k1 Precambrian time < a dearth of visible fossils >

> -- and some rin up hill and down dale, knapping the chucky stanes to pieces wi' hammers, like sae mony road-makers run daft -- they say it is to see how the warld was made!
> —Sir Walter Scott, *St. Ronan's Well*, 1824; The Guest.[1]

The principle of superposition has proven reliable for ordering and allowing for correlation of strata of the Phanerozoic. "Upon the leaves of that stone book are, as you know, stamped the characters [macro-fossils], plainer and surer than those formed by ink of history, which carry the mind back into the abysses of past time compared with which the period which satisfied Bishop Butler [2] cease to have visual angle," observed John Tyndall in 1874.[3] And now we add the astounding immensity known for the Precambrian (or "Prephanerozoic"—term floated in 1971 by Dott and Batten).[4]

In 1986, writing for *The Subcommission on Precambrian Stratigraphy*, Kenneth A. Plumb sensibly recommended that Precambrian time subdivisions be defined in terms of years, instead of by stratotypes. His is a practical proposal in view of the general absence of useful fossils in Precambrian strata and because woefully incorrect ages were assigned to Precambrian formations before. Added to what can be known using the principles of superposition and cross-cutting relationships (angular unconformities, nonconformities, and intrusive contacts) is radiometric dating of crystallizations of whole rocks and minerals that contain radioactive isotopes.[5] ❑

Table k2.1 [6] Radioactive isotopes commonly used in radiometric dating

ISOTOPES		HALF-LIFE OF PARENT (in years)	EFFECTIVE DATING RANGE (in years)	MATERIALS THAT CAN BE DATED
PARENT	DAUGHTER			
Carbon-14	Nitrogen-14	5730	100 to 50,000	Cloth, wood, charcoal, peat Bone and tissue Shell and other calcium carbonate Groundwater, ocean water, and glacier ice *containing* dissolved carbon dioxide
Potassium-40	Argon-40 Calcium-40	1.3 billion	50,000 to 4.6 billion	Muscovite Biotite Hornblende Whole volcanic rock
Uranium-235	Lead-207	0.704 billion	100 million to 4.6 billion	Zircon Uraninite Whole rock
Uranium-238	Lead-206	4.470 billion		
Thorium-232	Lead-208	14 billion		
Rubidium-87	Strontium-87	47 billion	10 million to 4.6 billion	Biotite Muscovite Potassium feldspar Whole metamorphic or igneous rock
Samarium-147	Neodymium-143	106 billion	1 to 4.6 billion	Whole metamorphic or igneous rock, silicate minerals