The Giant 1912 Eruption of Novarupta-Katmai: Laboratory Illustrating Earth's Catastrophic Past

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THE GIANT 1912 ERUPTION OF NOVARUPTA-KATMAI: LABORATORY ILLUSTRATING EARTH'S CATASTROPHIC PAST

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ABSTRACT

The Novarupta-Katmai eruption of June 6-8, 1912, is the largest volcanic eruption of the 20th and 21st Centuries. Located in a remote corner of Southwest Alaska, the predominantly rhyolitic eruption provides many opportunities for researchers who agree that high-energy, short-term events are the major shapers of earth's surface. The 60-hour eruption produced 30 km^3 of deposits, over 200 m deep in places. Most of this was released during the first 16 hours, forming The Valley of 10,000 Smokes. Deposits include massive, non-welded to highly welded ignimbrites, finely-layered high energy, proximal ignimbrite (HEPI) deposits, pyroclastic density current (PDC) deposits, mudflows, and large quantities of pumice and ash. Within a few years of the eruption, streams gouged 20-30 m deep canyons through valley floor deposits. The author's photogeologic evidence and $^{40}Ar/^{39}Ar$ analysis revealing excess argon, combined with recent secular neocatastrophist research on volcanism, allows for reinterpretation or rejection of several uniformitarian-biased models. Topics covered include radioisotopes, bedrock incision rates, timing of magma formation and crystallization, frequency of volcanic activity over time, and tuyas. Novarupta-Katmai testifies to the biblical pattern of Creation/Flood/Ice Age/Stasis, freeing us from unrealistic uniformitarian bias.

INTRODUCTION

For all of the 20th Century, and so far the 21st Century, no eruption compares to the June 6-8, 1912 Novarupta-Katmai volcano. Understanding the significance of this cataclysmic event requires imagining something no living human ever witnessed. Dr. Robert F. Griggs, one of the first to explore the 1912 eruption, imagines it best:

"*If such an eruption should occur on Manhattan Island, the….sounds of the explosion would be plainly audible in Chicago…in Denver…linen hung out on the line to dry would be so eaten by the sulfuric acid content [of the air] as to fall to pieces on the ironing board…..Ash would accumulate in Philadelphia a foot deep…the whole of Manhattan island, and an equal area besides, would open in great yawning chasms, and fiery fountains of molten lava would issue from every crack*" (Griggs, 1922, p. 1).

Such a powerful event did occur from June 6-8, 1912 in remote Southwest Alaska, in what is now Katmai National Park (Figure 1). For 60 hours, Novarupta spewed a volume of material 30 times larger than Mt. St. Helen's 1980 eruption, dropped worldwide temperatures up to 2° F, caused large parts of mountains to disappear, and caused the director of the National Geographic Society in 1922 to reflect on the Earth as a "young and active planet" (Griggs, 1922, p. xv).

Novarupta, The Valley of Ten Thousand Smokes (TVTTS) it formed (Figure 1), and the surrounding Katmai Volcanic Cluster (Hildreth and Fierstein, 2003) are now some of the most researched areas in all of Alaska. However, the area remains largely unnoticed by creation researchers (Brown, R.H., 1986, 1996; Shormann, 2010, Reed 2012), even though it is a powerful laboratory of opportunity for interpreting earth history within a Biblical framework (Shormann, 2010).

Almost all Novarupta-Katmai research is useful in building a better model of earth history that acknowledges the importance of high-energy, short-term events in shaping earth's surface. With an eye on building more realistic and biblically sound models of earth history, the research presented here has four objectives:

1) Revisit the sequence of events during the June 6-8, 1912 eruption.
2) Understand the varied interpretations of processes that brought about the events of the 60-hour eruption.
3) Use our understanding of the processes at Novarupta-Katmai as analogies that can help creation researchers detect bias in "millions of years" historical interpretations.
4) Consider ways the evidence for high energy, short term events at Novarupta-Katmai provide useful analogies for future interpretations of natural history within the biblical model of Creation/Flood/Ice Age/Stasis.

PART I. THE 1912 NOVARUPTA-KATMAI ERUPTION

"And then one old man from Katmai…started hollering and telling people about their water…"Put away as much water as you can and store it, reserve it. Wherever ashes come down, there will be no water to drink anywhere…Turn your boats upside down. They will be filled up with ash." He knows everything, that old fellow (Kaiakokonk, 1975).

The day dawned bright and clear on June 6, 1912, as the steamship *Dora* left Uyak, on the western edge of Kodiak Island, and headed northeast. At about 1 pm, the Captain C.B. McMullen sighted a heavy cloud of smoke which he believed was coming from the direction of Mount Katmai. By 3 pm the cloud overtook the *Dora*, and by 5 pm, ash was falling in the town of Kodiak, over 50 miles to the south (Griggs, 1922, p. 15). To those near Mount Katmai, the clear day had become 60 hours of "darkness and hell, thunder and noise. I do not know whether it is day or night." (Griggs, p. 19).

What Captain McMullen didn’t know was that for at least 5 days prior to June 6, earthquakes had begun in earnest at Katmai Village and surrounding areas over 100 miles away. Late on the

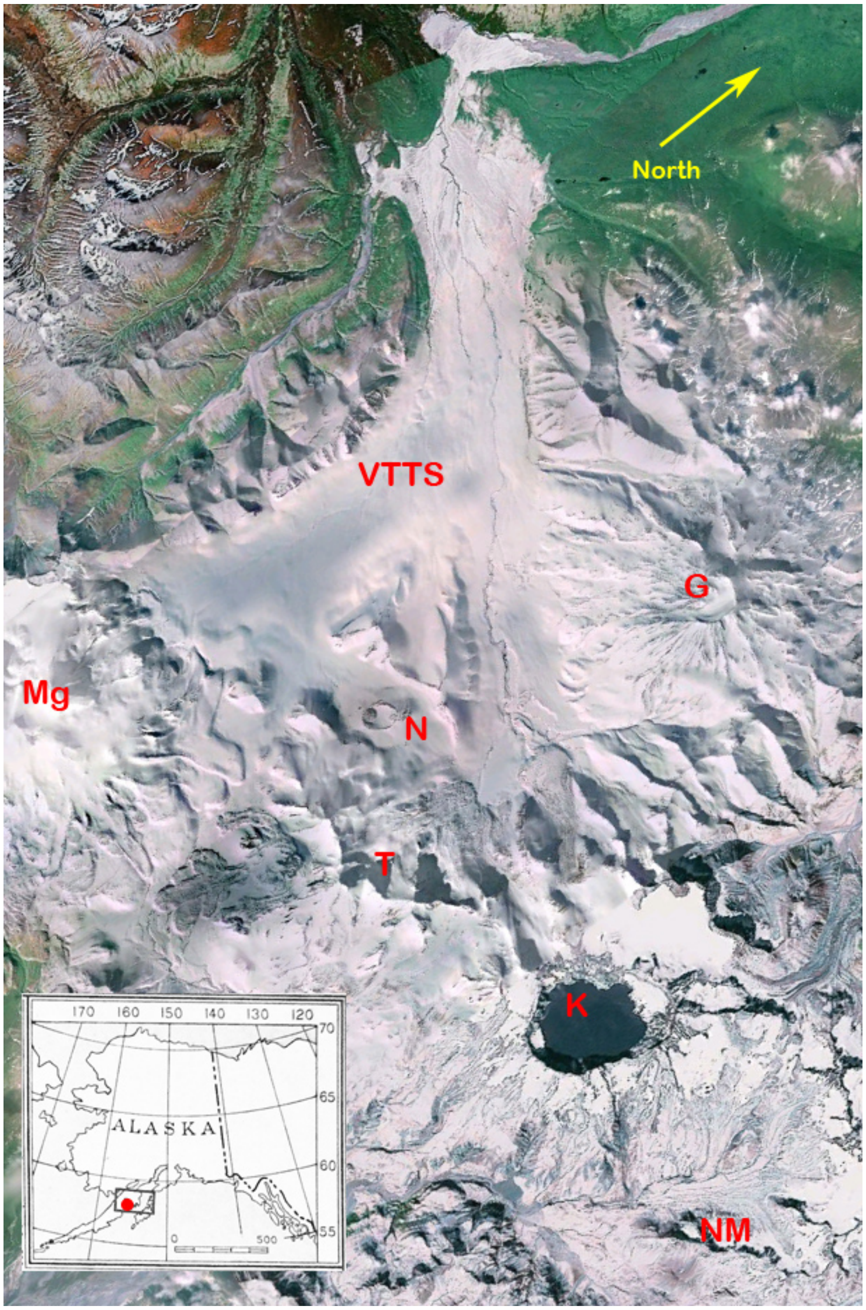

Figure 1. Location of Novarupta-Katmai in Alaska (red dot), and Google Earth image (eye altitude = 19.5 mi) of the Novarupta-Katmai region. N= Novarupta (lava dome is small circle to the left), VTTS = Valley of Ten Thousand Smokes, K= Mount Katmai and its caldera lake, NM = Noisy Mountain. Other prominent features not part of or significantly affected by the 1912 eruption include G (Mount Griggs), T (Mount Trident), and Mg (Mount Mageik).

evening of the 5th, observers at Cold Bay, 40 miles to the southwest, noted the northern sky looked "black and storming", even though skies were clear on the coast (Griggs, p. 19). Most likely, something happened on the 5th, but the real eruption did not begin until the 6th.

Although well-researched, much uncertainty remains regarding the eruption, particularly the origins of the 13.5 km^3 of magma released, an amount over 30 times greater than the 1980 Mount St. Helen's eruption. Retold and revised many times since 1912, what follows is the latest interpretation of the eruption. Most of this is described in greater detail in the 2012 USGS publication *The Novarupta-Katmai Eruption of 1912-Largest Eruption of the Twentieth Century: Centennial Perspectives* (Hildreth and Fierstein, 2012), as well as Dr. Grigg's 1922 book, *The Valley of Ten Thousand Smokes*.

The 5 Episodes of the Novarupta-Katmai Eruption

The 5 episodes of the Novarupta-Katmai eruption included 60 hours of plinian eruption (Episodes I-III), followed by two dome-forming events (Episodes IV and V). Novarupta, TVTTS, Mount Katmai, and other prominent mountains of the Katmai volcanic cluster are located on Figure 1. All told, 13-14 km^3 of magma erupted in three discrete events. Upon release, the magma expanded to produce 9-13 km^3 of ignimbrite flow deposits and about 17 km^3 of fall deposits. The erupted materials included all four major magma types (Figure 2), including 55% rhyolite, 35% dacite, no more than 10% andesite, and a minimal amount of basalt. It was one of only a handful of eruptions in recorded history to produce voluminous rhyolite, unlike Ice Age-era eruptions like Yellowstone which routinely produced thousands of cubic kilometers of high-rhyolite magma (Figure 3).

