Novarupta and the Valley of 10,000 Smokes: Begging for a Biblical Interpretation

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Abstract

On June 6, 1912, the biggest eruption in over 100 years occurred in what is now Katmai National Park, Alaska. Ejecting over 30 times more material than Mount St. Helen's, the Novarupta Volcano exploded for 60 hours. Novarupta contains a treasure trove of information just waiting to be interpreted within a Biblical framework. This article seeks to encourage further exploration of Novarupta and The Valley of Ten Thousand Smokes by creation scientists. Details of the eruption are discussed, together with first encounters of the eruption zone by Robert F. Griggs shortly after the 1912 eruption. Comparisons are made between Novarupta and other eruptions, and the local geology is discussed. Rates of glacial advance and retreat in the area may have implications for both global climate change and the causes of the Ice Age. Present-day bedrock incision rates are used to speculate about geologic timescales. The geologic history of Novarupta and The Valley of Ten Thousand Smokes appears congruent with Biblical history.

Introduction

Imagine if there was a place on Earth where astronauts trained for walking on the moon. Where one of the three largest volcanic eruptions in recorded history occurred and created a "great incandescent sand flow" (Griggs, 1922, p. 253), along with a rare form of rock known as "banded pumice." Where glaciers are growing. Where a canyon was gouged out following the breaching of a massive rockslide dam. Where rocks not only float but also fly! Where an eruption, 30 times larger than St. Helens, dropped temperatures worldwide 2° F, caused mountains to disappear, and caused the head of the National Geographic Society in 1922 to consider the earth as a "young and active planet" (Griggs, 1922, p. xv).

This place is The Valley of Ten Thousand Smokes (TVTTS), created by the June 6–8, 1912 eruption of Novarupta volcano. Novarupta, Latin for "new eruption," is the biggest volcanic eruption in over 100 years and one of the top three in recorded history. Located in Katmai National Park (Figure 1), TVTTS is one of the most researched areas in Alaska. This volcanic region lies atop 15,000 feet of sedimentary rock and presents an opportunity for interpreting earth history within a Biblical framework.

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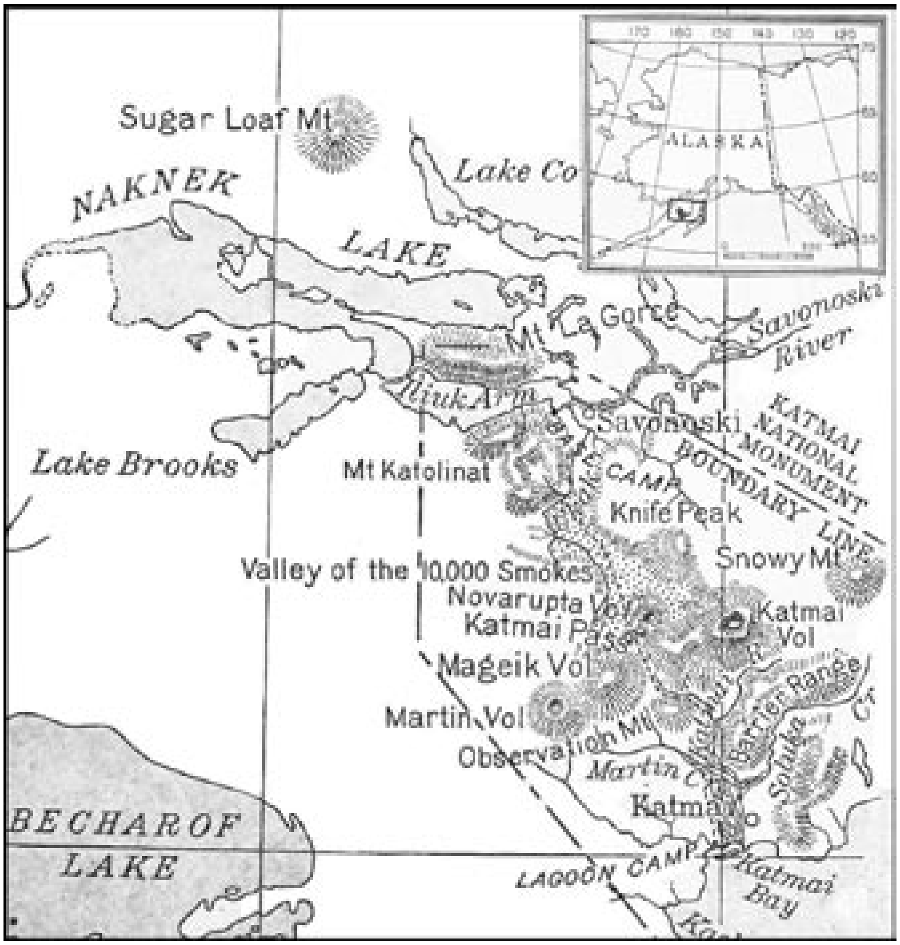

