The Transgondwanan Supermountain: a trigger for the Cambrian Explosion

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The dramatic increase in diversity of animals between about 530 and 510 million years ago (i.e., the Cambrian Explosion), coincides with the deposition of enormous volumes of continentally derived sedimentary rocks throughout Gondwana. These early Palaeozoic quartz-rich sedimentary units generally display remarkably similar U–Pb detrital-zircon age patterns, despite their present-day distribution in at least 7 different countries on 4 different continents. The striking correlation between the detrital-zircon age spectra for these quartz-rich sedimentary units and the rocks from the East African – Antarctic Orogen, which stetched from the Arabian–Nubian Shield through East Africa to Antarctia, clearly shows that the detritus was derived from the mountains that developed along this long collisional zone. The >8000-km-long and generally >1000-km-wide East African–Antarctic Orogen formed following collision between East and West Gondwana from ~650 Ma and is large enough to supply the huge volume of quartz-rich detritus dispersed over such a remarkably large areal extent. Here, we refer to the surface expression of this collisional zone as the Transgondwanan Supermountain to emphasise its palaeogeographic significance. The depositional system supplied by this mountain chain was >100 km^3 (i.e., equivalent to covering all 52 contiguous states of the USA with >10 km of sediment) and lasted at least 260 million years. The enormous size of the mountain chain, it position close to the equator, the absence land plants and possibly the appearance of biota in the soils that promoted rapid chemical weathering, resulted in extreme erosion and sedimentation rates that are arguably the highest in the geological record. This led to an unprecedented flux of P, Fe, Sr, Ca and bicarbonate ions into the oceans. The addition of Sr was responsible for seawater $^{87}Sr/^{86}Sr$ building up to the highest levels in Earth's history, the addition P and Fe provided the essential nutrients that supported a bloom of primitive life, which in turn provided abundant food to support the Cambrian explosion of life, and the addition Ca and bicarbonate ions increased $CaCO_3$ supersaturation in the oceans which allowed species in numerous phyla to simultaneous develop skeletons.