CRITICAL ANALYSIS OF: "CATASTROPHIC GRANITE FORMATION: RAPID MELTING of SOURCE ROCKS, and RAPID MAGMA INTRUSION and COOLING" by ANDREW J. SNELLING

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Introduction

The following is a critique of an article by Andrew J. Snelling (2008) entitled: "Catastrophic Granite Formation: Rapid Melting of Source Rocks, and Rapid Magma Intrusion and Cooling." See: link. There are a number of statements in his article that make it possible for him to claim scientific legitimacy for his young-earth model for the origin of granite, but I certainly do not support most of his statements from my perspective and the geologic studies that I have done (Collins, 1988, 1997; Hunt, et al., 1992).

On page 12, he says: "Because we don't observe granites forming today, debate has raged for centuries as to how granites form."

So, is anyone at the earth's surface capable of seeing granites form at depths of 3 to 5 km? Who is he trying to kid? Likely granite magmas presently exist underneath the Coso Range in California which has "recent" rhyolite and obsidian flows (the volcanic equivalents of granite) as surface exposures and several hot springs that carry off some heat from the underlying magma (Wood and Kienle, 1990). Likely granite magma also underlies the Long Valley caldera near Mammoth, California, because large amounts of carbon dioxide emerge from cracks and hot springs there and because of nearby obsidian domes and large volumes of rhyolite tuff (USGS). Who is to say that these underlying granite magmas are not forming today? But, of course, Snelling would say that these granites are just left over from creation during the Genesis Week and are not being created today.

On page 12, he says: "Nevertheless, the conventional wisdom has been adamant until recently that granites take millions of years to form, which is thus an oft-repeated scientific objection to the recent year-long global Genesis Flood on a 6,000-7,000 year-old earth as clearly taught in the Scriptures (Strahler, 1987; Young, 1977)."

I agree that this has been the conventional wisdom.

Then, the bulk of Snelling's article cites literature in which more rapid emplacements of granite plutons and fast crystallization rates have been postulated by some modern granite petrologists. The assumption is also made by Snelling that these same granite petrologists insist that all granite bodies of large size must be formed from magma, and this assumption is also true. Therefore, he continues to promote the idea that all granite bodies of large size must be formed from magma. Because of the modern literature, he is free to say that the creation of the earth can possibly occur within 6,000 to 7,000 years and (1) that an accelerated rate of decay of uranium must occur to generate the necessary heat to produce large volumes of granite magma, (2) that rapid rates of emplacements of granite magma are possible, and (3) that accelerated rates of cooling can occur to cause the granite magmas to solidify. Snelling does not dwell on the fact that accelerated rates of erosion must also occur to expose the granite bodies in the Sierra Nevada, but that is an issue that he avoids although I am sure he cannot cite any scientific literature that says that such rapid erosion of a possible 1-3 km-thick cover on granite by streams and glaciers can occur in less than 7,000 years or that the formation of four sequential continental ice caps can form on the North American continent and disappear in less than 7,000 years. The mountain glaciation of the Sierra Nevada must have occurred during the four continental ice ages, and he cannot justify that these ice ages can be condensed into 7,000 years if he uses any scientific laws (1) to precipitate sufficient snow to form the great thicknesses of ice that covered Canada four different times such that each flowed down into northern United States and (2) to cause these ice masses to melt rapidly after each ice cap was formed and within 7,000 years (total) unless he postulates blow-torch climates during this short time.

Evidence against all granite bodies being formed from magma

It is true that the conventional wisdom postulates that all granite bodies of large size are crystallized from magma, but that opinion is likely to change because of a recent publication:

Putnis, A., Hinrichs, R., Putnis, C. V., Golla-Schindler, U., and Collins, L., 2007, Hematite in porous red-clouded feldspars: evidence of large-scale crustal fluid-rock interaction, Lithos, v. 95, p. 10-18.

Large granite bodies in Finland, Sweden, and Brazil and in the San Marcos batholith near Temecula, California (in some places extending for several hundreds of square kilometers), are commonly pink. Conventional wisdom is that the pink color is due to tiny hematite (iron oxide) crystals (several thousand per cubic centimeter) which occur in high-temperature potassium feldspar crystals formed by crystallization from magma. The red hematite that makes the feldspar pink has been theorized to form by exsolution of ferric iron ions (substituted for aluminum ions) in the lattices of high-temperature potassium feldspar crystals so that the iron atoms separated from the lattices at lower temperature and formed their own separate crystals of iron oxide. Andrew Putnis found that this exsolution model is not correct. The results of his studies and those of co-workers are reported in the above paper. In the field, gradual transitions can be seen to occur between dark plutonic rocks (such as diorite) and light-colored pink granite. These transitions between the two rock types were studied by using transmission electron microscopy which enables the observer to see what happens in a crystal on an atomic scale. Andrew Putnis and his co-workers observed that plagioclase in diorite was microfractured and that fluids had come in and removed some calcium, sodium, and aluminum from the lattice to leave holes in the altered plagioclase crystal. In parts of some altered plagioclase crystals, these investigators observed that potassium had come into the holes and recrystallized the plagioclase as potassium feldspar, replacing the former sodium and calcium with potassium. In some places holes were still left in the lattice of the potassium feldspar, but now the holes were lined with tiny hexagonal crystals of red hematite. On that basis, some iron was introduced into the altered plagioclase crystals by the same fluids that brought in the potassium. Thus, these investigators observed how solid diorite was converted into granite by chemical replacement processes. All the textural changes that I have been describing for 35 years in granites that were formed by chemical replacement processes in other localities occur in these pink granites, including the formation of myrmekite. Because of these data, Andrew Snelling can no longer say that all granite bodies of large size must form from magma.

