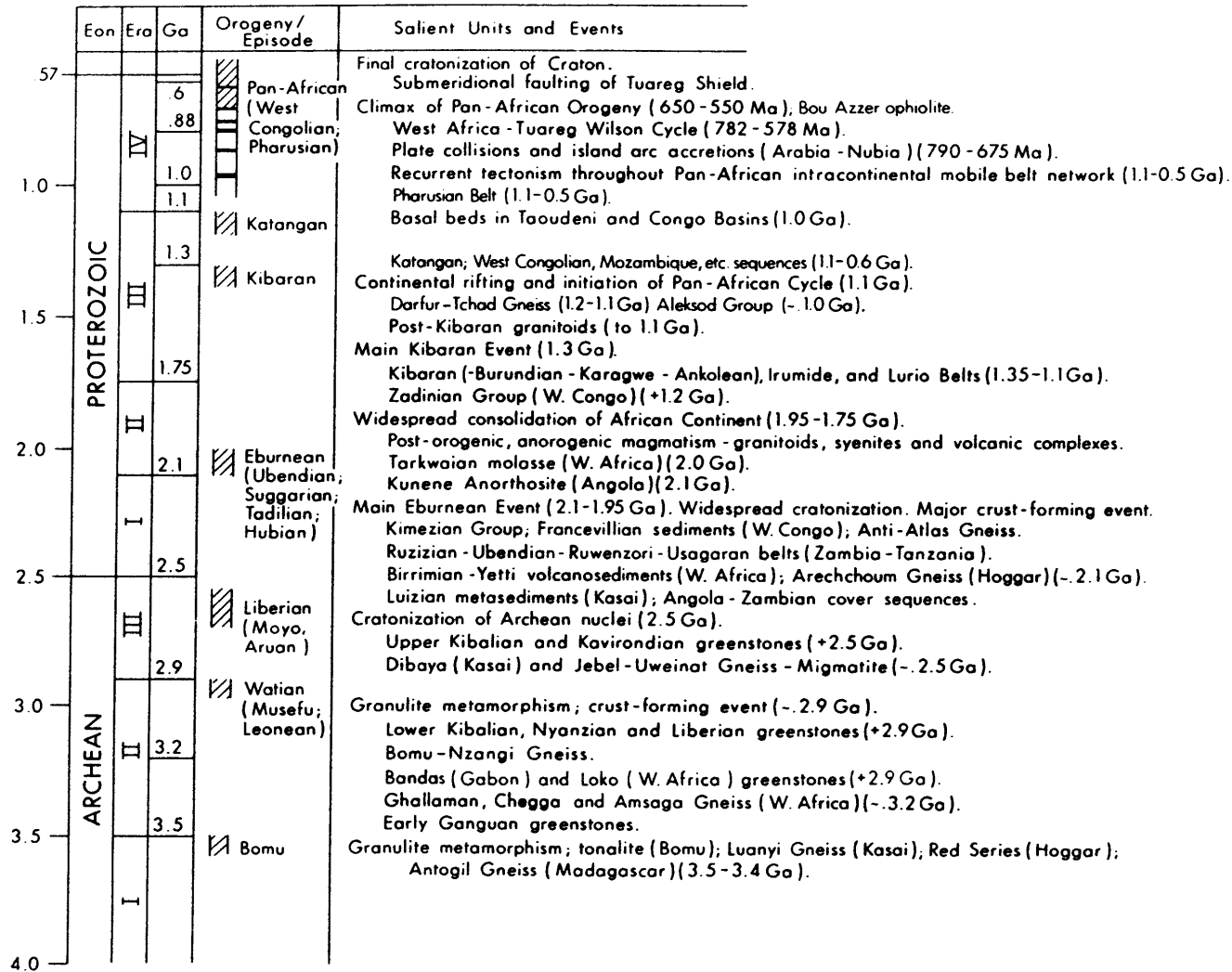


Fig. 1-3f(ii). Summary chrono-stratigraphic development of Precambrian crust of the African Craton—central-northern Africa. Salient crustal units and events are arranged in relation to internal orogenies and resulting tectonic cycles.