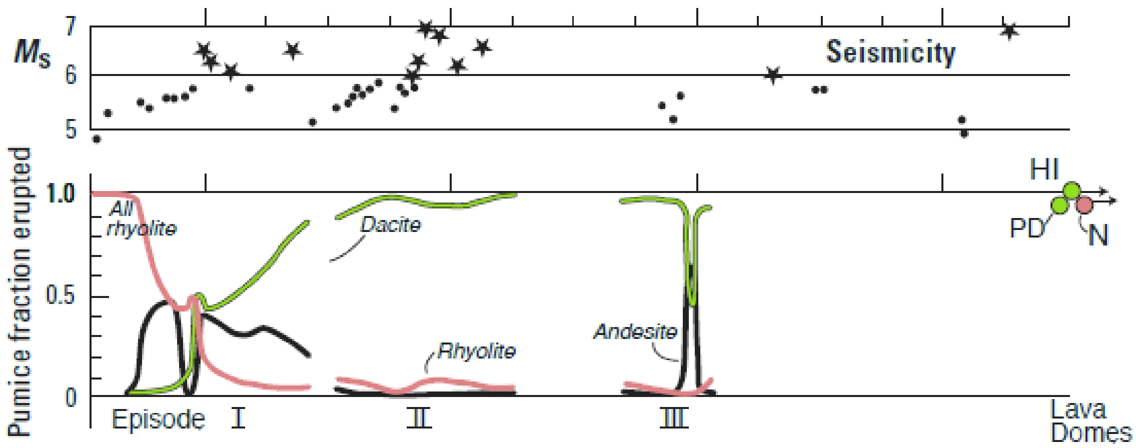

Figure 2. Rhyolite, dacite, and andesite pumice fractions, together with earthquake magnitudes (M_s) recorded during Episodes I-V. A minimal amount of basalt was released. Because of uncertainty in timing, Episodes IV and V are just labeled "Lava Domes". If one zoned magma chamber were responsible for all erupted products, one would expect dacite to follow rhyolite. However, the data shows that andesite followed rhyolite in Episode I, suggesting it may have been released from a different chamber(s). Adapted from Figure 60 of Hildreth and Fierstein (2012). PD = Phantom Dome, replaced by

N = Novarupta, the current dome; HI = Horseshoe Island dome at bottom of Mt. Katmai's caldera, and now submerged under 200 m of water.

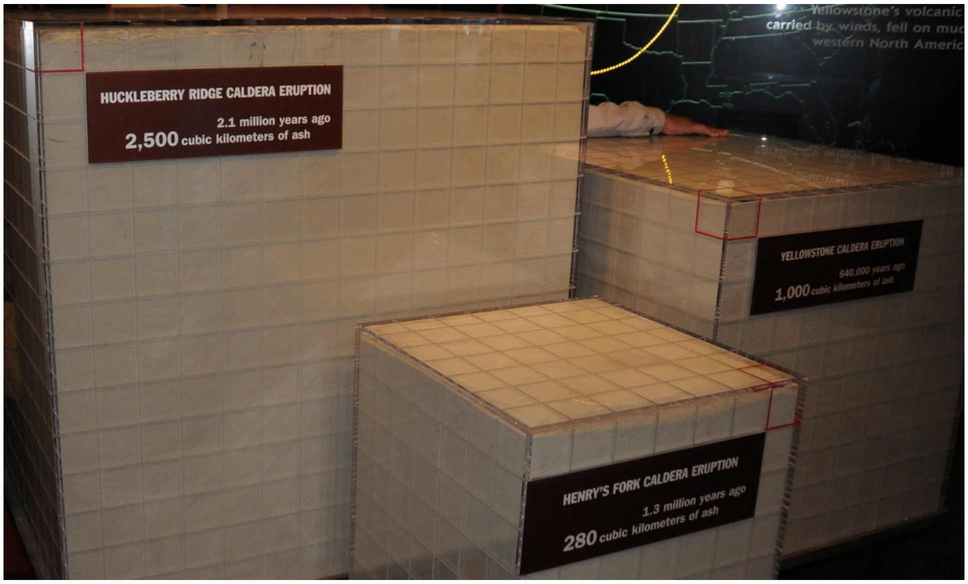

Figure 3. While Novarupta's 13.5 km^3 of magma expanded to about 30 km^3 of erupted materials, it is still dwarfed in comparison to ancient eruptions like those at Yellowstone National Park. The biggest of the three shown, Huckleberry Ridge, was over 80 times larger than Novarupta's 1912 blast. Photo by the author from Yellowstone National Park's Canyon Visitor's Center, 2012. The red-highlighted cubes depict the amount of material (1 km^3) released from Mount St. Helen's 1980 eruption, 30 times less than Novarupta-Katmai.

Episode I:

The most voluminous of the 3 plinian episodes, Episode I lasted for 16 hours, producing almost all of the ignimbrite (11 km^3) and about half of the 17 km^3 of fall deposits. About 11 hours into Episode I, the Mount Katmai's top began collapsing, releasing mudflows, ash, and hydrothermal breccias. Phreatic hydrothermal explosions resulted as the snow and glacier-covered mountaintop fell and contacted hot magma inside the mountain.

Figure 4 shows the simultaneous flow and fall deposits that occurred during Episodes I-III. Valley-filling ignimbrite (VFI) flows quickly filled the valley during Episode I. VFI's were released in 9 distinct "packages", beginning with the pure rhyolite Package 1, then transitioning to more andesitic and dacitic products. Package 8, for example, was highly andesitic (Figure 5, part ii). Packages 2-4 were the most extensive, flowing southward up and over Katmai Pass to the base of Observation Mountain, and northward as far as Mount Katolinat, over 30 km (18.6 mi) away. Eight packages also produced flows of high-energy, proximal ignimbrite, or HEPI (Fierstein and Hildreth, 1992). HEPI flows are created when gas-charged fountains of tephra collapse. Buoyed above the ground by heat and expanding gases from below, the turbulent HEPI currents "float" above the vent and flow radially outward, depositing as highly stratified and variably-sorted(σ_0=1-4) layers. As far as 9 km from Novarupta, HEPI flows are deposited hundreds of meters above the vent (Figure 5, part i).

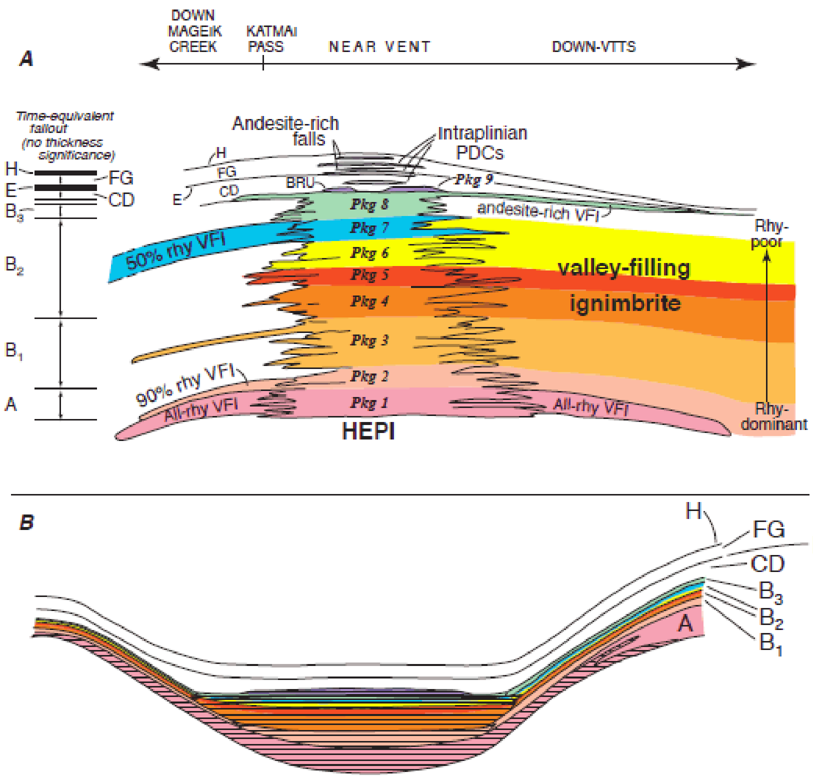

Figure 4. Simultaneous flow and fall deposits. *A*, flow deposits, including HEPIs, PDCs, and the 9 color-coded VFI packages. Time equivalent fallout layers A through H are shown on left. *B*, cross section through TVTTS showing how and where flow and fall deposits reshaped the original valley. Patterned layers are flow deposits, solid colors are A-H fall deposits.

Fallout layers A and B were produced simultaneously with VFI's and HEPI's of Episode I. Fallout layer A matches VFI Package 1, and layer B matches packages 2 through 8. Also, as eruptive products transitioned from pink/white rhyolite to darker andesites and dacites, mixtures of the three produced banded pumice fallout (Figure 6).

Episode I in particular produced a huge spectrum of layered deposits, everything from massive, non-welded, to highly-welded ignimbrite packages (Figure 5, part ii) to finely-layered HEPI deposits (Figure 5, parts i and iii), with a few exhibiting cross-bedding. Finely-layered alluvial deposits formed along edges of temporary lakes, dammed by landslide debris from Noisy Mountain and Mount Katmai (Figure 5, part iv). The non-welded and lightly welded ignimbrite packages are more like sedimentary strata than igneous rock. Robert Griggs referred to them as "incandescent sand flows" (Griggs, Ch. 19).

