k34 Evidence of supercontinents < five >

> A futurist, or an art critic, can comfortably spend a lifetime making judgments without the reality checks that confront [an exploration geologist,] a doctor, [a] scientist, or [a] business investor.
> —Drazen Prelec, 2004.[2]

We know that the continents today are fleeing fragments of an early-Mesozoic supercontinent called *Pangea*. The continental fragments did not separate from each other at one moment: Australia and Antarctica separated (with the opening of the Southern Ocean), began 40 Ma; Greenland and Eurasia separated (with the opening of northern North Atlantic), began 60 Ma; North America separated ending the existence of Laurasia (with the opening of the Labrador Sea), stalled 40 Ma, began 75 Ma (***Figure k34.1***). India (now one with Asia having run its course) separated (with the opening the Indian Ocean), began 130 Ma; South America had separated (with the opening of the South Atlantic), began 140 Ma; Madagascar had separated (with the opening of the Mozambique Channel), stalled 110 Ma, began 160 Ma ending the existence of Gondwanaland. The continents Laurasia (comprised of Florida and the former North Laurasia and South Laurasia realms of Pangea) and Gondwanaland (a former realm of Pangea that contained Florida-to-be) came to be 180 Ma with the opening of the southern North Atlantic that ended the existence of Pangea.

Significantly, in the oceans opening between these fragments, subduction has nowhere begun. Without examples, a mystery exists as to what initiates subduction. As what has separated is not what formerly joined, an inference is that, great displacement, transcurrent (transform) faulting, intervenes before subduction begins. Such faults, with a shift of stress in the lithosphere, could become the subducting or, the less common, obducting edge of a plate.

Pangea had a longevity (the time between first deep-ocean opening crack and last crunch that closed prior deep-oceans) of ~40 My. Its early Triassic completion was by the Ural-Mongolian foldbelt forming collisions between Uralian, Kazakhstania and Siberia paleocontinents [3] against its already coalesced Southern Laurasia and Gondwandland realms. These two realms were the separate former: paleoterranes Avalonia and Piedmont-Gander-Dunnage, and paleocontinent, Laurentia and Gondwana. The Gondwana paleocontinent (***Figure k34.2***), in separate existence for some 300 My, had been put together by 530 Ma by the Pan African orogeny from protocontinents that prior

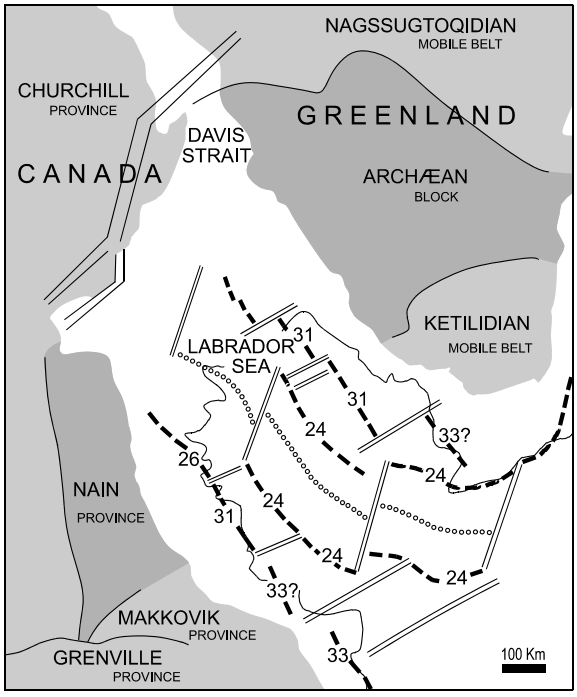

*Figure **k**34.1* [4] Map shows the details of seafloor spreading between Canada and Greenland that ended 40 Ma and had begun by fragmentation that began 75 Ma. Continental crust out to the -500 meter contour is shaded gray. The Nain province and Archean block were formerly a single fragment of an Archean shield that stabilized 2.5 Ga.