GENERAL GEOLOGIC DIVISIONS OF AFRICAN CRATON

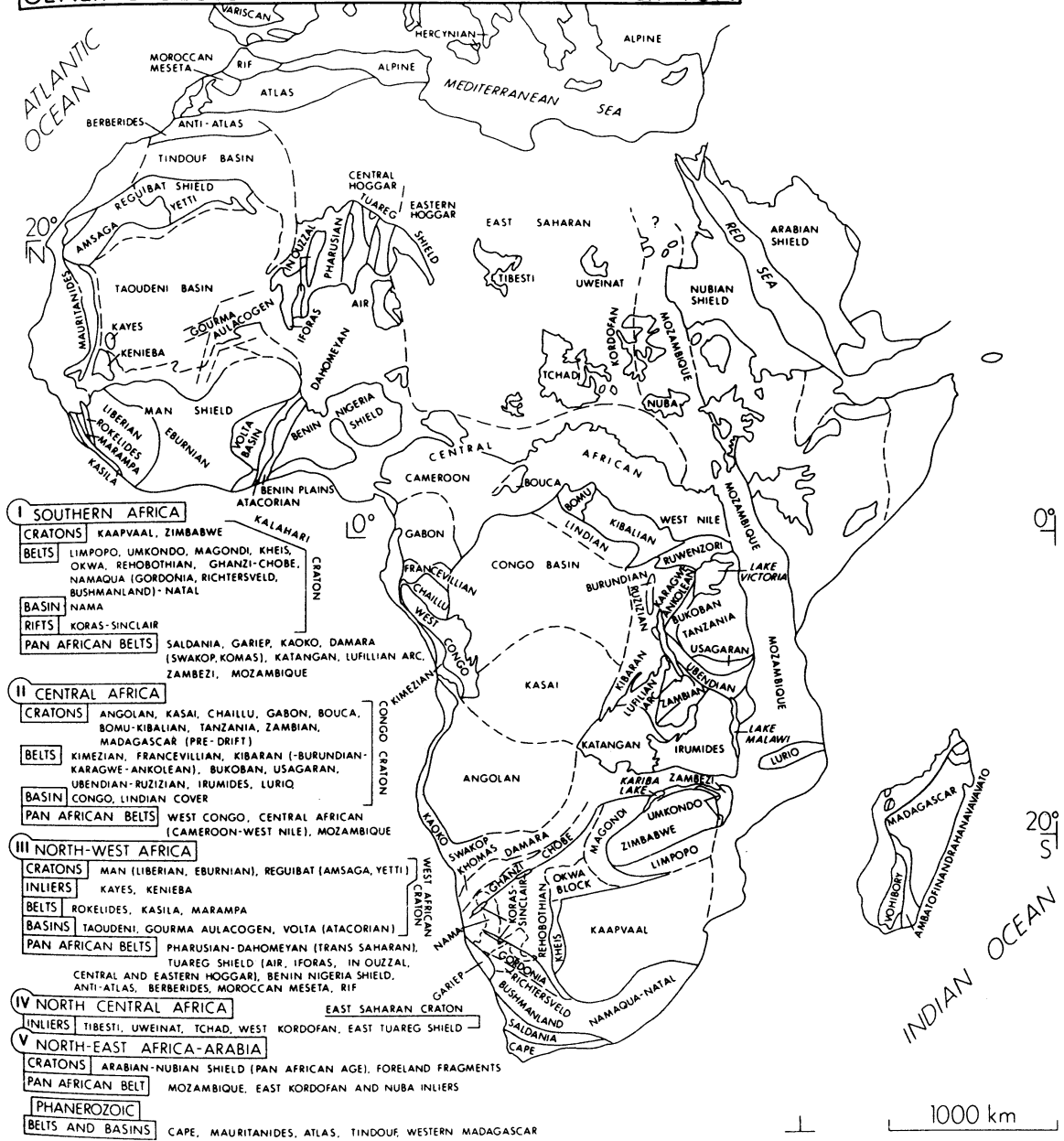
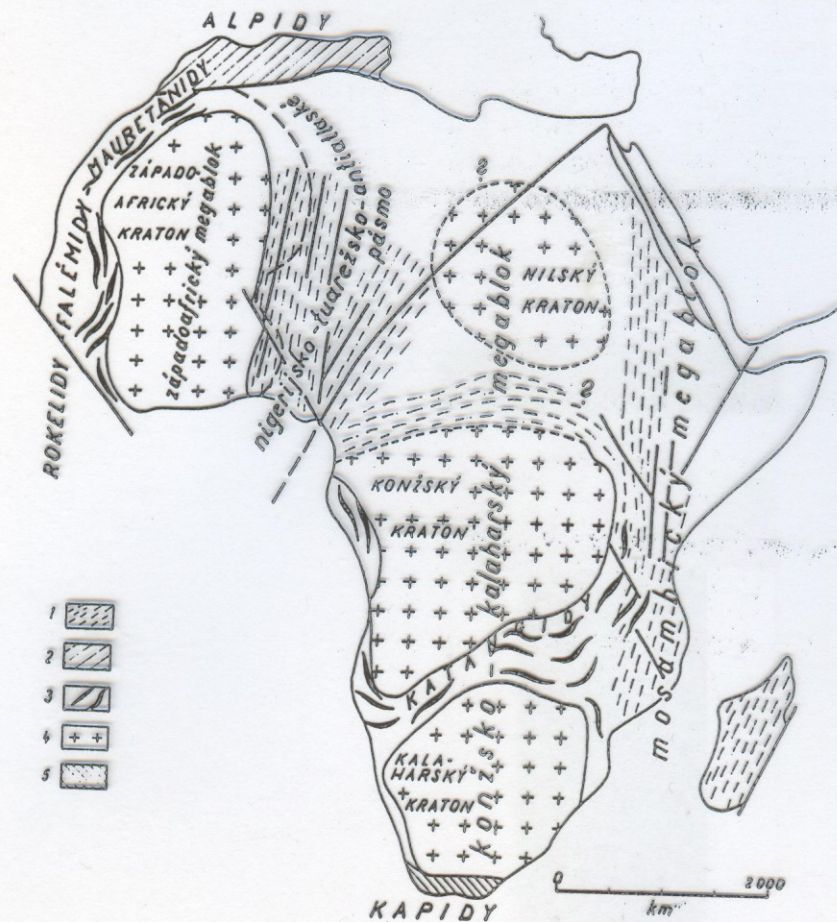


Fig. 1-5f(i)a. Main geologic outline of the African Craton showing general geologic divisions of Pre-cambrian crust (adapted from Saggerson 1978, Fig. 1).