Figure 1. Map of The Valley of 10,000 Smokes, modified from Griggs (1922).

The 1912 Eruption and Subsequent Exploration

On June 9, 1912, Ivan Orloff wrote to his wife:

> *My dear wife Tania:*
> *A mountain has burst near here, so that we are covered in ashes, in some places 10 feet and 6 feet deep.… The earth is trembling; it lightens every minute. It is terrible … Perhaps we will see each other again … We are praying.* (Griggs, 1922, p. 19)

God spared Orloff's life, and in fact not a single soul died during the massive eruption. Like Mount St. Helens, Novarupta was a plinian eruption, and the low density and high silica content of its rhyolitic magma made it even more explosive (Eichelberger and Izbekov, 2000). In three massive eruptions beginning on June 6, 1912, Novarupta spewed forth its volatile mixture of ash, rock, and corrosive gases, cloaking Kodiak Island (60 miles away) and its approximately 500 inhabitants in complete darkness for two days and three nights (Bodeau, 1996).

The volcanic plume rose 25 miles, and the eruption flooded the adjacent valley with a "great hot sand flow" (Griggs, 1922, p. 285), forming tuff. It was also one of few historic eruptions to form "welded tuff" (Hildreth, 1983), where high temperatures fuse tuff together into a pyroclastic rock. Mt. St. Helens and Yellowstone's Caldera also contain welded tuff (Christiansen and Blank, 1972). Ejecta from Novarupta buried the valley under nearly 700 ft of ash (Brantley, 1994; Glore, 2007). The ash flow stopped near the upper Ukak River, over 15 miles away (Griggs, 1922).

It is difficult to describe the spectacle of a massive volcanic eruption. Griggs, leader of the first expedition into the eruption zone, described Novarupta this way:

> If such an eruption should occur on Manhattan Island, the column of steam would be conspicuous as far as Albany. The sounds of the explosions would be plainly audible in Chicago. The fumes would sweep over all the states east of the Rocky Mountains…. There would be no occasion for rescue work [on Manhattan Island], for there would be no survivors. The whole of Manhattan Island, and an equal area besides, would open in great yawning chasms, and fiery fountains of magma would issue from every crack. (Griggs, 1922, p. 1)

Sponsored by the National Geographic Society, Griggs, a botanist by degree, made several expeditions to the area from 1913 to 1919. Initially sent to study the effects of ash fall on Kodiak Island plants, the expeditions expanded to include "a thorough investigation of the immediate environs of the volcano" (Griggs, 1922, p. 71). The expeditions included chemists, geologists, topographers, photographers, students, and even a one-handed bear hunter from Kodiak (Griggs, 1922, p. 73).

Griggs and his group thoroughly scoured the area for details and named many of the mountains and rivers in the area. One of his most appropriate names was the River Lethe, named after the river flowing through Hades in Greek mythology. The river has lived up to its name, as entries in the USGS Baked Mountain Cabin logbooks reveal.

