The 'Great Unconformity' and associated geochemical evidence for Noahic Flood erosion

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The Bible's Flood account describes the greatest rain event ever recorded. Forty days and nights of rain falling on the earth (Genesis 7:12) would have caused immense denudation of landmasses around the globe. Evidence for this is provided by a key stratigraphic surface and by associated geochemical signatures.

Nature and extent of the 'Great Unconformity'

The term 'Great Unconformity' was originally used to describe the prominent stratigraphic surface exposed in the Grand Canyon that separates the Lower Cambrian Tapeats Sandstone (of the Sauk cratonic sequence) from the underlying Precambrian strata (Granite Gorge Metamorphic Suite and tilted sedimentary rocks of the Grand Canyon Supergroup).[1]

The Great Unconformity can be traced across North America and globally, including most of today's southern hemisphere landmasses, along with Western Europe and Siberia—this makes it the "most widely recognised and distinctive stratigraphic surface in the rock record".[2] This surface in most regions separates continental crystalline basement rock from overlying undeformed Cambrian marine fossil-bearing sedimentary rock. It thus records the onset of the denudation of continental

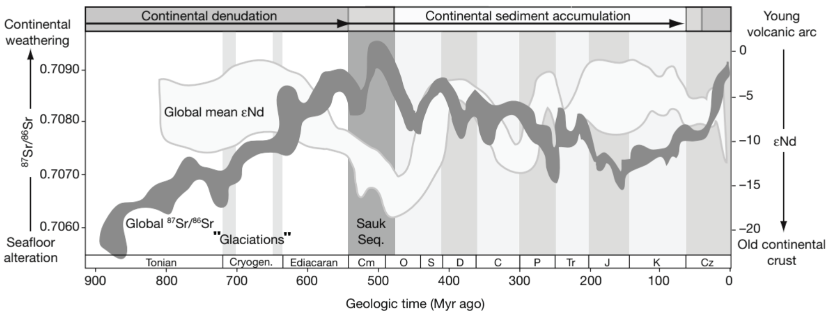

Figure 1. Summary of major geochemical and sedimentary patterns derived from Upper Proterozoic to Phanerozoic strata (modified from Peters and Gaines[2])

crust, followed by the first major marine transgression (Sauk Sequence) and sediment accumulation on the continents (figure 1).[2]

The Great Unconformity is a clear case where uniformitarianism does not apply. Extensive planation surfaces are not forming today but channel erosion is occurring today.[3] The very high energy erosion of the global Flood would have had the capacity to wear down Precambrian cratons to simultaneously form the Great Unconformity as a peneplaned surface over tremendous areas of the earth. Most Flood geologists point to this widespread erosional discontinuity in the geological record, known as the Great Unconformity, as indicating the Flood's abrupt onset.[4]

The Sauk Sequence often has quartz and feldspar-rich basal sands overlying Precambrian basement across North America and North Africa.[2,5] Similarly, basal sandstone units are widespread in the large (2 million km^2 surface area) Australian intracratonic sedimentary basin known as the Centralian Superbasin, which is believed to have formed at the time of the break-up of the Rodinia supercontinent.[6] The Heavitree Quartzite is the basal sandstone unit of the Amadeus Basin, which is in turn part of the Centralian Superbasin.[7] The Heavitree Quartzite has been described as an early Flood formation.[8]

In southern Israel the fossiliferous Cambrian sedimentary strata of the early Flood sit directly on the eroded surface of the crystalline basement of the northernmost Arabian-Nubian Shield.[9]

Evidence of sea level rise includes a universal fining upward sequence that has been observed in Cambrian and Lower Ordovician strata in locations across the USA (Sauk Sequence), Greenland, UK, Russia, Australia, Bolivia, and Ghana.[10] A classic fining upward succession occurs in Grand Canyon Cambrian strata.[11]

A Flood model has been proposed to explain the erosion of the Great Unconformity and subsequent deposition of the Cambrian Tapeats Sandstone, Bright Angel Shale, and Muav Limestone as floodwaters advanced in areas now known as Nevada, Arizona, and New Mexico.[11]