198. Základní strukturální rozdělení Afriky. Upraveno podle různých pramenů. 1 - oblasti panafrické rejuvenace, 2 - alpidní struktury, 3 - svrchnoproterozoické struktury, 4 - starší (>1800 Ma) kratogenní jádra, 5 - kapidy.

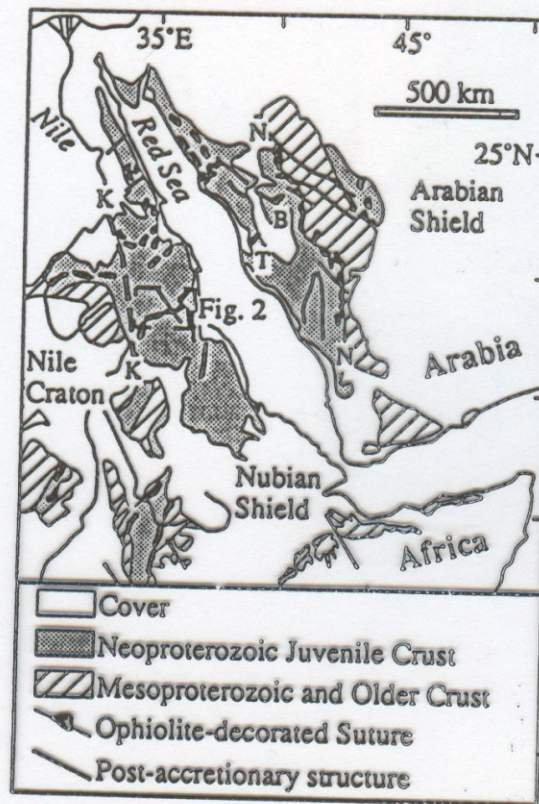


Fig. 1 Generalized geologic map of the Arabian-Nubian shield, showing the location of the Nakasib suture (inside *dashed box*, labeled Fig. 2) and related tectonic elements, as discussed in text. *Dashed line K-K* is Kerf suture. Continuation of the Nakasib suture in Arabia as the Bir Umq suture is also shown. *T* Thurwah ophiolite; *B* Bir Umq ophiolite. (Modified after Worku and Schandemeier 1996)