Evidence against the model that Po halos indicate nearly instant formation of the earth during the Genesis Week

Concerning Po halos, Andrew Snelling says, page 20: "Nevertheless, because of the very short half-lives of these three polonium radioisotopes that necessitate their rapid hydrothermal fluid transport to generate the polonium radiohalos within hours to a few days, it is estimated that the granites also need to have crystallized and cooled within 6-10 days, or else the required large quantities of polonium (from grossly accelerated decay of uranium) would decay before they could form the polonium radiohalos (Snelling, 2005; Snelling and Armitage, 2003). Such a timescale for crystallization and cooling of granite plutons is certainly compatible with the biblical timescale for the global Flood event and for earth history."

It is true that large crystals of biotite and feldspars can grow rapidly within hours or days where large amounts of water (steam) are available to facilitate quick movements of silica and other ions in solution to nucleation sites. Such rapid growth would enable Po isotopes to crystallize on faces of growing biotite crystals. But it is not true that such growth is limited to less than 6,000 to 7,000 years. That is, it cannot be said that very rapid crystallization of a host granite of magmatic origin is necessary merely because (1) Po isotopes have short half lives (3 minutes, microseconds, and 138 days), and (2) there would not be enough radioactive Po left in the residual fluids if long cooling times for granite magma were required. If the granite hosting the Po-halo-bearing biotite is formed by chemical replacement processes in solid rocks that are deformed instead of being formed by crystallization from magma, (1) the deformation opens up the system for movement of potassium to make the potassium feldspar that converts a former magmatic but solidified rock into granite, (2) the scattered uranium atoms can be extracted from ferromagnesian silicate minerals that are being replaced by quartz and this uranium can form local concentrations in ore deposits, (3) radon (an element that is a gas, inert, and released from the radioactive uranium) can move readily from large volumes of deformed rock and be concentrated in relatively low pressure sites (fractures), and (4) polonium ions produced from zillions of these radon atoms in these low pressure sites can migrate in fluids, nucleate in biotite, and produce the Po halos. All of this can occur over thousands of years because deformation and replacements can occur over thousands of years and because chemical replacements to produce granite are not necessarily fast. The system must be open and be repeatedly kept open because replacements and recrystallization could eliminate the

openings. At any rate, the formations of some large granite masses and Po halos do not necessarily happen in the ways postulated by Andrew Snelling.

It is likely that the Po halos in biotite that Gentry (1986) illustrated in his book "Creation's Tiny Mystery" did form relatively quickly in large crystals of biotite in calcite dikes (Wakefield, 1988a, 1988b). The dikes occur in fractures that were opened to allow abundant water (steam) and carbon dioxide to come in with calcium and other ions to form the calcite and facilitate the rapid crystal growth of biotite "books" coexisting with the calcite. The association of betafite (a complex uranium oxide) in the calcite dikes provided an immediate source of zillions of radon (Rn-222) atoms. The Rn-222 is the precursor for the Po isotopes and subsequent Po halos. The immediate proximity of uranium and zillions of Rn-222 atoms allowed even the formation of Po-214 halos even though the Po-214 has a half life of micro-seconds. Significantly, calcite does not form by magmatic processes that occur during the solidification of a granite melt. So, Andrew Snelling has ignored this detail. Some of the Po halos were not even formed in granite at this locality but in biotite in calcite dikes. Moreover, the adjacent granite is in Canada, is Precambrian in age, and has both myrmekite and pink hematite-bearing potassium feldspar crystals like those described above in Finland, Sweden, Brazil, and California (Putnis, et al., 2007).