> After spending careful hours of contemplation I chose a narrow gorge in

Figure 2. Novarupta then (left, from Griggs, 1922, p. 280) and July 2009 (right).

> which to jump the River Lethe … After the tragic loss of our Swiss camper this summer, I was confronted with a respect, perhaps fear, of this river (Fisher, 1989).

The most memorable name that Griggs gave to the area was The Valley of Ten Thousand Smokes. When he first saw it in July of 1916, he had this to say:

> The sight that flashed into view as we surmounted the hillock was one of the most amazing visions ever beheld by mortal eye. The whole valley as far as the eye could reach was full of hundreds, no thousands—literally, tens of thousands—of smokes curling up from its fissured floor. (Griggs, 1922, p. 191)

Novarupta and TVTTS Today

Almost 100 years have passed since Novarupta exploded. Although Novarupta no longer steams as profusely as it did in 1917, the general shape of the lava plug remains the same (Figure 2).

TVTTS no longer emits "ten thousand smokes" (Figure 3), as the ash flow sheet has cooled and the sources are depleted. The ash flow sheet has not lost all its heat, though, as mid-valley thermal springs still emit water at 30°–60° C (Hogeweg et al., 2005), down from the 95° C temperatures Griggs's team measured from the same area in 1918 (Griggs, 1922).

The weather has not changed much since 1912. On multiple occasions, Griggs's expeditions were faced with a curious phenomenon known as a pumice storm (Figure 4). When the winds gust upwards of 50 mph, the lightweight pumice stones get whisked away, forming miniature tornadic slurries of rock and wind. In a particularly nasty storm that destroyed their campsite, he had this to say about the storms:

Figure 3. TVTTS then (left, from Griggs, 1922, p. 188) and July 2009.

Figure 4. A pumice storm. Imagine how rain stings when it hits your face at a high speed. Magnify that feeling many times over, and you can get a feel for a pumice storm!

> The hail of pumice that greeted us as we crawled out to see if anything could be done cannot be imagined. It could not be endured on face or hands for an instant. It hurt clear through our clothing. It drove in around our 'dust proof' goggles, a constant menace to our eyes. Many of the pieces were as large as hickory nuts and all were armed with sharp corners that made them terrible missiles. (Griggs, 1922, p. 229)

While the weather has not changed much in 100 years, our understanding of the processes that formed the area has. Griggs concluded that Mount Katmai was the source of the eruption. Before the eruption, it towered over the landscape, ascending from the waters of Cook Inlet to a height of over 7,500 ft. Afterwards, it looked like its top had blown off, leaving a massive hole in the top of the mountain over 2 miles wide in places (Figure 5). Griggs thought Mt. Katmai had exploded, although he also thought Novarupta contributed a significant portion of the eruption (Griggs, 1922, p. 261).

One clue that Katmai did not explode was the banded pumice that formed (Figure 6). As flour is to baked goods, silica is to rocks (Bodeau, 1996), and different densities of silica from different magma chambers usually have different colors. The banded pumice was a clue that more than one magma chamber was involved. Scientists now believe that an andesitic/dacitic magma chamber underneath Mt. Katmai emptied during the Novarupta eruption, while mixing with a lower-density rhyolitic magma source that had risen up and formed the dike that triggered the event (Eichelberger and Izbekov, 2000), 6.2 miles to the west. Once the magma chamber underneath Mt. Katmai emptied, the mountain collapsed, forming a caldera. However, volcanism is ongoing. The new Novarupta Dome is about 1,300 ft in diameter and 215 ft tall (Figure 2 and Brantley, 1994).