ANTARCTIC CRATON

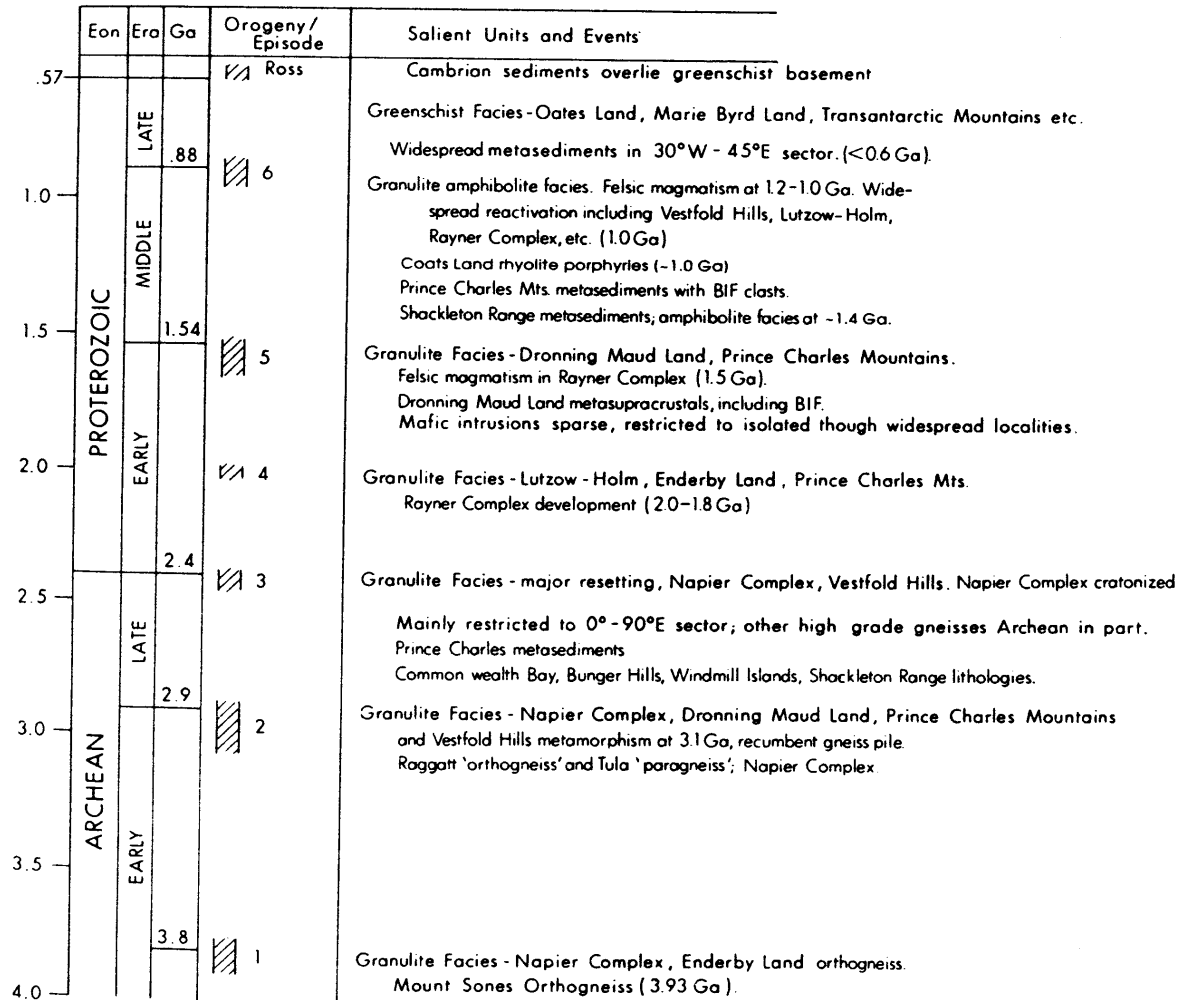


Fig. 1-3i. Summary chrono-stratigraphic development of Precambrian crust of the Antarctic Craton. Salient crustal units and events are arranged in relation to internal orogenies and resulting tectonic cycles.

ANTARCTIC CRATON

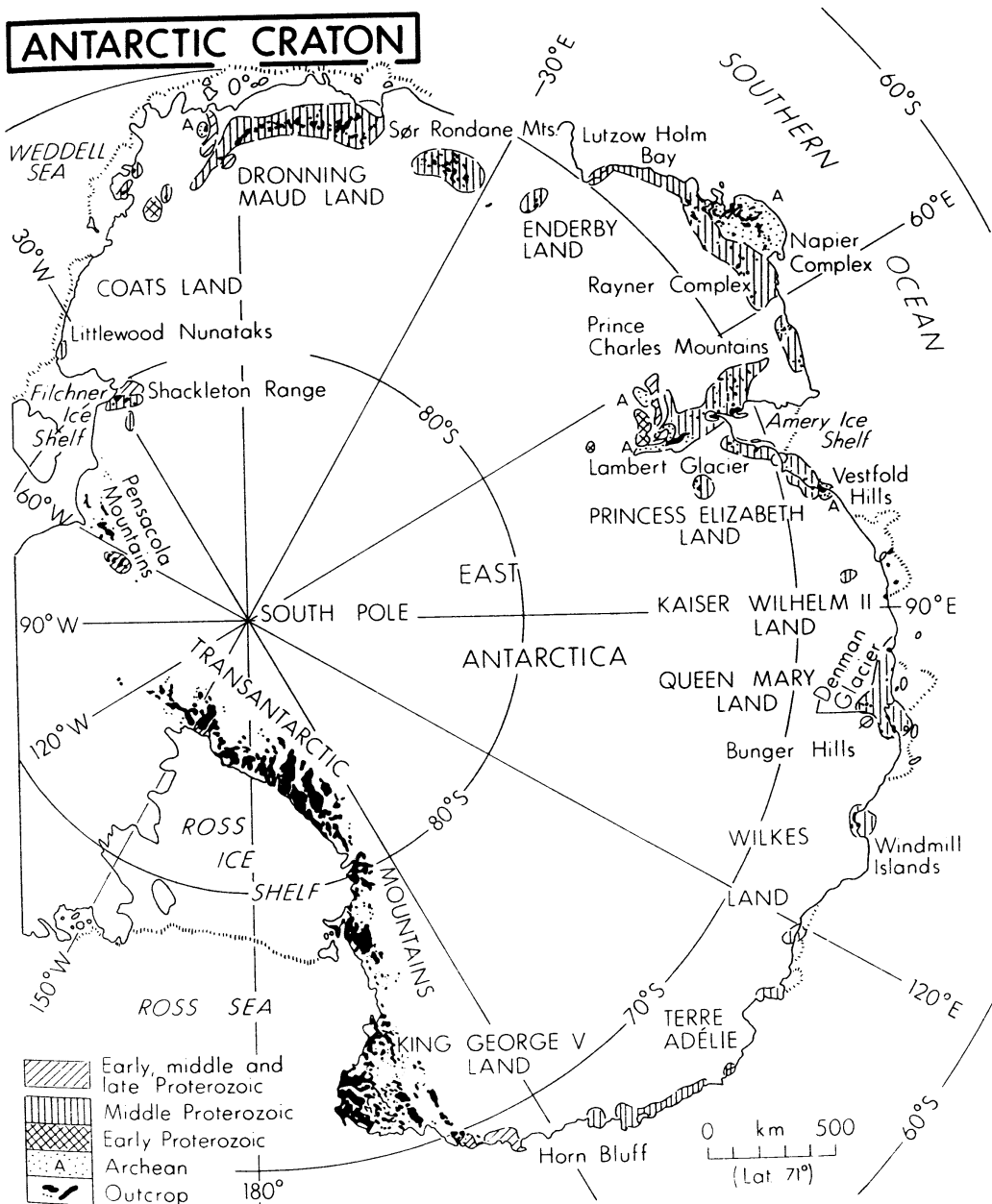


Fig. 1-5i. Main geologic outline and divisions of the Antarctic Craton (from James and Tingey 1983, Fig. 1).