Along with tremendous erosion of the exposed continental landmasses, torrential rain would likely have caused huge mass flows sweeping down into the adjacent seas. Upper Proterozoic mixtites, interpreted by secular scientists as occurring during 'glaciations' (figure 1), are more likely mass flow deposits formed in the early stage of Noah's Flood due to enormous rainfall on the continents.[12–15] Other Upper Proterozoic mixtites are found in the Appalachian Mountains, Scandinavia, Russian Platform, Siberia, Caledonian Mountains, northwest China, Brazil, central and southern Africa, and northwest, central and southern Australia.[16]

Geochemical signatures consistent with continental denudation

Numerous geochemical signatures indicative of continental denudation have been described from Upper Proterozoic strata.[2,17]

Strong evidence for an increase in continental erosion and weathering products to the global ocean is provided by measurements of Ca^{2+} in fluid inclusions.[2] Concentrations of Ca^{2+} show a precipitous increase from Upper Proterozoic strata to a peak in Cambrian strata.[18] Much of this near threefold increase in Ca^{2+} has been attributed to greater chemical weathering of continental crust during the Sauk marine transgression.[2]

The abundance and distribution of the phyllosilicate mineral glauconite, $(K,Na)(Fe^{3+},Al,Mg)_2(Si,Al)_4O_{10}(OH)_2$, in Cambrian sediments likely required rapid authigenesis due to an unusually large flux of continental weathering products, particularly Fe^{3+}, K+ and H_3SiO_4, during the formation of the Great Unconformity.[2] Trough cross-stratified deposits of glauconitic mineral-rich accumulations (glaucarenites, i.e. coarse-grained glauconitic mineral pellets) found in Cambro-Ordovician strata indicate a high energy environment. The abundance of thoroughly cross-stratified deposits also indicates that, at least on the cross-set scale, individual pellets were deposited and covered by other laminae very rapidly.[19]

Precipitation of carbonate sediments also reached a peak in the Phanerozoic, as recorded in the Cambrian-Lower Ordovician strata of the Sauk Sequence of North America.[20–22] Petrographic textures (displasive growth of calcite crystals within the claystone matrix) and depleted $\delta^{13}C$ values provide evidence of rapid direct precipitation of carbonate at the sediment-water interface.[23] Calcium carbonate precipitation does not require deep time as has been demonstrated by laboratory studies.[24]

Thus huge volumes of Cambro-Ordovician carbonate globally could have precipitated rapidly, likely within months during the year of Noah's Flood.

During the early stage of the Flood, the enormous runoff from continents may have contributed to the drawdown of carbon dioxide described for the Cryogenian,[25] since chemical weathering of silicate rocks is a major carbon dioxide sink.[26,27]

^{87}Sr is a radiogenic daughter isotope of ^{87}Rb and is found in silicate rocks such as granite. The abundance of radiogenic ^{87}Sr relative to 'common' ^{86}Sr in a sample of sediment is related to the amount of sediment that originated from erosion of continental crust as opposed to that originating from the ocean. The observed increase in Upper Proterozoic strontium isotope ratios $^{87}Sr/^{86}Sr$ (figure 1) has been explained by accelerated rates of erosion during the so-called Pan-African orogeny, and high crustal erosion rates have been inferred from Cambrian $^{87}Sr/^{86}Sr$ values.[28]

The subsequent decline in $^{87}Sr/^{86}Sr$ ratio in post-Cambrian strata indicates greater oceanic influence and a time of accumulation of sediments on the continents (figure 1) as more of the Sauk Sequence began to be deposited, reducing the direct erosive impact on landmasses. The radiometric 'time-span' for the Upper Proterozoic to Cambrian increase in $^{87}Sr/^{86}Sr$ ratio is approximately 400 Ma (figure 1), but in the biblical framework the actual time elapsed would have been of the order of weeks to months.

Final comment

The erosional surface represented by the Great Unconformity is found on continents around the globe and is an exceptional boundary in earth history. This surface commonly separates Precambrian rocks from overlying Cambrian sedimentary strata. Continental denudation, enhanced chemical weathering, and changes in global ocean chemistry are indicated by numerous geochemical signatures associated with this boundary. The evidence is consistent with what would be expected from the effects of enormous rainfall and rising Flood waters/tsunami-like waves on the continents during the early Noahic Flood.

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