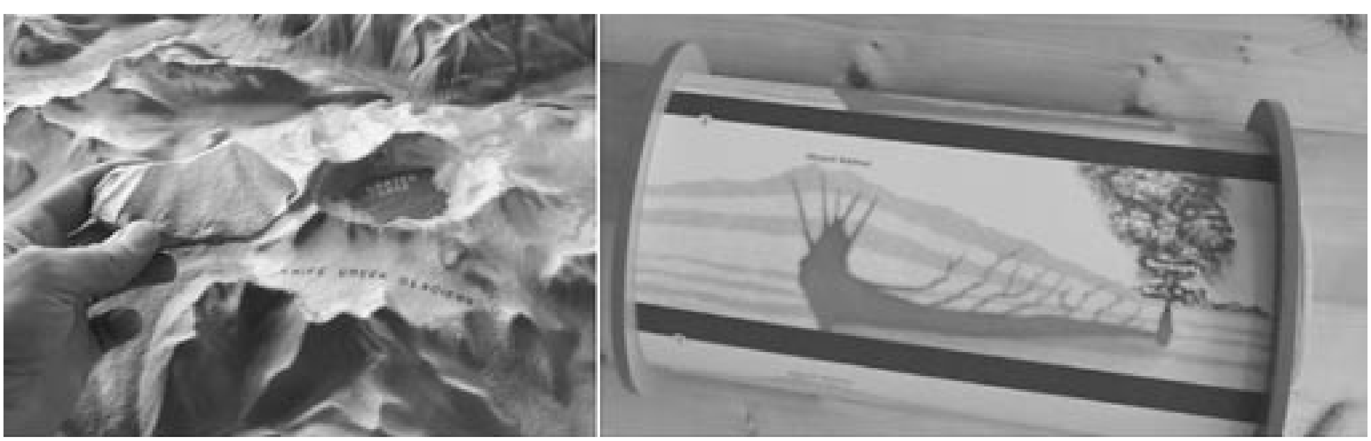

Figure 5. Portion of Mount Katmai that collapsed (left) after the magma chamber underneath emptied out Novarupta (right). Photographs from the Three Forks Visitor Contact Station, Katmai National Park.


Figure 6. Banded pumice (left) from the floor of TVTTS and rhyolite (right) from the top of Novarupta.

What Can Novarupta Teach Us About Biblical Earth History?

Catastrophism

Traditional geology was built on the gradualism of Lyell and the evolutionary directionalism of Darwin. However, these views are changing because the empirical evidence of the rock record shows that both catastrophism and stasis are elements of natural history. This is consistent with the commonsense understanding that science can only draw inferences about past events based on incomplete evidence and a forensic approach, since observation is not possible.

Overconfidence in historical interpretations arose because uniformitarians required scientific certainty to rid history of the Genesis Flood (Froede, 2007). Thus, many modern scientists have ignored evidence pointing to a worldwide flood, although many now style themselves as secular catastrophists. This view predates Lyell; his continental opponent, Georges Cuvier, published a number of works advocating past "revolutions" (e.g., Cuvier, 1825).

Novarupta and TVTTS can readily be interpreted within the framework of Biblical history. Eichelberger and Izbekov (2000) compared the Novarupta Volcano/Katmai Caldera complex with Russia's Karymsky Volcano/Academy Nauk Caldera complex. They found that the lower silica content of the Russian magma resulted in an effusive eruption, while the high silica magma of Novarupta resulted in an eruption they simply described as "catastrophic."

There really is no better word to describe Novarupta than "catastrophic," an eruption that was 10 times more powerful than the Mt. St. Helens 1980 blast (Glore, 2007). However, it was still small compared to ancient eruptions like the Yellowstone Caldera (Table 1). Novarupta dwarfs Mt. St. Helens, but the Yellowstone eruption ejected over 75 times more magma than Novarupta. The welded tuff and rhyolite formations left behind by the Yellowstone Caldera eruption suggest that it too was extremely explosive like Novarupta. Still larger eruptions have occurred in the past (Austin, 1998; Froede, 2007). This is consistent with the Biblical Flood and associated phenomena.

Table 1. Comparison of magma ejected from several volcanoes.

Eruption	Year	Volume of Magma Ejected (cubic miles)
Yellowstone Caldera	unknown	240*
Krakatoa	1883	4.3*
Novarupta	1912	3**
Mount Saint Helens	1980	0.1ᵀ

*Austin (1998); **Eichelberger and Izbekov (2000); ᵀ Brantley (1994).