AUSTRALIAN CRATON

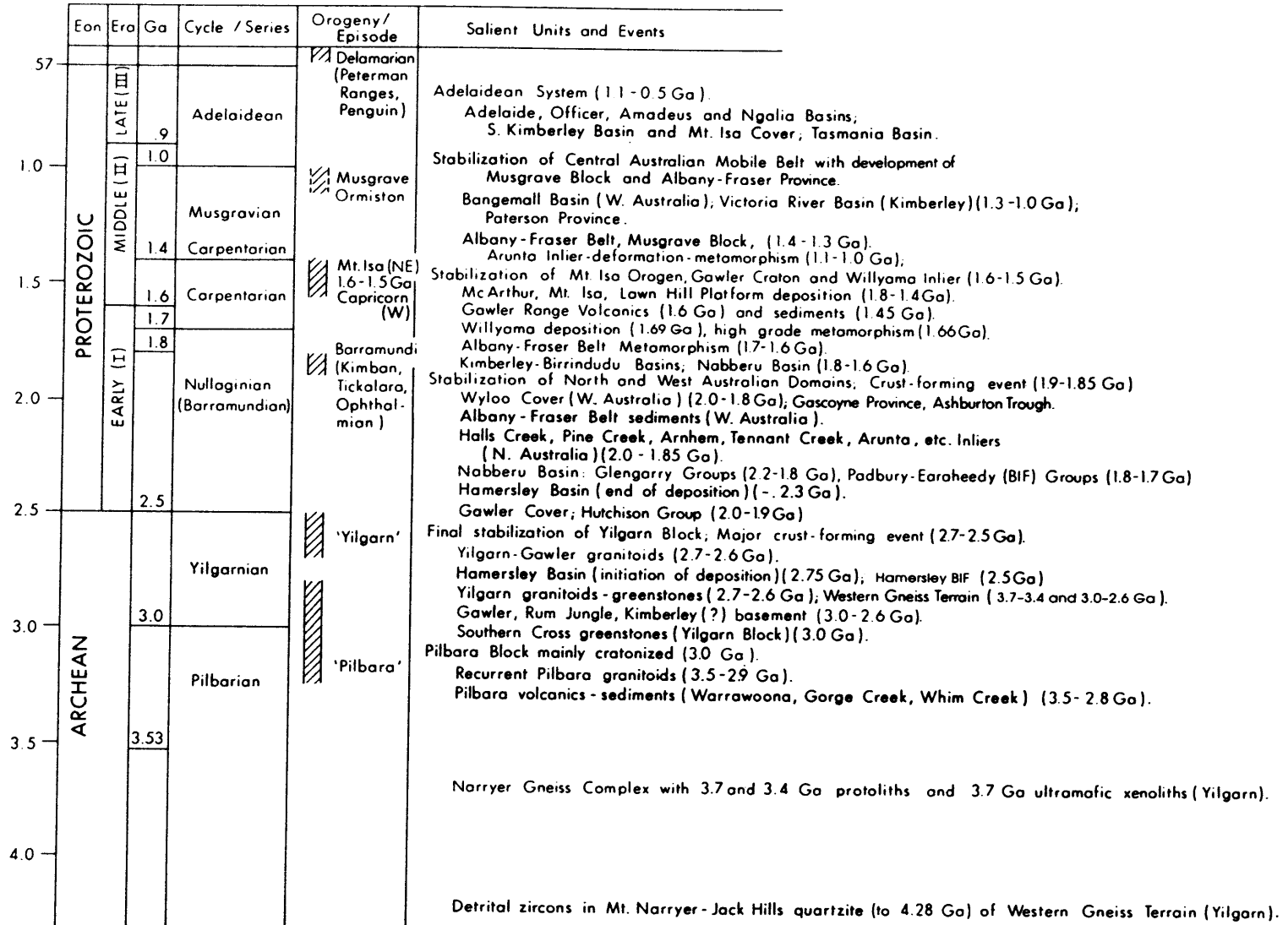


Fig. 1-3h. Summary chrono-stratigraphic development of Precambrian crust of the Australian Craton. Salient crustal units and events are arranged in relation to internal orogenies and resulting tectonic cycles.