In terranes in which Po-halo-bearing biotite does occur in granitic rocks, the rocks also contain myrmekite, exhibit deformation, and contain nearby uranium concentrations. But the Po halos commonly are in the small biotite crystals that are part of the crystalline mass of the granite, and the biotite generally contains only Po-210 halos. See Fig. 1. Note the fracture cutting through the biotite and the pleochroic halo damage caused by millions of Rn-222 atoms decaying and sending out alpha particles into the biotite lattice. The radius of damage caused by alpha particles ejected during the Rn-222 decay is about the same radius as that of the Po-210 halo. Because radon is inert, it does not nucleate anywhere and is free to move through the fracture without hindrance. Because the Po-214 isotope has a half life of micro-seconds, there is not sufficient time for 10^{10} atoms of the Po-214 atoms to nucleate at a particular site in the biotite lattice to make an isolated visible halo, whereas the Po-210 isotope has a half life of 138 days. Therefore, large amounts of Po-210 can nucleate at a particular site and make a visible halo.

Significantly, large granite masses that are formed solely by magmatic crystallization processes and which do not contain nearby concentrations of uranium do not contain any Po-halos in biotite. This observation also applies to granite pegmatites even though large crystals of biotite, feldspar and quartz in pegmatites likely formed by rapid crystallization (days or weeks).

At any rate, the formation of Po halos and large granite bodies by chemical replacement processes are consistent with their creation by natural processes during long periods of time without requiring miraculous events to occur.

Other evidence against Snelling's model

Furthermore, Snelling's model does not take into account magmatic rocks other than granite such as granodiorite, diorite, or gabbro which crystallized at high temperatures (800 to 1,000ºC) in comparison to granite (550ºC). Therefore, more heat would be needed to produce their magmas, and much longer cooling and crystallization histories of these former rocks would have had to occur before solidification. Presumably, this time would also have to be squeezed into the 6,000 to 7,000 years during which time the earth was supposedly formed. Moreover, Andrew Snelling does not mention the many different igneous plutonic rock types that occur in the Precambrian that underlie the "Flood deposits." Presumably, these other intrusive igneous rocks that are older than the Paleozoic, Mesozoic, and Cenozoic intrusive granitic plutons were formed nearly instantly on Day Three of the Genesis Week and also had extremely rapid events of melting, emplacement, cooling, and crystallization.

Andrew Snelling says, page 19: "Of course, granitic magmas rapidly emplaced during the Flood would have been intruded into sedimentary strata that were still wet from just having been deposited only weeks or months earlier. Furthermore, complete cooling of such granitic plutons did not have to occur during the Flood year."

Although Andrew Snelling says that granite bodies can intrude the sedimentary rocks deposited by the Flood, he avoids the problem that many sandstones and conglomerates in the "Flood deposits" near the Sierra Nevada granitic rocks contain eroded boulders and fragments of granite that came from the Sierras. So, how can such eroded boulders be possible if the granitic rocks in the Sierra Nevada plutons are being intruded into the Flood deposits as magma? Evidence for these intrusions of granite magma into sedimentary rocks includes the remnants of fossils in the metamorphosed wall rocks.

Robert Gentry also found Po-210 halos in petrified wood in Triassic, Jurassic, and Eocene sedimentary rocks in

the Colorado Plateau. If this wood were deposited during the Noachian Flood, why does it not contain carbon-14 (C-14) and give C-14 age dates of less than 10,000 years as are measured for wood in bristlecone pines in the Panamint Range of California, whose C-14 ages correlate with the same chronological ages in their growth rings? If Snelling's model is correct about the formation of Po halos, should not the age of the wood in the "Flood deposits" in which the Po-210 halos occur give evidence in support of his model?

It is true that some granite masses result from the melting or partial melting of sedimentary rocks whose chemical compositions are the same as that found in granite (Wiebe, 1996) , but there are many large granite masses that are formed by magmatic differentiation, a process that Andrew Snelling ignores.

If heat were generated by an early accelerated decay of U-238 (prior to the Flood) to produce granite magmas, then this greater decay implies vast amounts of U-238 that should have produced very large quantities of the stable Pb-206 isotope. Where are the large quantities of this Pb-206 that would provide support to Snelling's model?

Other considerations

There is no scientific evidence that supports the model of the creationists that accelerated nuclear decay occurs (Humphreys, 2000; Vardiman, Snelling, and Chaffin, 2005) or that it is possible that catastrophic plate tectonics (Austin et al., 1994) can occur to drive the mechanism of the Flood event, although Snelling includes these additional references and models in support of his model. Also, although modern granite petrologists suggest that rapid melting, emplacement, cooling, and crystallization of granite magma are possible, the rates that these petrologists propose for all these processes in no way approach the speeds at which Snelling says must happen. But, of course, all that Andrew Snelling needs is his belief in the literal interpretation of the Bible to make granite bodies form during the Genesis Week and in less than 7,000 years. In science, we generally need better evidence than personal belief. The above critical analysis of his article suggests that Andrew Snelling has not considered all the available data that need to be taken into account to make his model valid and that he has not properly considered the full complexity of issues that have a bearing on his proposed young-earth model. Also, the evidence provided by Putnis et al. (2007) that not all large granite masses are magmatic in origin and the fact that Po halos can be created by natural processes indicate that the conclusions by the RATE team (Vardiman et al., 2005) for a young earth model are false.

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