Canyon Formation

While most would agree that canyons form by water eroding through rock, disagreements come primarily when rates and initial conditions are discussed due to the lack of direct observation. However, canyons near Novarupta help illustrate the forces involved in canyon formation.

When an eruption as large as Novarupta occurs, highly unstable geologic

Figure 7. Gorge formed (dashed borders) by the Great Flood of 1916 (from Griggs, 1922, p. 116). White lines show the source of the landslide that had dammed the Katmai River, holding back 8 billion cubic feet of water.

conditions may exist for years afterwards. Griggs's 1916 expedition experienced this in what he called the "Great Flood" (Griggs, 1922, pp. 103–122). The flood was caused by the escape of water impounded by a landslide (Figure 7). The landslide, formed during the eruption when a portion of Mt. Katmai fell away, impounded about 8 billion cubic feet of water. The landslide dam burst, and the water's erosive actions formed a "trench as straight and clean-cut as though excavated by man to carry some great engineering work, like the Panama Canal" (Griggs, 1922 p. 117; Figure 7). Comparing it to other great floods, Griggs calculated the Katmai flood to be 35 times as great as the 1889 Johnstown, Pennsylvania flood (Griggs, 1922, p. 119). With speeds calculated at over 60 mph, the Katmai flood had a destructive power over a million times greater than the average Mississippi River flood (Griggs, 1922, p. 121). It excavated about 33 million cubic yards of material, about half the amount moved in excavating the Culebra Cut (aka Gaillard Cut) of the Panama Canal (Griggs, 1922).

Griggs did not reach the landslide dam until the year following the breach, and the photograph taken that year (Figure 7) clearly shows the large channel excavated by the flood, and the smaller channel formed from the more normal flow levels of the Katmai River. Griggs felt very fortunate that their arrival in 1916 was behind schedule, for if they had landed a week earlier, they "would almost inevitably have been overwhelmed, for our work kept us on the flats [of the lower Katmai River] and there would have been no chance for escape" (Griggs, 1922, p. 115). The photograph is excellent testimony of how catastrophic events form larger canyons, similar to evidence found in the Upper Toutle River near Mt. St. Helens (Austin, 1984; 1998) and at Red Rock Pass (Austin, 1998).

TVTTS provides excellent evidence for subsequent canyon erosion. Scientists commonly use the stream power erosion law for modeling stasis bedrock channel incision (Goudie, 2004; Ritz, 2008; Stock and Montgomery, 1999; Whipple et al., 2000a; Whipple and Tucker, 2002). In TVTTS, stream flow incision models have been used to pattern incision rates into bedrock of the Ukak River (Whipple et al, 2000b). The Ukak River provided an excellent setting for applying the stream power erosion law, because scientists knew the exact year (1912) when incision began in a diverted section of the Ukak River.

The most visibly striking feature of the bedrock incision in TVTTS is the width of the canyons. In Figure 8, the Ukak River cuts through sedimentary rock of the Naknek formation. A few miles upstream from this, the River Lethe incises into welded tuff from Novarupta (Figure 8). The canyons in Figure 8, formed under normal flow conditions, are narrow enough to jump across in places. Although many variables, including lithology, effect canyon width (Wil-

Figure 8. Ukak River cutting through sedimentary rock (left) and the River Lethe cutting through welded tuff. The catastrophic canyon formation of Griggs' "Great Flood" was far greater than modern fluvial action.

liams, 1998), evidence from TVTTS shows that under stasis conditions, rivers flowing over two different types of bedrock cut extremely narrow, steep-walled canyons. This is the opposite of what a uniformitarian model might predict (Froede and Williams, 2003).

Glaciers, Timescales, and Climate Change

Almost all the volcanoes in TVTTS are covered by multiple glaciers (Figure 9). Glaciers at the base of Mount Mageik retreated about 2,424 ft between 1912 and 1987 (Hildreth et al., 1998).