CATHAYSIAN CRATON

Eon	Era	Ga	Cycle / Series	Orogeny / Episode	Salient Units and Events					
PROTEROZOIC	LATE	85	Sinian	Jinningian (Yangtze)	Widespread Sinian Cover: lower clastics with tillites; upper argillites-carbonates. Start of Yangtze Platform Cover. Final consolidation of Yangtze Craton and northern margin of Tarim Craton. Jixian Uplift.					
			Qingbaikou			Sibaoan (Wuling)	Arc-trench volcanics; turbidites, ophiolites along SE Yangtze Craton. Platform sediments in northern regions Partial cratonization of Yangtze Craton. Profound organic changes. Luanxian Uplift. Arc-trench volcanics; turbidites, ophiolites along SE Yangtze Craton.			
		1.0	Jixian	Dongan	Aulacogens with clastic-volcanic fill on Sino-Korean and Tarim Cratons. Qinglong Uplift. Stable sedimentation in northern regions.					
			1.4			Changcheng				
	EARLY	MIDDLE	1.85	Hutuo	Luliangian (Zhongtian)	Final consolidation of Sino-Korean and main Tarim Cratons. Consolidation of Sichuan, etc. massifs of Yangtze Protocraton. Pronounced orogenesis; widespread metamorphism and plutonism. Hutuo (Liaohe) shelf sediments, volcanics; inc. redbeds.				
				2.0			2.2	Wutaian	Cratonization of Sino-Korean Craton. Folding, metamorphism, plutonism. Wutai volcanics-turbidites with BIF.	
							2.5			Wutai
		2.5	LATE	2.9	Fuping	Fupingian	Consolidation of Protocontinents. Formation of Ordos and Jilu Nuclei. Granulite-amphibolite facies; migmatites; granitoid plutonism (2.6-2.5 Ga). Badaohe, Dantzi, Dengfeng etc. supracrustals(2.5 Ga). Taihua gneiss (2.8 Ga).			
					3.0			Qianxi	Qianxi (Songyang)	Granulite metamorphism; migmatites; granitoid plutonism. Qianxi, Fuping, etc. supracrustals (2.7-2.9 Ga).
								3.5		
3.5	EARLY	4.0	Tsaozhuang	Tsaozhuang						

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

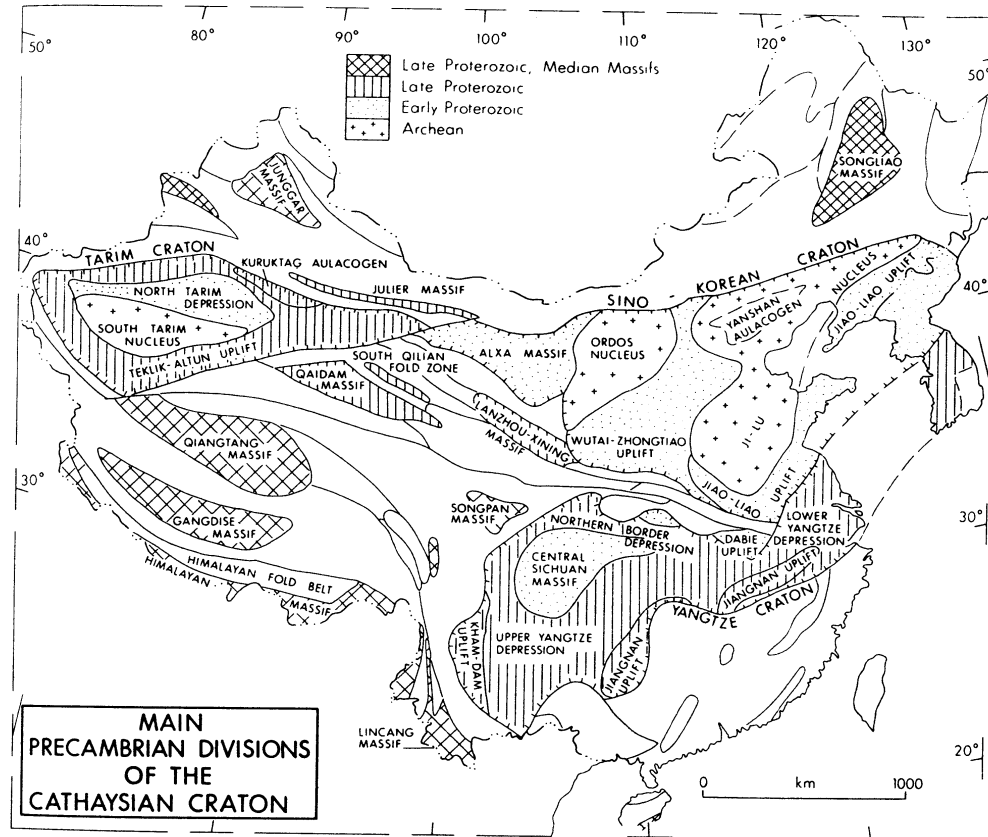
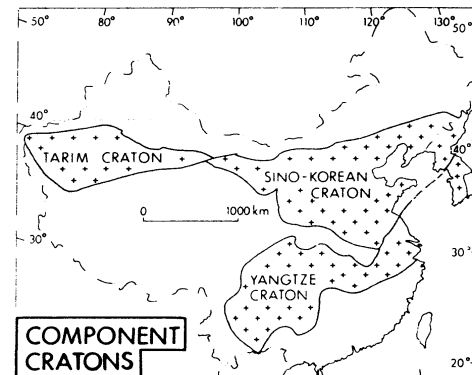


Fig. 1-5a. Main geologic outline and divisions of the Cathaysian Craton showing craton outline, main geologic features, and relevant political and geographic divisions (adapted in part from Atlas of Palaeogeography of China, 1985, Map 141).