Episode II:

In 1912, earthquake monitoring technology was just being developed, and the closest seismic station was over 1,000 miles away in Victoria, British Columbia (Griggs, p. 23)

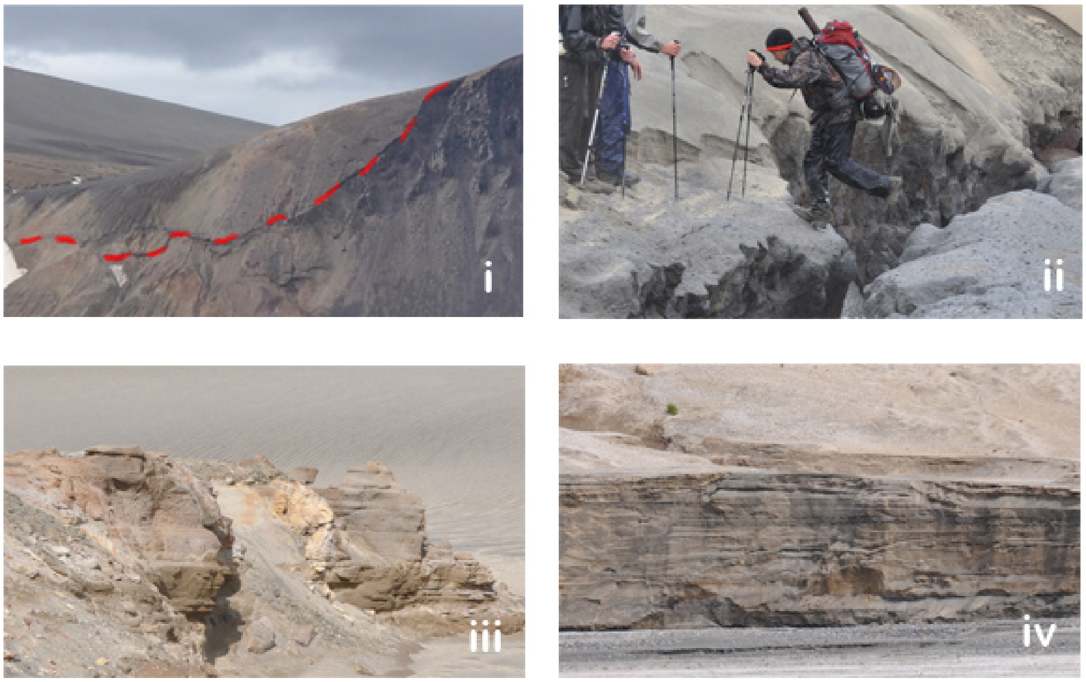

Figure 5. Various flow and fall deposits. i, HEPI deposit draping South flank of Falling Mountain, a few hundred meters above Novarupta’s vent. ii, jumping the River Lethe where it knifes through highly-welded VFI Package 8. iii, partly eroded, finely layered HEPI deposit West of the River Lethe. iv, finely layered deposit East of Noisy Mountain, probably deposited in an ephemeral debris-dam lake formed when Noisy Mountain collapsed during Episode I and II. All photos by the author (i-iii in 2009, iv in 2011).

Figure 6. Banded pumice. Light color is rhyolite, dark is andesite or dacite. Like batter in a marble cake, banded pumice is evidence that different magma types mixed together before exploding out Novarupta's vent. 2009 photo by the author.

Nevertheless, this station and others detected many of the magnitude 5(M_s 5) or greater earthquakes associated with Novarupta-Katmai, which were then used to help distinguish between the episodes (Figure 2). A M_s 7.0 shock, largest of the event, took place during Episode II amidst a swarm of powerful quakes. This one quake represented 37.4% of the total seismic energy released during all 5 episodes (Hildreth and Fierstein, 2012, p. 137).

Episode I was the only episode to simultaneously emit large quantities of plinian fallout, turbid HEPI currents, and VFI packages. Episode II began after a pause in seismic activity of no more than a few hours. Plinian fallout layers C, D, and E (Figure 4) made up the bulk of the 4.8 km^3 of ejecta. Some pyroclastic density currents (PDC's) were formed together with the fallout layers C and D. Most of layer E was probably deposited between Episodes II and III, as ash fell continuously during the lull.

Episode III:

The third and final episode of the main eruptive sequence began after several hours of relative quiet. Like Episode II, it mainly produced plinian fallout (layers F, G and H). Episode III produced about 3.4 km^3 of fallout. And while 3 episodes are discernible by seismic recordings and fallout patterns, Episode I rhyolite ash was still descending during Episodes II and III. In fact, as much as 40% of the ash in layers F, G and H is composed of Episode I rhyolite (Fierstein and Hildreth, 1992). A small dacite lava dome plugged the Episode III event.

Episodes IV & V:

The dacite lava dome that plugged the Episode III event was blasted out later in the summer, possibly as a result of gas buildup underneath. Vaporization of infiltrating surface water may have also contributed to the gas buildup. A similar event occurred inside Mount Katmai's new, 2 mile-wide caldera. Part of the caldera's dacitic lava dome exploded, creating a "horseshoe island" visible in the 1900's, but that now rests submerged in over 200 m of water. Eruptive Episode V produced the current, 95% rhyolite Novarupta dome (Figure 7).

Figure 7. Novarupta's rhyolite dome then (Griggs, p. 280), and now (2009, author photo). The steam emanating from the top and edges is minimal compared to when Dr. Griggs discovered TVTTS. Both photos taken from the eastern side of the dome, with Griggs' view more southwesterly, and the author's view more westerly.

Absent any observers, it is impossible to pinpoint the exact date(s) of origin of the current Novarupta plug. According to eyewitness accounts from Cold Bay, reported by Griggs (p. 21), the sky showed a "large reflection like a large fire" on June 23rd, and a similar occurrence on July 21st. On September 20th a large shock occurred that "twestie the houses bad". Any, or none, of these events could have been associated with Episodes IV and V.

PART II. VARIOUS INTERPRETATIONS OF THE NOVARUPTA-KATMAI ERUPTION

Was it Katmai or Novarupta that erupted? Or both? Or neither?

Originally, there was confusion as to where the eruption occurred. The Captain of the *Dora* first pointed to Mount Katmai, but then others said there was no such thing as a "Mount Katmai", and listed other mountains like Iliamna and Redoubt as the eruption site (Griggs, p. 15). Griggs thought Mount Katmai exploded, initiating the 60-hour event on June 6 at 1 p.m., although he believed Novarupta's contribution was minimally important (Griggs, p. 285). Later, researchers concluded that it was Novarupta, not Katmai that erupted virtually all volcanic products (Hildreth and Fierstein, 2012, p. 44). Today, most agree that both Katmai and Novarupta erupted, hence the title of "Novarupta-Katmai" in Hildreth and Fierstein's 2012 centennial publication.

Certainly, there is much more to the Novarupta-Katmai eruption than what Griggs published in 1922, or what Hildreth and Fierstein summarized 90 years later. For instance, photogeologic evidence collected by the author in 2011 shows large pumice and hydrothermal breccia clasts were hurled much farther from Mount Katmai than estimated by Hildreth and Fierstein (Figure 8), and HEPI-like deposits blanket uplifted layers of the Naknek formation between Mount Katmai and Noisy Mountain (Figure 8). This evidence suggests Mount Katmai's contribution may be significantly more than Hildreth and Fierstein's 2012 interpretation.

Origin of the 1912 Magma

Griggs (p. 304) speculated that TVTTS deposits resulted either from a sill or a large batholith (pluton). He speculated that if it was a sill, then the "smokes" of TVTTS would be short-lived. Griggs also deduced that if it was a sill, then the parent body must be of vastly greater

Figure 8. Left, HEPI deposit blanketing unknown object (uplifted Naknek formation?), east of Noisy Glacier's creek between Noisy Mountain and Mount Katmai. Note the finely-layered, yet vertical structure, revealing how a "HEPI cloud" might descend and blanket an object. The dark object on top is a volcanic bomb. On right, large (>20 cm) pumice and breccia (large red-brown rock) clasts near the HEPI deposit, about 4.5 km from Mt Katmai's caldera rim. Figure 105 of Hildreth and Fierstein suggests clasts of this size should not travel that far. Therefore, Mount Katmai's eruption may have been more powerful than Hildreth and Fierstein believe.

proportions in order to generate the propulsive force required to push the magma through the crust.

Now that most fumaroles are inactive, it seems Griggs' sill/large magma chamber hypothesis was correct. It is the same interpretation of Hildreth and Fierstein (2012, Fig. 158).

In determining what happened with Mount Katmai and any magma within, Griggs humbly acknowledged he did not know, and wished only to present facts without adopting a particular theory (Griggs, p. 304).

90 years after Griggs' publication, Hildreth and Fierstein (2012) give an excellent summary of the work at Novarupta-Katmai. Like Griggs though, they wisely present multiple hypotheses regarding the origin of the 1912 magma. Although they favor a single, zoned magma chamber

beneath Katmai, they also discuss other ideas such as two chambers (described in Shormann, 2010), a new magma batch from depth, and roof-zone remelting. Some petrological and isotopic studies favor continuity (single chamber) between the rhyolite/dacite/andesite magma types released, while others suggest discontinuity (separate chambers).

The hole left in Mount Katmai is about 5.5 km^3 in volume, while the 1912 magma volume is about 13.5 km^3. Hildreth and Fierstein deduced that the magma was stored in a region much larger than inside Mount Katmai. One scenario is that the chamber was elongated across a Katmai to Novarupta axis (Hildreth and Fierstein 2012, p. 219).

Hildreth and Fierstein (2012, p. 219) speculated that present-day upper crustal seismicity largely reflects responses to hydrothermal processes and not shallow magma storage. This contradicts findings of Jolly and others (2007) that large quantities of partially molten rock may exist at shallow depths in the Mageik-Katmai-Novarupta region, centered at Katmai Pass (Figure 9).

Hildreth and Fierstein (2012, p. 219) also mention that the only evidence for late Quaternary (last few hundred thousand years of uniformitarian time scale) reservoirs sufficiently large, shallow, and sustained to produce rhyolite, rhyodacite, large-magnitude eruptions, and caldera collapse points exclusively to Mount Katmai. But, as will be discussed later, there is no reason to emphasize extreme longevity of magma chambers, as new findings reveal these can be ephemeral features (Gualda et. al., 2012). Hildreth and Fierstein make no mention of the evidence for rapid rhyolite formation, even though the Novarupta Episode III dacite dome was short-lived, replaced by a rhyolite dome a few months later.