Although global temperatures, on average, are rising, it appears to be a cyclical trend (Singer and Avery, 2008). That view is supported by the Katmai National Park glaciers, which retreated an average of 56.8 ft per year from 1951–1987, accelerated that retreat from 1974 to 1987 to 112.5 ft per year, and then decreased from 1987 to 2000 down to 44.0 ft per year (Giffen et al., 2007), suggesting a cyclical pattern of temperature change.

After the 1912 eruption and collapse of Mt. Katmai, a new glacier formed inside the Katmai caldera. It may be the only glacier in the world whose exact age is known (Bodeau, 1996). In addition, the Knife Creek Glaciers on the north face of Mt. Katmai actually have advanced from 1951–2000 (Giffen et al., 2007; Figure 9). One reason for this advance may be the insulating effects of the pumice covering over the Knife Creek Glaciers (Hildreth et al., 1998).

After the eruption, scientists calculated that if the Novarupta ash had

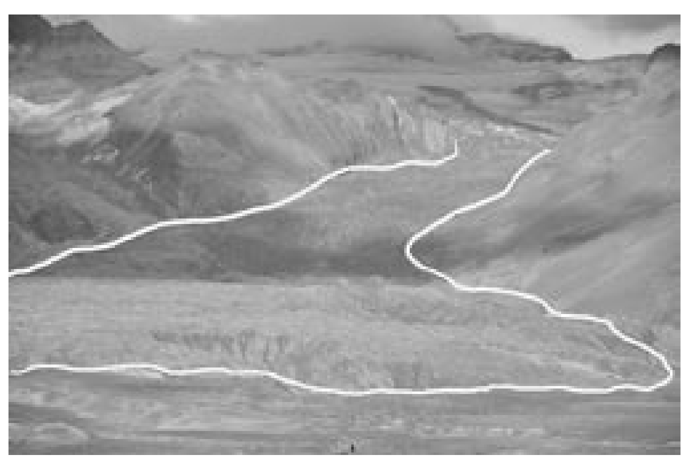

Figure 9. The top of glacier-coated Mt. Mageik (left), with steam rising and the moon setting over its volcanic peak. On the right, ash-covered Knife Creek Glaciers (inside white borders) have been advancing.

