Paul Artale 4.8.13

Review: Answers in Genesis, *Radiohalos* (ft . Dr. Andrew Snelling), 2009

Runtime: 62 min

A deep look into what seems superficial yet has surprising explaining power for Noah's Flood.

They were first discovered in the 1930s by a Canadian scientist Henderson, then later by Dr. Robert Gentry.

Radioactive halos (abb. Radiohalos) are formed from radioactive isotope decay within biotite flakes, which can be white or black. Inside the biotite are found tiny Zr crystals (1+ microns[1]) long that contain some $^{238}U^{4+}$ which can substitute for Zr^{4+} in the crystal lattice. The zirconium crystals would have formed within granite for example during the rock's cooling phase.

$^{238}U^{4+}$ decays in eight steps, ending in Pb. The decay process stabilises the isotope by reducing the size of its nucleus. At each stage of parent->daughter decay an □-particle is emitted (which consists of 2p and 2n).

Like explosive bullets, these emissions release large energies in three dimensions from the radio*centre* and into the biotite. Most damage is done at the circumference giving rise to visible 'rings'. N.b. for decay within Zr crystals 60 microns and larger no damage is visible as the α particle energies are insufficient to escape.

Eight decay steps means eight visible rings, all with unique but constant cross-specimen radii depending on the parent isotope:

Radioisotope	MeV
^{238}U	4.19
^{234}U	4.77
^{230}Th	4.58
^{226}Ra	4.78

1~One micron is ~1/2 the width of a human hair.

^{222}Rn	5.49
^{218}Po	6.00
^{214}Po	7.69-->most energetic/largest radio halo
^{210}Po	5.30

(n.b. obviously each isotope has two less protons and neutrons).

From radiohalo radius measurement the parent isotope causing the particular halo can be precisely determined.

It is estimated to make a radiohalo requires $500*10^6$ to 10^9 parent isotopes and 100Ma in time *at today's decay rates*. Geologically these halos have been found across five continents implying a common global process must have been at work to cause them.

Focus is then moved to Po radiohalos (all three are observed-3, 2, and single ring), the conundrum being their radiocentres are observed *outside* the Zr crystals, in the biotite. The intractable question to uniformitarians becomes how did the Po get into the biotite to decay and form a halo?

In a 1989 trail in Arkansas, Dr. Robert Gentry presented findings that were countered by Dr. G. Brent Dalrymple, Deputy of the United States Geological Survey and academic at ACLU. When confronted with Po radiohalos, Dalrymple merely dismissed them as a 'very tiny mystery', because there was (is) no evolutionary answer. Dr. Gentry said they were part of God's special ex-nihilo act of creation, along with the granite itself. Dr. Snelling notes this is a telling statement (that granite was *created* – later he shows it was *not* created, but formed from metamorphic rock under great heat, this means the Po radiohalos were not primordial).

Interesting facts of Po isotope t(1/2): ^{218}Po=3.1min, ^{214}Po=164usec and ^{210}Po=138 days. How can such short half lives be reconciled with the required large concentrations[2] of Po in the *radiocentre* to produce the halos?

After 10 half lives isotopes are unable to be measured (i.e. 31.1min, 1.64sec and 1380 day upper dating limits for Po isotopes).

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[2]~50% concentration of Po in the biotite (of volume as the pictures didn't look like it?)

Rock formation sequence is: Sedimentary--[T&P]-->Metamorphic--[T&P]-->Granite.

At the Cooma Granodiorite (c7000 feet elevation), NSW, Australia, one can walk two miles and go from sedimentary to granite rocks! This indicates fast processes at work. The millisecond dilemma of Po concentrations only make sense given these fast processes.

Po is a rare element and so its source must have been from the Ur decay chain (last three decay nodes). 100 Ma-worth of nuclear decay must have happened in μsecs, where it was then transported into the surrounding biotite before decaying further (with 3,2, or 1 rings depending upon whether the 218, 214 or 210 isotopes respectively were carried out).

A key question is raised by Dr. Snelling – if Ur decay was sped up so much, why wasn't ^{14}C or Po-isotopes? It is stated the decay rate impact of the Flood *inversely* affects isotopes depending upon their *normal* rates (i.e. those observed today).

Again, using the 3-D book analogy, the *horizontal alignment* of the radiohalo radiocentres is explained. Initial water-transported Po isotopes form a 'pathway of least resistance' which the next isotopes travel on. It is noted granite is made up of 24% of dissolved H_20 and H_20-soluble metals like Cu can migrate freely within the $ZrSiO_4$ lattice.

A critical scientific fact is radiohalos will only form at temperatures below 150^0C. At higher temperatures any radioactive 'damage' from α-particles is *annealed* (i.e. atoms are 'reset' back in their proper lattice).

Another element in the Ur decay chain, the gas Radon (Rn) can supposedly bind with Polonium and is also water-soluble. Chlorine and sulphur can also flow through zircon crystals and PoS_2 has been found in Italy (where?).

Thus multiple plausible conditions were available for the polonium to be transported from the Ur.

It is stated empty 'bubbles' are found at the centre of all Po radiohalos (why?)

^{222}Rn radiohalos can also form. All radiohalos had to survive while the granite cooled from 650^{0}C-730^{0}C down to 150^{0}C and this must have been within 6-10 days. This is a small 'time and temperature window'.

As to the existence of hydrothermal fluids, the Great Smokey Mountains in Tennessee is a source of vast quantities of fluids. High-magnification photos of metamorphic rocks are shown and the visible minerals are very pretty. The radiohalos are also plainly visible as small black circles.

A chemical formula containing the metamorphic rock staurolite is given:

54muscovite + 31chlorite-->54biotite+24staurolite+152quartz+224**water**

The ^{210}Po is found in the *metamorphic* intra-isograd zone. An isograd seems to be a graduating line differentiating the different rock formation conditions (i.e. for sedimentary, metamorphic, granite).

The ^{238}Ur, ^{214}Po and ^{218}Po halos have been found in the *highest* grade (high temperature) metamorphic zones just before the rock melted, then afterwards in the granite.

The above comes under the sub-discipline of *metamorphics*.

A compelling graph is shown of #radiohalos (dependant-Y) Vs isogradzone (independent). Isograd zones are in turn heavily dependent upon temperature. The gradient is ~45^0 in the first zone (sedimentary?), then *declines* at a similar angle (metamorphic zone) as temperature increases/radiohalo tracks annealed, then steep-positive in the granitic zone as the rock cools. One consequence of this evidence is granite rock is *not* primordial, meaning the Po radiohalos aren't either.

The Schap formation in Cornwall, U.K. is an example of granite rock formation (e.g. beautiful pink Potassium Feldspar) found amongst *sedimentary* rock. From here it is observed radiohalos are also higher where there are large ore deposits.

The Tuolumne granite in Yosemite is made of sequentially intruded rock beds. These beds don't have visible alteration effects due to heat meaning they must have formed quickly. These also have evidence of high hydrothermal fluid flow in *later* intrusions, precisely where radiohalos are

higher. These flows also cause a darkening of the biotite due to dissolved mineral content.(?)

The Johnson Granite Porphyry is mentioned as a partial explanation of volcanism/catastrophism. As granite formation requires much water under incredible pressure, volcanic explosions occur (no wonder 70% of volcanic emissions are *steam*). The analogy used here is a cork popping.

To answer the charge of 'Creationism' lacking any original research, *this* original research predicted a positive correlation between ore concentrations and radiohalos, useful for mineral exploration.