Hildreth and Fierstein (2012) speculate that modest batches of andesite-dacite magma typical of the Katmai Cluster volcanoes probably ascends from midcrustal reservoirs or deeper, from well below the brittle-ductile transition (at a depth of ~10 km). But they failed to discuss evidence that andesitic bodies can form rapidly, regardless of whether the region is considered a

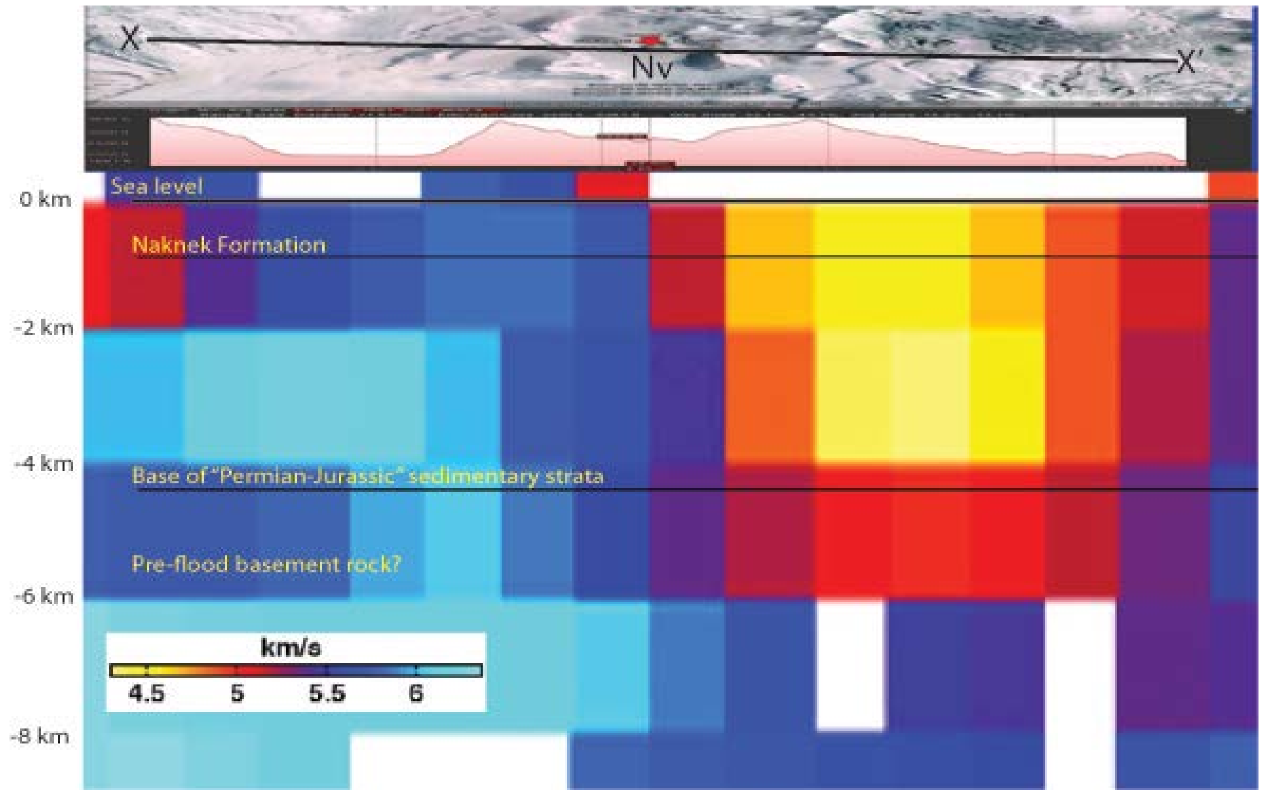

Figure 9. Identifying possible magma chambers beneath Mount Katmai. Google Earth elevation profile through X-X' is approximately 16 km from the base of Mount Griggs (X) to Katmai Pass (X') and through Novarupta (Nv). P-wave tomographic cross-section adapted from Figure 6b of Jolly et. al. (2007). The low-velocity zone centered near Katmai Pass suggests large quantities of partially molten material at shallow depths (P-waves travel slower through liquids and faster through solids). Also, unlike most volcanic cross-section diagrams, the vertical and horizontal scales are similar. Typically, vertical dimensions are "shrunk", but here it is easy to see the incredible size of the shallow magmatic zone beneath the Katmai volcanic cluster. It is believed that hundreds of cubic kilometers of molten material exist in multiple chambers, 13 km^3 of which were expelled during Novarupta's 60-hour eruption. Locations of sedimentary layers and basement rock adapted from Hildreth and Fierstein (2012).

subduction zone (Oard, 2011b) like the Novarupta-Katmai region is. Figure 9 provides evidence that a large magma body exists above, and disconnected from, the brittle-ductile transition zone.

In contrast to Hildreth and Fierstein (2012), the author favors a two-chamber model (Figure 10), similar to the model of Eichelberger and Izbekov (2000). Both chambers were probably zoned. Rhyolite from the lower chamber erupted first, but associated seismic activity created fissures for the andesite from the bottom of Mount Katmai's chamber to flow next (Figure 2). Syneruptive dacite from both chambers dominated for the remainder (Figure 2).

The reader is advised to take special note of the fact that, in spite of all the scientific advances of the 20th and 21st Century, and the countless hours of research spent on Novarupta and the surrounding area, there is still no consensus regarding the origin of Novarupta's 13.5 km^3 of

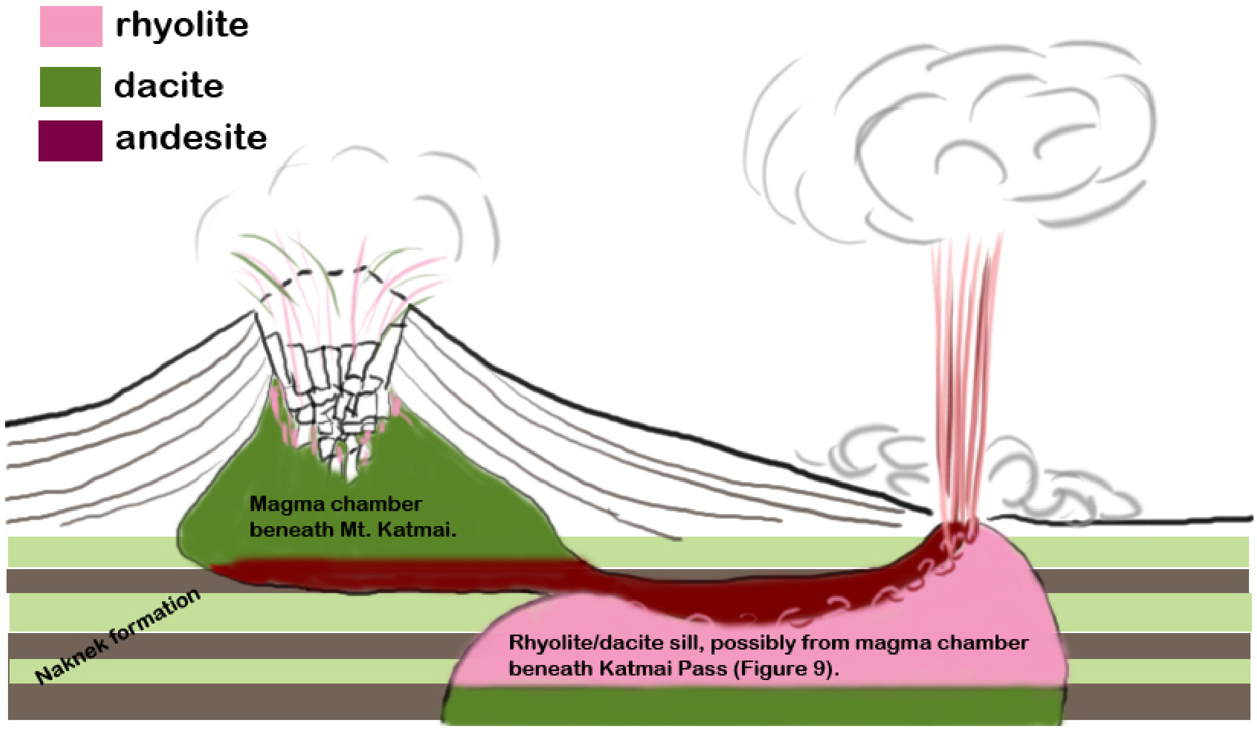

Figure 10. Author's two-chamber model for Novarupta-Katmai. Both chambers are zoned, with rhyolite dominating the magma chamber possibly centered West of Mount Katmai (Figure 9). Novarupta began when a sill formed by splitting layers of the Naknek formation eventually broke through the surface. Rhyolite drained first, followed by denser andesite from the bottom of Mt. Katmai's chamber (Figure 2). Dacite flows, possibly a mixture from both chambers, dominated Episode II and large parts of Episodes I and III.

magma. The complex labyrinth of magmatic chambers beneath the Katmai volcanic cluster will probably forever obscure the exact origin of Novarupta's material. This should remind us of two important things:

1) When interpreting unreapeatable past events, all researchers have the same set of published data. Different conclusions are reached because we all don't have the same interpretation of that data.

2) Natural history research is different from scientific research. Natural history research is an exercise in interpreting past events. American philosopher Mortimer Adler described it as a mixed question (Adler, 1965), more closely related with history than with science (Reed and Klevberg, 2011). Natural history research certainly requires inputs from science, but also other areas such as Scripture, history, art, and philosophy. This differs greatly from the scientific method, which is about verification. Scientific research involves formulating experimental methods that, like a recipe, can be passed on to someone else, who in turn should be able to repeat the experiment and arrive at similar results.

Scientific methods, which are repeatable and verifiable, differ from the work of natural historians, who are interpreting an unrepeatable past event. Therefore, just like a man can have multiple roles, such as husband, son, and father, so too a geologist can at times be a scientist and at others a natural historian. It would be odd if we called our own father by the name "Boss" instead of "Dad". Likewise, it is odd to call a geologist's investigations into the origins of the Grand Canyon, "scientific" research instead of history research. And while the natural historian will use scientific instruments and methods during research, the conclusions the researcher makes will merely be interpretations of the past.

PART III. DETECTING "DEEP TIME" BIAS AT NOVARUPTA-KATMAI

Addressing the "deep time" dogma

For over two centuries now, natural historians have been deceived by the uniformitarian idea of "deep time", an idea used by some as a "scientific" proof that either 1) the Earth and Universe are much older than what Scripture claims, and therefore Scripture is false, or 2) the past is filled with tremendous time gaps not described in Scripture. It is important for creation researchers to address this issue. What follows is primarily empirical evidence that contradicts uniformitarian thinking, an approach begun by Whitcomb and Morris (1961). Steve Austin (1984) was one of the first to apply their approach to volcanism. Arguments from analogy, considered a good method for reasoning about past events (Reed and Klevberg, 2011), will help connect events at Novarupta-Katmai to Flood-related phenomena and Biblical history.

In an interesting twist, secular neocatastrophists also use Whitcomb and Morris' approach to studying earth history, as they now see how an overemphasis on uniformitarian thinking blocked the path to free inquiry and painted an unrealistic picture of earth history. Today, secular geologists, some who are also Christians, publish research about megafloods reshaping the surface of not just Earth, but even Mars, while simultaneously ignoring and/or suppressing empirical and Scriptural evidence of the worldwide Flood described in Genesis, and attested to by others, including Jesus Christ (Matthew 24:37-39). Some assert it is unacceptable to consider the biblical Flood story because for science to "have its answers ordained in advance is a restriction on free inquiry" (Burr et. al., 2009). But the same natural historians fail to realize that by rejecting the possibility of a worldwide flood simply because Scripture mentions it, they also restrict free inquiry into nature! In effect, what they are saying is that if Scripture were silent regarding a worldwide flood about 4,500 years ago, then this would be an acceptable hypothesis.