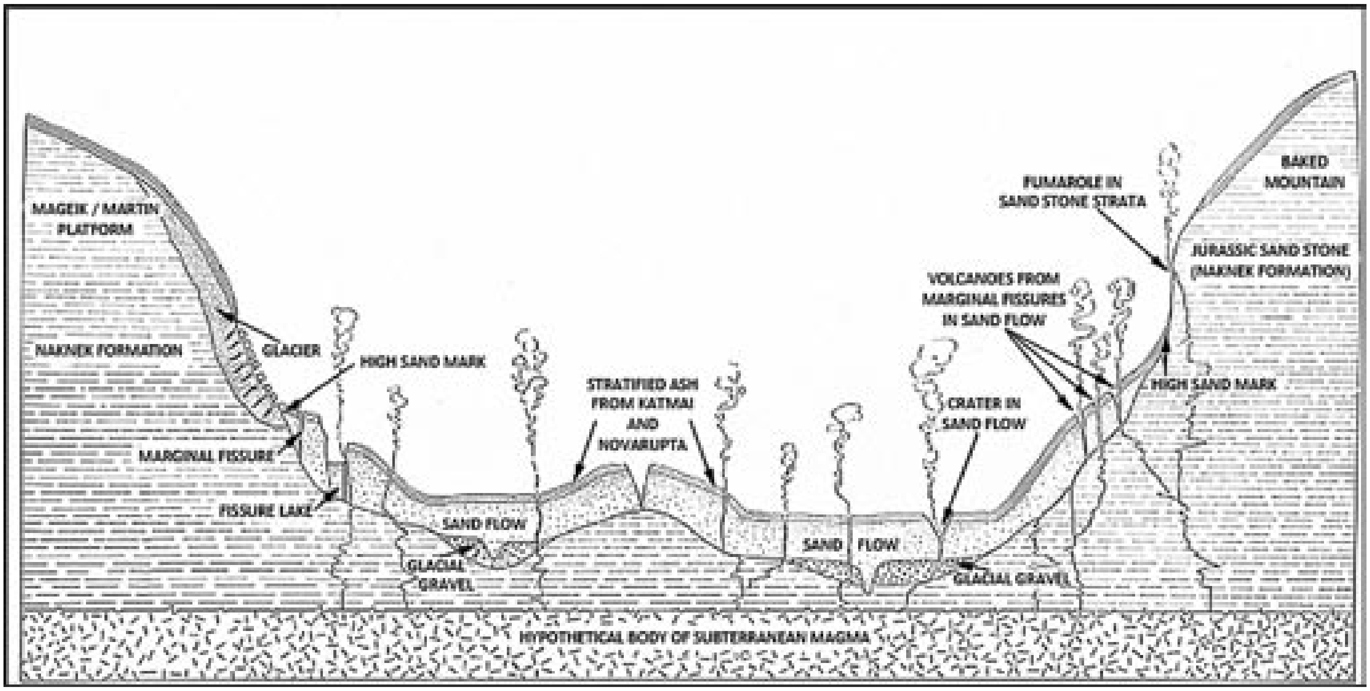

Figure 10. Cross section of TVTTS from Griggs, p. 263. The dashed lines represent sedimentary rock of the Naknek formation.

stayed in the atmosphere a little longer, the temperature decrease would have been enough to initiate another Ice Age (Griggs, 1922). Given that impact, larger volcanic eruptions in the past, like Yellowstone, might have generated significant climate change. Cuvier believed that the volcanic upheavals surrounding the Genesis Flood were responsible for the Ice Age (Cuvier, 1825), and the hypothesis still is popular today (Froede, 2007; Oard, 1990).

The Naknek Formation and the Genesis Flood

Beneath the volcanics produced by the Novarupta eruption, lie up to 15,000 ft of sedimentary rock. This suggests a massive, water-related event (Figure 10). Hundreds of square miles of Alaska are covered by the sedimentary Naknek Formation. The Naknek and underlying Shelikof formations in Katmai National Park are said to be composed of rapidly eroded coastal sediments mixed with a "considerable volume" of volcanic debris (Harris et al., 2003).

In places, the Naknek Formation is described as having been formed by "continuous sedimentary deposition" (Church et al., 1994). In the Talkeetna Mountains northeast of TVTTS, studies describe the Naknek Formation forming when "gravelly mass flows transformed downslope into sandy turbidity currents on a muddy pro-delta slope" (Trop et al., 2005). In places, the Naknek Formation contains a considerable number of marine fossils, and fossil-containing rocks litter many mountaintops in the park (Figure 11).

Summary

The Valley of Ten Thousand Smokes sits atop one of the most volcanically active regions in the world, where the Pacific Plate dips underneath the North American Plate. In an old-earth framework, one would expect this area to consist of layer upon layer of volcanic strata, with steep-walled canyons incising thousands of feet down. Instead, we find evidence of a relatively recent, yet massive geologic upheaval that mixed marine sediments and volcanic ash into a uniform slurry in places. Glacial action then sculpted the terrain, and this is capped by a volcanic layer from an eruption less than 100 years old.

Grosvenor (Griggs, 1922, p. xv, emphasis added) described Griggs's work as an "important addition to our knowledge of the *young and active planet* upon which we live." This is a description that would receive great ridicule from many scientists today, but why should it? Great effort has been expended over the past 200 years to rid geologic history of any connections to Biblical history (Froede, 2007), but many scientists are now finding this was a foolish idea. One thing is certain: man's interpretations of past events will always be speculative,

Figure 11. Fossil-bearing sedimentary rock of the Naknek Formation.

because we cannot go back in time and verify the results. Nevertheless, evidence that supports Biblical history should not be ignored.

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