A -3000 meter contour line in the Labrador Sea is shown by a thin line. The line of open circles is the extinct seafloor spreading center. Thick dashed lines are seafloor spreading anomalies with identified epoch numbers.

Anomaly 31 = 67.7 Ma.

orogenies (***Figure k34.3***) had sutured. Similarly, paleocontinents Laurentia, Paleobaltica, and Paleosiberia, had shields that Proterozoic orogenies put together from more ancient terrains.[5]

The margins of all these paleocontinents, as Late Proterozoic geosynclinal sediments that first began to accumulate on their shield margins record, came into being by the breakup of a prior supercontinent called *Rodinia*. Two fragments of Rodinia, called *East Gondwana* and *West Gondwana*, evidently continued to add to themselves 0.6-0.8 Ga as orogenies record in the now shield rocks of South America, Africa,[6] and Asia. In that same interval, another broken-free fragment of Rodinia, called *Laurentia*, began to accumulate passive margin sediments 0.76 Ga. Rodinia could have had only the briefest existence as a supercontinent 0.87 Ga if it ever was whole (***Figure k34.4***). Its older parts had been assembling 0.8-1.0 Ga as once orogenies record in the now shield rocks of North America and Europe. A prior continent that joined, John Rogers has called *Nena*.[7] This had broken free 1.5 Ga from *Columbia* that an accordance of orogenies 1.8 Ga indicates. For that same supercontinent, Fortey has floated the name *Suessia* to honor (lest we forget!) the great geological synthesizer of yore.[8] As for the existence of older supercontinents? The magmatic, metamorphic, detrital and xenocrystic congregation (reported from North America) of 2.0-2.5 Ga ages, has a pattern that, for Lawrence Aspler and Jeffrey Chiarenzelli, suggests dispersal beginning ~2.1 Ga following climax aggregation.[9] For that supercontinent, Harold Williams in 1991 proposed the name *Kenorland*.[10] The climax aggregation of ages ~2.65 Ga. (reported from southern continents) suggest an older supercontinent again. For it, Ian G. Stanistreet in 1991 proposed the name *Zimvaalbara*.[11] No earlier supercontinents are evidenced although 3 Ga existed a first continent, which has been named (what else?) *Ur*. ❑

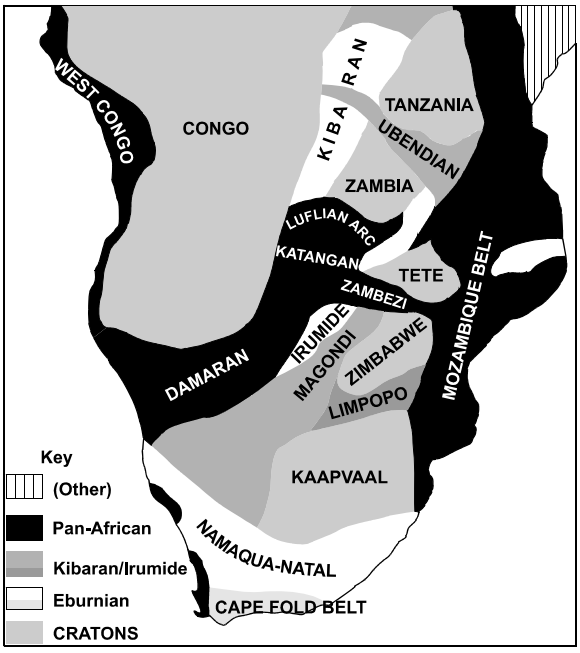

Figure k34.3[12] The patched together "crazy quilt" pattern of cratons and orogens that comprise the African shield (southern portion shown here).

Figure k34.4[13] **Times of the existence of supercontinents** (vertical gray bars). The once existence of Pangea is known from many lines of geological evidence. Rodinia and the three older named supercontinents are inferred mostly from the frequency distribution of U-Pb zircon ages of shield rocks in South America, Africa and Asia (thick line), and North America and Europe (thin line).