Christians should not be intimidated by such foolish, dogmatic claims, but instead should be confident that both logic and reality confirm that uniformity and actualism (uniformity of process) are best understood as physical expressions of divine providence (Reed, 2011). Creation and providence uphold a Christian view of reality that justifies science (Reed and

Williams, 2011). As a result, Scripture and its historical narrative are the most important of many tools for studying natural history. The path to truth is not through absolute natural law (science), but through providence and revelation found first in Scripture, but also in creation.

Problems with K/Ar ratios as a method to determine Novarupta-Katmai rock ages

Radioisotope dating requires a measurement of the quantity of daughter atoms resulting from decay of radioactive parent atoms within an igneous rock sample (DeYoung, 2005). One popular method used in the 20th Century was Potassium/Argon (K/Ar), Where radioactive K-40 was compared to the Ar-40 found in igneous rocks. The K/Ar method was the dominant method used to date igneous rocks in the Novarupta-Katmai region (Curtiss, 1966; Reed and Lanphere, 1972; Shew and Lanphere, 1992; Hildreth and Fierstein, 2003).

Readers should take special note of the fact that one man (M.A. Lanphere) was responsible for analyzing a large majority of K/Ar samples published for the Novarupta-Katmai region from 1966-2003. This "one man, one method" procedure lacks scientific rigor and is reason enough to be highly skeptical of these dates.

Compared to potassium, argon is much easier to measure accurately, and in the 21st Century, the $^{40}Ar/^{39}Ar$ method is more commonly used. In this method, a rock sample is first bombarded with fast neutrons, converting stable K-39 to Ar-39. The ratio of Ar-40 to Ar-39 is then measured. For more detailed descriptions of both methods, the reader is referred to DeYoung (2005) and the New Mexico Bureau of Geology and Mineral Resources website (2013).

Both techniques assume that, when the magma solidified, no daughter product (Ar-40 gas) was present. They also assume radioactive isotopes decay at constant rates (Dalrymple and Lanphere, 1969). All Ar-40 present formed after the rock solidified, remaining trapped until the rock was analyzed. Also, in the Ar/Ar method, the laboratory technician will ask for an estimate of how old the scientist thinks the rock is. This is because the procedure must include a "monitor" sample of "known" age, and the scientist's sample is compared with this one. But, the estimated age can bias the sample, because the technique can be adjusted depending on how much "information" is needed (NMGRL, 2013). In other words, the older the estimate given, the longer and hotter the sample is heated in order to extract more argon.

Many other faulty assumptions surround radiometric dating techniques, not the least of which is assuming the radioactive decay rate of a substance is constant (DeYoung, 2005). This is the uniformitarian error of gradualism (uniformity of rate). Contamination of samples can be a problem, too, either by atmospheric argon or argon from within a magma chamber.

Apparent contamination found in samples from Novarupta and elsewhere(G.H. Curtis, 1966) provide evidence that K/Ar ratios might be better-suited for studying environmental histories, an idea proposed dozens of years ago (T. Kirsten, 1966). More recently, K/Ar ratios were mentioned as possible tools for studying inheritance and mixing histories of magmas (Snelling, 2005; Snelling, 1998; Austin and Snelling, 1998). Others suggest gravity separates lighter daughter isotopes from heavier parents, rendering radioactive isotopes useless as chronometers (Berthault, 2010).

Huge changes in Novarupta-Katmai rock age since 1960's

Garniss H. Curtis was one of the pioneers of the K/Ar method for dating rocks, and one of his first samples was a granitic xenolith extracted from Novarupta's ignimbrite packages. The sample was K/Ar dated at 4 million years old (Curtiss, 1966). While Brown (1986, 1996) used this as evidence of a rock that was about 5 orders of magnitude older than its actual age, Curtiss and his former graduate student G. Brent Dalrymple used it as evidence of "argon loss" due to heating. Curtis and Dalrymple "knew" that granitic basement rocks around Novarupta were 150 million years old, which meant their sample had only retained 4/150, or 2.7% of its argon(Curtiss 1966, Dalrymple and Lanphere, 1969). Dalrymple and Lanphere assumed the 2.7% argon was a result of partial melting of granitic rocks along the volcanic conduit.

Dalrymple and Lanphere were perplexed as to why this sample retained any argon at all, and concluded that "Apparently, volcanic rocks cool much too quickly, leaving insufficient time for complete degassing to occur" (Dalrymple and Lanphere, p. 143). This, however, raises more questions than it answers. First, if volcanic rocks cool too quickly to start with zero 40-Ar, then this negates one of the method's primary assumptions! Plus, if volcanic rocks cool quickly, couldn't that mean magma along conduit edges could cool and form granite, and be just a few days old at the time of eruption? Also, could the amount of argon be a function of depth (pressure) at time of cooling, with shallower rocks having less argon (younger dates) and deeper rocks having more (older dates)? And what about the different types of igneous rocks and the minerals that compose them? Do they differ in their ability to trap argon? Austin's work on Mt. St. Helen's suggests they certainly do (Austin, 1996). However, neither Curtiss, or Dalrymple and Lanphere, the K/Ar pioneers, address these questions.

Another question the K/Ar pioneers don't address is evidence for accelerated nuclear decay. Although creation researchers found evidence for accelerated nuclear decay (Vardiman et. al.., 2005), this is usually ignored by secular scientists. But why then do so many samples contain excess argon? Is this just "inherited argon" from surrounding rocks, or is it the result of accelerated decay at the Flood or other times?

To find out if excess argon was present at Novarupta-Katmai, the author tested a sample from the top of Novarupta's lava dome using the $^{40}Ar/^{39}Ar$ method (Shormann, 2013). Even though the sample's known age was 100 years, it gave apparent ages as high as 5.5 Ma (Ma=million years old), and an integrated age of 2.36 Ma (Figure 10). The sample contained 3.6% radiogenic Ar.

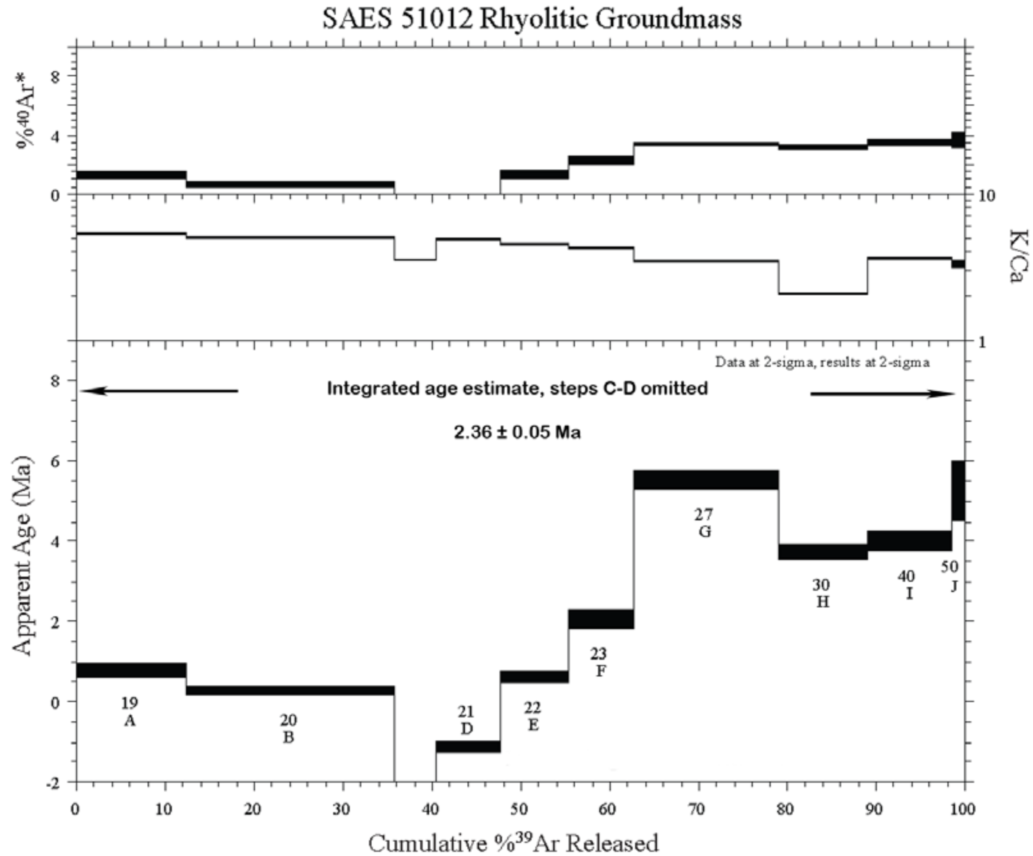

Figure 10. From Shormann (2013). Step heating results for % radiogenic argon (Ar*) released (top), K/Ca ratio (middle) and apparent ages in millions of years (Ma) (bottom). Black bars at top of each step represent 2-sigma errors. Step C and D omitted from integrated age calculation due to analytical errors.

Coming from the top of Novarupta's lava dome and surrounded by normal atmospheric pressures, the rock was a prime candidate to have its "argon clock" set to zero when it cooled. Tested when it was 100 years old, below-detection-limit levels of radiogenic argon were expected. However, the sample gave radiometric apparent ages over 4 orders of magnitude greater that it should have. A possible source of the excess argon is Flood-related accelerated nuclear decay.

Other evidence of widely variable ages for Novarupta-Katmai basement rock comes from personal communication with USGS Geologist Wes Hildreth. In a 2011 email exchange, Dr. Hildreth described the granitic basement rocks as "Miocene", meaning 10-20 million years old (Wes Hildreth, 2011). This is an order of magnitude younger than the age given by Curtiss (1966)! While Dr. Hildreth has done much fine work in unlocking the mysteries of the Novarupta-Katmai event, the widely varying ages given for the same rock-layers, along with the many unproven assumptions used to calculate radiometric ages, leave little reason to support deep time interpretations of the Novarupta-Katmai region.

Supervolcano studies demolish one of the original pillars of "deep time"

Natural historians from the 18th Century argued the biblical timescale was unsupported by the evidence from volcanism. By comparing the size of volcanoes like Vesuvius and Etna to the volume of observed eruptions, they concluded that 6,000 years or less was simply not enough time to form these volcanoes (Reed, 2012). Rates of volcanism were one of the original evidences used to argue in favor of "deep time".

Extrapolating present rates of volcanism into the past to justify a vast prehistory is a product of faulty Enlightenment thinking (Reed, 2012). However, as Reed points out,

> "Evidentiary logic demands that a conclusion be abandoned if its original evidence is invalid. New arguments can be made for the same proposition, but if the original faulty conclusion is assumed in that argument, then the reasoning becomes circular."