SIBERIAN CRATON

	Eon/Era	Ga	Cycle/Series	Orogeny/Episode	Salient Units and Events
57	LATE PROTEROZOIC	.56		Baikalian	Ultramafic-alkaline intrusions; kimberlites. Tillites; carbonate-pelite sequences; flysch and mixtites; Ediacara-type metazoa. Final consolidation of full platform with addition of peripheral massifs and fold belts. Local granitoids.
		.65	Vendian		
		.68	Kudash		
		1.0	Karataevian		
1.0		1.40	Yurmatinian		
	RIPHEAN	1.65	Bourzianian		Major subsidence and vast platform cover (Platform stage): cyclically alternating psammite-carbonate-pelite deposits. Thick deposits in peripheral geosynclines, sites of future fold belts.
1.5					Ulkan Laccolith (alkaline granitoid) (1.65 Ga). Aulacogen stage: clastics and bimodal volcanic fill. Craton border rifting with development of major pericratonic fold belts
	EARLY PROTEROZOIC	1.95	Akitkan	Stanovoyan	Final consolidation of main craton: thick, extensive crust. Stanovoy Fault (1.9 Ga); granitoids; retrogression. Extensive reworking and metamorphism of belt network across the platform; local granulite metamorphism.
2.0			Oudokan		
	ARCHEAN	2.6		Aldanian	Epicratonic rifting with bimodal volcanic red-bed fill; including Oudokan-Kodar and Ulkan Troughs (to 1.9 Ga). Epi-Archean Platform Consolidation: Granitoid intrusion and granulite facies metamorphism (2.6-2.5 Ga). Gneiss terranes and greenstone belts (2.96 Ga). eg. Aldan and Stanovoy Domains. Anabar Gneiss. Aldan mafic gneiss (3.2 Ga). Gneisses of Onotsk Graben, Sayan Province (3.2 Ga). Sayan greenstone belts (+3.2 Ga). Granulite facies metamorphism (3.4 Ga) (Omolon Massif). Aldan basement gneiss (3.4 Ga).
2.5			Subgan		
3.0		2.9			
		3.2	Aldan		
	KATARCHEAN	3.4		Omolonian	
3.5					
4.0					