Fast-forwarding to the 21st Century, geologists have accreted layers of evidence revealing massive historic eruptions, much bigger than anything in recorded history (Figure 11). Austin (1998) noticed a similar pattern with North American volcanoes. Placed in a biblical framework, this evidence suggests a definite trend towards decreased volcanic activity since the Flood.

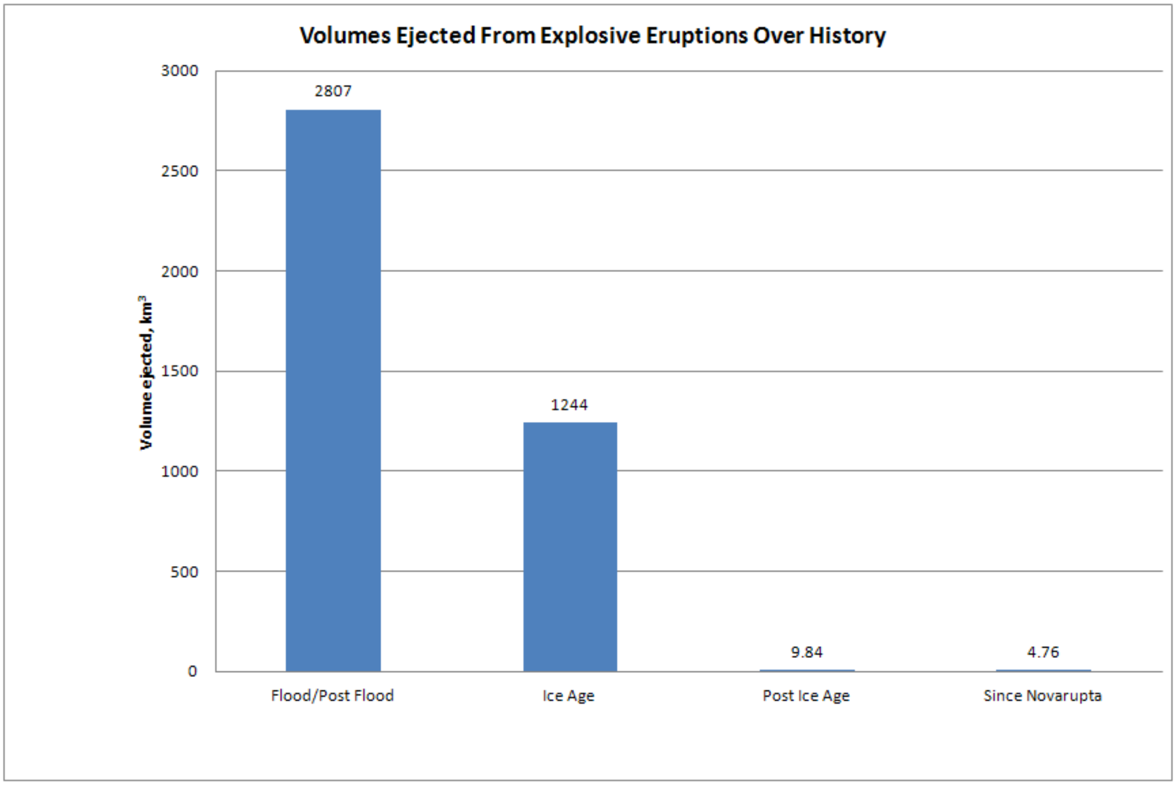

Figure 11. Average volumes, in km^3, of volcanic material ejected from explosive eruptions. Data from Hildreth and Fierstein (2012, Table 3) and http://en.wikipedia.org/wiki/List_of_largest_volcanic_eruptions The uniformitarian time scale was used to group into Flood/Post Flood (approx. 500 Ma to 2.6 Ma) , Ice Age (2.6 Ma to 10,000 years BP), post Ice Age (10,000 years BP to 1912), and 1912 to present.

Unfortunately, even though the original evidence from volcanism is now considered invalid, the conclusion of deep time is still held by secular historians. Therefore, to assume deep time and its actualistic premise that the "present is the key to the past", one is either using circular reasoning or is motivated to believe it on faith alone (Reed 2012).

Today, natural historians are reinterpreting the timing of supervolcanoes larger than Novarupta-Katmai. Substantial evidence now exists that magma bodies forming rhyolitic supervolcanoes are ephemeral features. In a critique of calculations by Fowler and Spera (2010) for the longevity of the Bishop magma body, Gualda and Ghiorso (2011) commented that their results were three orders of magnitude less than Fowler and Spera's. Gualda and Ghiorso argued that the differences are a result of prejudice and "just-so" scenarios, and that the million-year timescales of Fowler and Spera are difficult to reconcile.

In subsequent work, Gualda et. al. (2012) concluded that quartz crystallization in giant magma bodies required to form a supereruption would be in the timeframe of 500-3,000 years. Because crystallization is so fast, in order for a crystal-poor supereruption to occur, the magma body must be short-lived.

In related work, Snelling (2008b) discussed that granitic plutons, previously described as subsurface, spherical-shaped blobs of magma, actually spread out as tabular sheets. A flat shape would cool much faster than a spherical shape, especially if it contacts water. Snelling (2008b) also discussed the experimental formation of crystals from magmas in a matter of hours.

Novarupta, like many supervolcanoes, released large quantities of rhyolite, the extrusive form of granite. Therefore, understanding the nature of these supereruption magma bodies sheds light on previous Novarupta research. For example, we discussed previously the conclusion of Dalrymple and Lanphere (1969, p. 143) that a boulder-sized granitic xenolith from Novarupta did not sufficiently degas, giving a radiometric age of 4 million instead of the expected 150 million years. Today though, there is no good reason to believe this xenolith was that old, and in fact, it could have formed a few days prior to the eruption, or even during the eruption. As magma along the edges of the newly-forming chamber cooled first and crystallized, it could easily become entrained in the magma flowing out as the eruption proceeded. In addition, many geologists think that rhyolitic magma bodies forming supervolcanoes originate in a “crystal mush zone”, a mixture of crystals and silicate liquid whose mobility is inhibited by a high fraction of solid particles (Bachmann and Bergantz, 2008). That means a granitic xenolith could form at any time, giving no good reason to believe the Novarupta xenolith sampled by Curtiss (1966) was part of a 150 Ma grantic pluton.

Current research on supervolcano magma bodies fits nicely within a biblical framework. And while the above studies focus mainly on rhyolitic magma bodies, there is evidence that andesitic magma bodies can also form rapidly (Oard, 2011b). All the mountains surrounding Novarupta are volcanic, breaking through the sedimentary Naknek formation, which is most likely a Flood-related feature. Today, only blind faith in deep time would cause someone to dogmatically reject the possibility that post-Naknek (and post-Flood) mountains of the Novarupta-Katmai region took less than 4,500 years to form.

Using radiometric dating to “stretch” time

The mountains of the Novarupta-Katmai region are also referred to as the Katmai Volcanic Cluster (Hildreth and Fierstein, 2003). More evidence of dogmatic “deep time” assertions are evident when reviewing research on rates of volcanism of the Katmai Volcanic Cluster. As Table 1 shows, deep time assumptions result in incredibly slow rates of volcanism when compared to present-day observed rates. In fact, pre-Ice Age rates are six orders of magnitude less than rates over the past 100 years!

Some of this discrepancy results from an incomplete body of evidence. More ancient flows are buried and difficult to identify, except where they outcrop in various places. However, it is argued here that the inconsistent rates result from assuming the long ages acquired from radiometric dating of Katmai Volcanic Cluster rocks.

A similar observation bias is seen regarding historic Alaskan eruptions from 1760-2009 (Alaska Volcano Observatory, 2013). The number of eruptions from 1890-2009 is more than double the number from 1760-1889. However, the human population of this remote state has also increased greatly in the period from 1890-2009, so the chance of someone observing and recording an observation has also increased. Observations are more likely to occur now, so more eruptions are recorded.

	# of mapped units	Rate (# per 1,000 years)	Time span used to calculate rates
Last 100 years	4	40	100 yrs
Post Ice Age	18	1.8	last 10,000 yrs
Ice Age	42	0.017	2.59 my
Pre Ice Age	6	0.00003	Jurassic to 2.6 mya=197 my
Creation model	64	14.2	4,500 years since Flood

Table 1. Hildreth and Fierstein's 2003 map was used to calculate the number of mapped eruptive units for each time span, assuming the uniformitarian time scale for the Ice Age from 10,000 to 2.6 Ma. Mount Katmai and Novarupta deposits were combined as single units. The Creation Model assumes all 64 mapped units (some units overlap timescales, hence 64 total units, not 70) were deposited in the past 4500 years (Post-Flood). The Creation model rate is closer to the observed rate over the past 100 years, when eyewitness accounts and instruments were used to collect and confirm events. Tables like this show how uniformitarian models stretch time out unrealistically, resulting in a decreasing trend in volcanic activity with time. This data also contradicts the evidence in Figure 11 that shows much greater volcanic activity in the past.

Similarly, materials from more recent eruptions are more likely to be seen, which may give a false impression that present day rates are much faster. And while rates of volcanism could be faster today than in the past, it is highly unlikely that they are 40 ÷0.00003 = 1.33 million times faster, as figure 11 suggests! The author speculates the difference results from "stretching" time to fit a deep time model. Table 1 also contradicts the evidence of Figure 11 describing the massive eruptions of the past. Just as the giant Novarupta-Katmai event had subsequent smaller eruptions and dome-forming events after the June 6-8 event, ancient supereruptions likely had multiple smaller eruptions afterwards. It is reasonable to conclude that Flood/Post-Flood volcanism rates were much higher than present rates.

When the data in Table 1 is interpreted within a biblical framework, the rate per 1,000 years is much more similar to present rates. In other words, the rate of formation of volcanic units in the Katmai Volcanic Cluster fits a biblical, Flood geology model better than a deep time model. Even Kaiakokonok's (1975) testimony quoted in Part I makes more sense in a biblical framework, where Native Americans obviously had plenty of experience dealing with massive eruptions in the recent past, as opposed to huge periods of relative dormancy.

Bedrock incision rates since 1912 don't match uniformitarian assumptions

Bedrock incision rates are another method used to fit timescales requiring a vast prehistory not found in Scripture. Incision rates are calculated using the "stream power bedrock incision rate law" (Sklar and Dietrich, 1998), or more simply the "stream power law". From a scientific perspective, it is really no law at all, and should not be considered on par with other scientific laws like Newton's laws of motion, Boyle's law, etc. "Stream power equation" would be a better description, and the equation has the general form of

$$E = KA^m S^n \tag{1}$$

E is the bedrock incision rate in volume eroded per channel bed area per time(Sklar and Dietrich, 1998), with units of meters per year. *A* is the drainage area in square meters, or alternatively, annual discharge in cubic meters, divided by stream width in meters. *S* is the channel slope in meters over meters (dimensionless), and *m* and *n* are "exponents whose values are debated" (Stock and Montgomery, 1999). *K* is a constant related to erosion resistance by the stream's bedrock, so it will vary depending on bedrock type. More resistant rocks are expected to have a lower *K*, resulting in a lower bedrock incision rate, while less resistant rocks have a higher *K*.

To come up with *K*-values for different rock types, geologists typically use stream data where *E* can be determined from radiometric dating combined with measurements of stream channel depth. Equation 1 is then solved for *K*. Common values for *m* and *n* are 0.4 and 1, respectively (Stock and Montgomery, 1999; Whipple et. al., 2000a). Whipple et. al. (2000b) were the first to calculate values for *K* based on erosion rates estimated from a streambed formed during recorded history, the Ukak River in the Valley of 10,000 Smokes. The River Lethe, Windy Creek, and Knife creek join forces in the lower VTTS to form the Ukak River, which was diverted by the 1912 Novarupta-Katmai ignimbrite flows. At the time of Whipple et. al.'s sampling, the channel carved by the Ukak River was 86 years old.

A possible error made by Whipple et. al. (2000b) was the common mistake made by adherents to deep time: assuming the erosion rate of the Ukak River was constant over the entire period prior to their experiment. Evidence that this might be a very large error is found when one researches Dr. Griggs' pioneering fieldwork in TVTTS. When he entered the valley in 1917, 5 years after the eruption, the River Lethe and other streams had already carved deep paths through the valley's ignimbrite layers. Griggs discusses the valley floor canyons in several places (Griggs, 1922), although he overestimated some depths (Hildreth and Fierstein, 2012, p. 167).

To obtain estimates of *K*-values from streams of known age, the author calculated *K* for the River Lethe (Table 2). Google Earth (2013) was used to estimate stream channel width and slope (*S*) at five locations. *K*-values for the River Lethe ranged from .079 to 0.66 $m^{0.2}$/yr.

To learn whether deep time assumptions might influence *K* calibration, the author compared River Lethe *K* values to data from Stock and Montgomery (1999) and Whipple et. al. (2000b) (Table 3).

Latitude	Longitude	*S* (m/m)	Width (m)	*A* (m^2)	*E* (m/yr)	*K* ($m^{0.2}$/yr)
58° 20.13'	155° 17.13'	0.0883	37.6	13776596	5	7.90E-02
58° 20.33'	155° 17.75'	0.0867	33.6	15416667	5.25	8.07E-02
58° 20.48'	155° 17.97'	0.07456	44.5	11640449	5.5	1.10E-01
58° 20.58'	155° 18.14'	0.0114	31.8	16289308	5.75	6.58E-01
58° 20.72'	155° 18.42'	0.0467	38.2	13560209	6	1.80E-01

Table 2. K-values calculated for the River Lethe. It was assumed the erosion rate was 5-6 meters per year for 5 years after the eruption. Annual streamflow was estimated based on a value of 100 m^3/s from Whipple et. al. (2000a) for the upper Ukak River. Based on personal experience in the area, the author assumed the River Lethe contributed 30% of the Ukak River's flow, and that this flow was maintained for 200 days each year (frozen in winter). This resulted in an annual discharge of 5.184 x 10^8 m^3, and when divided by the stream width, gave an estimate for *A* in Equation 1.

Whipple et. al.'s Ukak River data was also recalculated, assuming that most of its depth was carved from 1912-1917, similar to Grigg's eyewitness account from the River Lethe. Hildreth and Fierstein (2012, p. 167), apparently unaware of Whipple et. al.'s work on the Ukak River, nevertheless concluded that *E* is not constant, as they said "erosion slowed greatly after the first few years".

Photogeologic evidence and actual measurements from TVTTS suggest there is a real problem with the stream power law, especially regarding its uniformitarian assumption of a constant erodibility (*K*), constant streamflow (*A*), etc. More evidence of its uselessness comes from Table 3, where almost 80% of the variability in *K* can be explained by rock age. This is a big problem, because *K* is not supposed to predict the age of stream formation! *K* is supposed to vary with rock type. Also, when the Ukak River data is recalibrated to a 5-year period instead of 85, a higher *K* results.

The recalibrated Ukak R. *K*-value makes sense when compared to the River Lethe's value, because the Naknek sandstones and siltstones are typically a less erodible material than the valley-filling ignimbrites the River Lethe cuts through. In reality, *K*-values probably do not vary

Estimated Erosion Period (stream age) t	Mean K
~20 Ma*	2.0×10^{-6}
~1 Ma*	1.4×10^{-4}
~5 ka*	3.7×10^{-3}
~100 yrs**	5.7×10^{-4}
Ukak R. adjusted to 5 yrs**	9.8×10^{-3}
River Lethe (5 yrs)†	2.2×10^{-1}

Table 3. Mean K-values from *Stock and Montgomery (1999), **Whipple et. al. (2000b), and the †River Lethe mean from Table 2. Excluding the Ukak R. 5-yr adjusted value, data fits a power regression with an $R^2 = 0.79$ (K=$0.15t^{-0.6}$). K is supposed to vary with rock type, not stream age! 1 Ma = 1 million yrs, 1 ka = 1000 yrs.

as much as Table 3 shows. In addition, because streamflow is highly variable both within and between years, the stream power law is highly suspect, and is probably not a useful tool for studying real streams. Perhaps this is why little interest in the stream power law is found in 21st Century scientific literature. The failure of the stream power law makes other methods that assume constant rates over long ages highly suspect as well.

PART IV: NOVARUPTA-KATMAI EVENTS AND FLOOD GEOLOGY

The "Great Incandescent Sandflow" of 1912, and its usefulness in understanding Flood deposits

Novarupta's explosive effusion resulted in what Dr. Griggs called a "great incandescent sandflow", with hot, gas-filled ignimbrite spewing from the ground and filling the valley, sloshing hundreds of feet up the sides of surrounding mountains before coming to rest. 700 million metric tons of water also issued forth (Hildreth and Fierstein, 2012, p. 90). In addition, the top 1.3 km of Mount Katmai collapsed (Hildreth and Fierstein, 2012, p. 138), suggesting that something happened about that depth beneath its pre-eruption peak. Most likely, water was in its supercritical phase at this depth. The critical point of water is about 374°C and 22 MPa. Above these pressures and temperatures, water no longer acts like either a liquid or gas, but something in-between. It is also very corrosive, and can eat away at rock walls.

If the pressure is reduced below the critical point, the material can expand suddenly and explosively. This is exactly what happened in1912, as 8.5 km^3 (over 60%) of material issued from Novarupta's vent in the first 11 hours (Hildreth and Fierstein, 2012, p. 3). Since the density of rhyolitic magma is about 2,400 kg/m^3, about 515,000 metric tons of material issued from Novarupta's vent each second for the first 11 hours. This is equivalent to about 5 Nimitz-class aircraft carriers each second!

While uncertainty still exists regarding Novarupta-Katmai magma origins, observations confirm that a large quantity of magma flowed out laterally, covering surrounding mountains and valleys in deposits over 200 meters deep. But what does this spewing out of volcanic material have to do with the Flood?

Flood geologists generally accept that Flood-related phenomena deposited most sedimentary layers present today. However, provenance studies of such layers are infrequent (Reed and Froede, 2009). Part of the lack of effort placed on provenance studies could be from acceptance of one or more secular and/or creationist "geotheories" (Reed and Klevberg, 2011), which speculate about massive lateral plate movements (Austin et. al., 1994; Brown, 2008) rather than massive lateral movements of sediments, as well as flood basalts (Duncan, 2010). Looking to Scripture, lateral plate movement is not suggested. What Scripture reveals is that great "fountains of the deep" burst forth (Genesis 7:11 and elsewhere), and that mountains rose and valleys sank, as described in Psalm 104:8 NASB (Oard, 2009).

Novarupta provides a clue to possible events during the Flood, and the significance of the biblical fountains of the deep. Some scientists believe there is still more water underneath us in the asthenosphere, even more than is in the hydrosphere (Mingguo, 2010). And the idea of magmatic waters is not new, as geologist Eduard Suess noted in 1902, "Volcanoes are not fed by the infiltration of the sea but the waters of the sea are increased by every eruption" (Suess, 1902). Also, scientists now know more than ever about supercritical water and its corrosive effects on rocks (Hovland, 2006), not to mention advanced argillic alteration by hydrothermal waters laced with hydrochloric and sulfuric acids (Guilbert and Park, 1986).

Imagining 1500 years of relative stasis on earth's surface between Creation and the Flood, during this time supercritical and hydrothermal fluids and magmas were eating away at the crust from beneath. At the Flood, this pressurized slurry of superheated magmatic water and sediments burst forth.

Other creation researchers agree that the effects of supercritical water and hydrothermal waters during the Flood have been overlooked in developing Flood models (Bowden, 2000). For example, instead of only considering erosion of the Appalachian mountains towards the end of the Flood as a source for sediments east and west of there (Snelling, 2008; Oard 2011), perhaps the Appalachian region also "burst forth" at the Flood's beginning, rapidly releasing and transporting large quantities of sediments. Perhaps the fountains of the deep are also the source of the 4500+ meter-thick, water-deposited Naknek Formation (Trop et. al., 2005) covering TVTTS and much of Southwest Alaska.

If Novarupta could deposit over 200 m of material in just 60 hours (most of it in the first 16 hours), then it is possible for the entire Naknek formation to form in 4500 x 16 ÷200 = 360 hours

= 15 days. It is not unreasonable to assume that the year-long global cataclysm described in Genesis could be responsible for the majority of the world's sedimentary deposits.

Supervolcanoes and Ice Ages

Flood geologists generally agree that water vapor and other volcanic materials released during the Flood triggered the Ice Age (Oard, 1990, Vardiman, 2001). Because of heat released from the fountains of the deep, post-Flood seas were likely warmer than today, generating higher rates of evaporation, and therefore precipitation. While the global cataclysm ended after about a year, there is no reason to believe associated volcanic activity completely stopped. In fact, earth's surface was probably quite barren after the Flood, and the high albedo of silica-bearing surface rocks would reflect sunlight. And if volcanic activity was still high, ash and sulfur dioxide gas spewing from volcanoes would also reflect incoming sunlight. The post-Flood world was likely a perfect mix of ingredients needed to trigger the Ice Age.