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

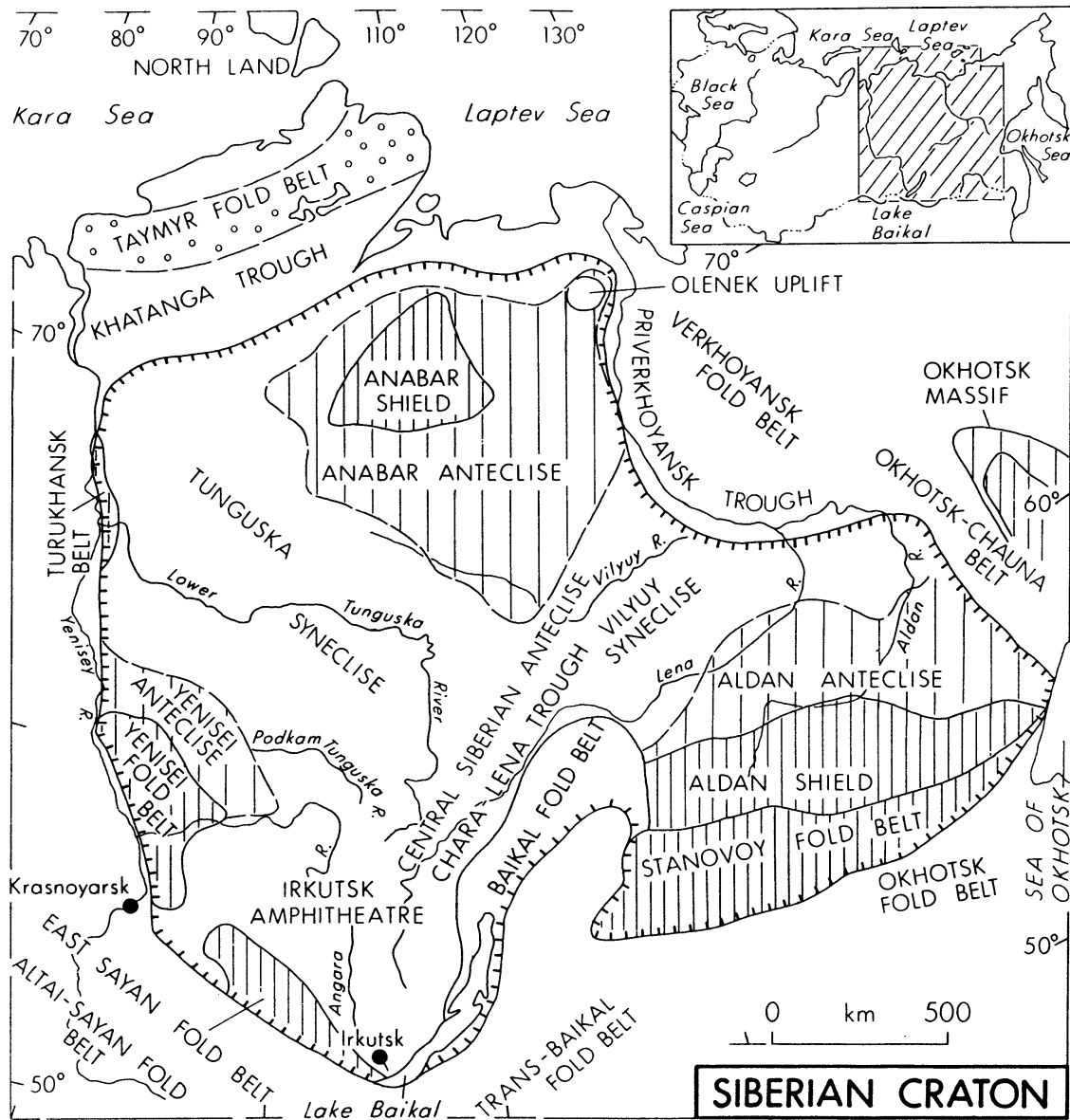


Fig. 1-5b. Main geologic outline and divisions of the Siberian Craton showing the main positive elements (exposed shields, fold-belts and adjoining anteclines) and negative elements (buried synclises and troughs) (adapted from Salop 1977, Fig. 6 and Shatzki and Bogdanoff 1961, Fig. 1).

INDIAN CRATON

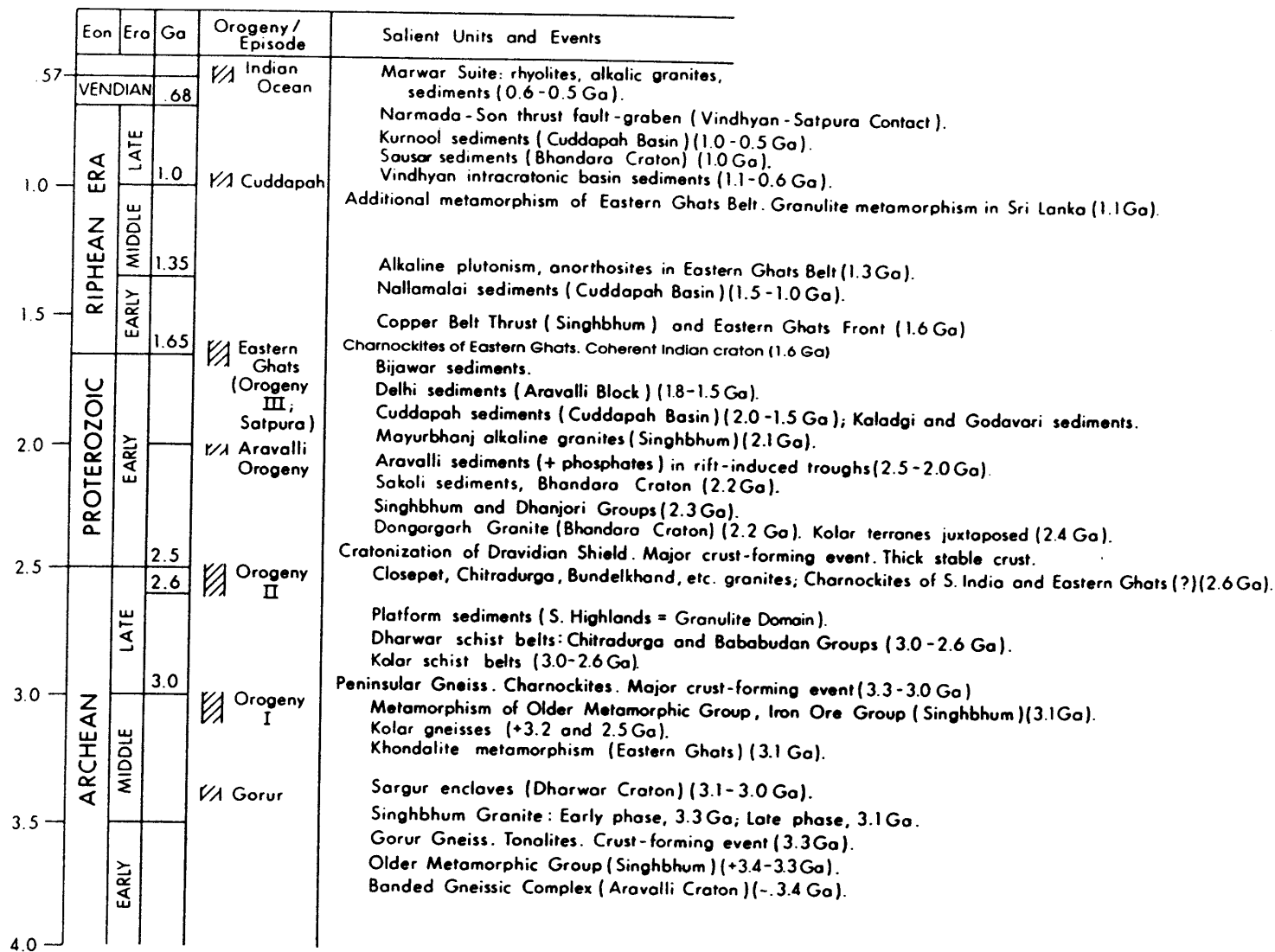


Fig. 1-3g. Summary chrono-stratigraphic development of Precambrian crust of the Indian Craton. Salient crustal units and events are arranged in relation to internal orogenies and resulting tectonic cycles.