Does evidence exist that heightened volcanic activity could trigger another ice age? Yes. Novarupta-Katmai ash traveled all the way to Algeria in just a few days, and worldwide temperatures dropped up to 2°F (Griggs, 1922). Leading climatologists at the time believed that if Novarupta's ash had stayed in the air a little longer, a new Ice Age was possible (Griggs, 1922, p. 39-40). And if Novarupta dropped worldwide temperatures, imagine the effects of a supereruption like Yellowstone's Huckleberry Ridge (Figure 3).

Novarupta-Katmai also adds support to the idea of only one large Ice Age in earth history. Photogeologic evidence collected by the author and Dr. Griggs reveals post Ice Age vertical tectonics near Mount Katmai, along with post Ice Age volcanic deposits lying directly on top of glacial material (Figure 12). The evidence does not seem to support multiple large advance/retreat cycles over hundreds of thousands of years as deep time supporters believe (Wes Hildreth, USGS, personal communication, 2011). Instead it suggests more of a battle between post-Flood glacial formation and volcanic eruptions that brought heat with them to melt the glaciers back. Once volcanic activity subsided, glaciers grew again. The landscape surrounding Novarupta-Katmai certainly supports a pattern of Creation, followed by the Flood-formed Naknek formation, a post-Flood Ice Age, and present day volcanism. The only real difference between secular and Flood geologist interpretations is deciding how much time elapsed between events. The evidence supports short (tens to hundreds of years) time periods between events, as little or no erosion is visible within or between layers.

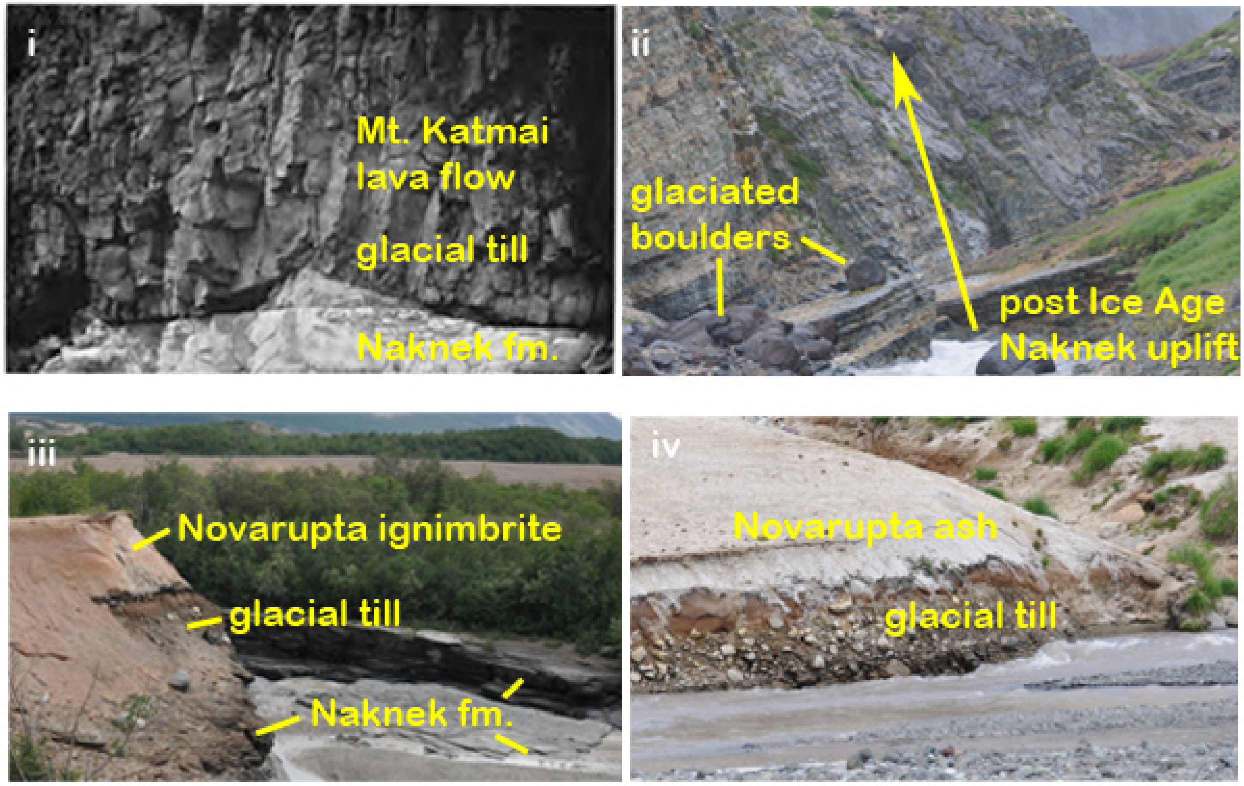

Figure 12. Evidence of the Creation/Flood/Ice Age/Stasis pattern is everywhere in the Novarupta-Katmai region. The author assumes the Naknek formation was a Flood deposit, followed by Ice Age glacial action, with volcanic mountain-forming during and after glacial retreat. Photo i from Katmai Canyon by Griggs (p. 125). 2011 photo ii by author shows post-Ice Age uplift of Naknek formation between Mount Katmai and Noisy Mountain, with glacially-smoothed boulders still resting on uplifted blocks. 2009 photo iii by author shows Flood/Ice Age/Stasis pattern along upper Ukak River. 2011 photo iv by author shows Ice Age/Stasis pattern in extreme upper Katmai Valley.

Is Noisy Mountain a Tuya?

Deep time advocates are having a hard time placing Noisy Mountain, due East of Mt. Katmai (Figure 13). No published radiometric dates exist for Noisy Mountain. Photogeologic evidence collected by the author suggests Noisy Mountain is a tuya (Wikipedia, 2012), a flat-topped volcanic mountain that forms beneath an ice sheet. If Noisy Mountain is a tuya that formed during the deep time “glacial maximum” of 20,000 years ago, then that differs greatly compared to its current deep time age estimate of “Tertiary-Jurassic” or 2.6-200 mya in the Hildreth and Fierstein map (2003). It is estimated as Tertiary-Quaternary on the 1993 Alaska DNR map. The author suggests that instead, Noisy Mountain was formed towards the end of the post-Flood Ice Age, a few thousand years ago, and possibly sooner. As is typical with tuyas, one side of the mountain has collapsed, possibly during Novarupta, causing massive landslides in Katmai Valley. Noisy Mountain actually helps place the rest of the Katmai volcanic cluster as beginning to form towards the end of the Flood or during the Ice Age, continuing on to the present day. As glacial ice retreated, the release of so much weight allowed further mountain building and upward buckling to occur.

Figure 13. 2011 author photo of Noisy Mountain (left), compared to Herðubreið(right), an Icelandic tuya (Wikipedia, 2012). Inset is 15 cm dia. pillow lava on floor of Katmai Valley, approximately 3 km South of Noisy Mountain. Pillow lava is often associated with tuyas. Note relatively flat tops on both, and steep sides with landslide debris.

Volcanoes and abiogenic hydrocarbons

Much speculation exists regarding the origin of hydrocarbons. Dr. Griggs' explorations found methane and asphalt around Novarupta's vent (Griggs, 1922, p. 247-248). Research in Brazil and elsewhere suggests oil has an abiogenic origin, formed by a process called serpentinization. In fact, petroleum geologists now search for drill sites that fit abiogenic models requiring high temperature and pressure (Szatmari et. al., 2010). There are even suggestions that oil is on Mars (Hovland, 2013).Asphalt volcanoes exist in the Gulf of Mexico and elsewhere (McDonald et. al., 2004). If most oil comes from volcanism, it is not reasonable to assume millions of years of plant and animal death produced the world's petroleum.

CONCLUSIONS

The 1912 Novarupta-Katmai eruption is one of the most researched eruptions in history. It produced a tremendous variety of materials, from finely-layered high-energy, proximal ignimbrite (HEPI) and pyroclastic density current (PDC) deposits, to massive, valley-filling ignimbrite (VFI) packages. VFI's ranged from nonwelded, to slightly welded (sintered) to welded. In some VFI's, lamination developed within the sluggish current as it flowed northward from Novarupta's vent. Novarupta-Katmai produced everything from gases, to liquids, to muds, to welded and nonwelded ignimbrites, a wide array of intrusive or extrusive rocks, and even asphalt. Novarupta-Katmai is evidence that volcanoes make pretty much any type of earth material!

Great damage is done to the gospel story by assuming the earth is much older than Scripture claims, or that there are giant gaps of missing time not recorded in Scripture, including a vast prehistory. Thankfully, evidence from Novarupta shows there is no good reason to doubt the historical account of Scripture. In fact, the rate of formation of volcanic units in the Katmai Volcanic Cluster fits a biblical, post-Flood model better than a “deep time” model.

Several orders of magnitude difference in actual versus radiometric rock ages, magma formation and cooling rates, incision rates of streams into Novarupta-Katmai deposits, and historic volcanism rates reveal the illogical and unrealistic assumptions often used to stretch time to fit a uniformitarian model. Observations of Novarupta-Katmai over the past 100 years provide compelling evidence that not much time has passed between the Flood, Ice Age, and present-day conditions (stasis). This is what one would expect if the Biblical creation story were true and the Flood occurred, just as Jesus and many others described.

Natural history research is an exercise in interpreting past events based on the available evidence. All interpretations are performed within a framework, and biased by various assumptions. This is why multiple working hypotheses should be the rule, not the exception, when studying the past. The Novarupta-Katmai eruption of 1912 clearly shows the failure of uniformitarian dogma in many ways. Assuming present day rates are keys to extrapolating past events creates a major stumbling block for secular and creationist researchers alike. However, assuming the Bible is the key to the past sheds new light on earth’s catastrophic and recent history, and more reasonable and realistic interpretations result. Flood geologists are just beginning to free natural history from its uniformitarian shackles. They are preparing fertile ground for developing a more realistic, biblically sound model of earth’s catastrophic past.

TOPICS FOR CREATION RESEARCHERS TO EXPLORE AT NOVARUPTA-KATMAI IN THE FUTURE:

1) Use radioisotopes to study thermal history and magmatic “signatures”, rather than absolute age. Already being done to study magma chamber that erupted out Novarupta (Hildreth and Fierstein, 2012).
2) Collect more evidence to discern whether Noisy Mountain is a tuya.
3) Return to the Ukak River and measure erosion rates and compare data to Whipple et. al. (2000).
4) Provenance studies of worldwide sedimentary deposits and similarities to Novarupta’s ignimbrite flows. X-ray diffraction (XRD) data may be helpful.
5) Supercritical fluids and their effects on surrounding rock, especially corrosion and argillic alteration.
6) Supercritical fluids and their role in volcanism, especially as it relates to giant magma bodies being ephemeral features.
7) Abiogenic oil and its relation to volcanism in the Katmai Volcanic Cluster and elsewhere.

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