An Overview of Various Igneous Rock Outcrops Near The Van Andel Creation Research Center Interpreted Within A Young-Earth Flood Model

Van Andel Creation Research Center Report Number 3

Carl R. Froede Jr., George F. Howe, John K. Reed, and John R. Meyer*

Abstract

For many areas of the Earth, intrusive and extrusive igneous rocks form a significant portion of the vertical stratigraphic column. They reflect geologic energy levels which might aid in understanding Earth's short history within the Young-Earth Flood model. We propose that intrusive igneous rocks reflect high-energy heat and tectonic conditions and that their exposure provides testimony to the erosional power of the global Flood. We believe that extrusive igneous rocks can also provide information about both the passage of time and the former environmental conditions that prevailed when they were deposited. The Van Andel Creation Research Center provides a strategic location from which a great variety of these igneous outcrops can be investigated. We discuss several locations which reflect such features as exfoliating granites, flood basalts, and subaerial volcanic deposits, and explain them within the framework of the Young-Earth Flood model.

Introduction

The Van Andel Creation Research Center (VACRC) provides a strategic location for the study of exposed intrusive (granite, granodiorite, quartz monzonite, etc.) and extrusive (ash, tuffs, lava flows, etc.) igneous rocks. In many cases these areas have been previously investigated by uniformitarian scientists as part of an economic survey of the state or as part of the quest to determine the geologic history of the area (Jenny and Reynolds, 1989; Nations and Stump, 1996). However, the origin and stratigraphic relationships of these igneous rocks have yet to be defined within the framework of the Young-Earth Flood model, and creationist geological timescale (Froede, 1995, 1998; Walker, 1994).

Igneous rocks reflect tremendous forces in operation within the Earth. We believe that these immense forces began with the advent of the Flood, and continued (although at ever-decreasing rates) into recent times (Froede, 1998; Reed, Froede, and Bennett, 1996). We propose that igneous rocks can provide the creationist researcher with many clues concerning their origin and development both during and after the global Flood.

The creationist study and interpretation of intrusive and extrusive igneous rocks, along with their associated environments, necessitates both a review of the relevant literature and locations where we can observe and study a variety of these terrains first hand. For example, Froede (1995, 1997) and Froede, Williams, and Brelsford (1998) have presented information about exposed granitic plutons within the Atlanta, Georgia area in an effort to explain their origin and development within the framework of the Young-Earth Flood model. Likewise, the volcanic rocks and catastrophic features of Mount St. Helens, in Washington state have also been investigated and presented within this same framework (Austin, 1984, 1986, 1991; Snelling and Mackay, 1984). However, these locations only demonstrate a few of the processes that relate to the history of magmatic generation, mobilization, emplacement, or even eruption. Essentially, we see the top (e.g., volcanoes) and bottom (e.g., plutons), but miss the opportunity to observe or understand the relationship between them.

The Creation Research Society's Van Andel Creation Research Center (VACRC), located in Chino Valley, Arizona, affords the visiting scientist the opportunity to study a wide variety of igneous rocks in diverse settings

*Carl R. Froede, Jr., B.S., P.G., 2895 Emerson Lake Drive, Snellville, GA 30078-6644

George F. Howe, Ph.D., 24635 Apple Street, Newhall, CA 91321-2614

John K. Reed, Ph.D., 915 Hunting Horn Way, Evans, GA 30809

John R. Meyer, Ph.D. Van Andel Creation Research Center, Creation Research Society, Box 376, Chino Valley, AZ 86323

Received 7 August 1997; Revised 10 August 1998]

within close proximity to the research facility (Figure 1). These igneous rocks span the entire spectrum between plutons and extrusives. This wide range of igneous rock can help us understand the forces in effect during and following the Flood. Surprisingly, these intrusive and extrusive rocks are not limited to any one specific geomorphic province (see Froede, Howe, Reed, Meyer, and Williams, 1997).

In this article we present a few select sites of igneous rock outcrops near the VACRC (Figure 2). We hope that this article might stimulate interest in more detailed investigations of these areas in the future. A glossary of terms is included to help the reader understand some of the geological terminology used throughout this paper.

Intrusives

South of the VACRC are exposures of granite in an area identified by Krieger (1965, p. 44) as the Granite Dells (Location 1 in Figure 2). This granite weathers by exfoliation (Figure 3) in a manner typical to most granitic plutons (see Froede, 1995; Froede et al., 1998). Following its original emplacement, additional stresses served to generate internal jointing within the rapidly cooling granitic mass which likely enhanced the formation of liesegang rings or banding. These bands reflect areas where iron oxide precipitated due to complex crystallizing conditions within the fluid-saturated magma. The formation of additional late-stage joint sets within the granite likely influenced its exfoliation along these liesegang bands resulting in the exposed checkerboard pattern (Krieger, 1965, pp. 45-46) [Figures 4 and 5].

Interestingly, granitic outcrops are more commonly found in the Transition Zone, and Basin and Range provinces. We believe that this is because the original sedimentary overburden or perhaps the former volcanic cover has been removed (via Floodwater erosion) exposing the underlying granitic rocks (see Lipman, 1984). Granitic rock outcrops along sections of the Grand Canyon, where

Figure 1. Surface outcrops of igneous (intrusive and extrusive) rocks across the State of Arizona. The map is a composite spanning the entire uniformitarian stratigraphic column (from Reynolds, Welty, and Spencer, 1986). Note that all three geologic-geomorphic provinces contain rocks of igneous origin: CP—Colorado Plateau, T—Transition Zone, and BR—Basin and Range.

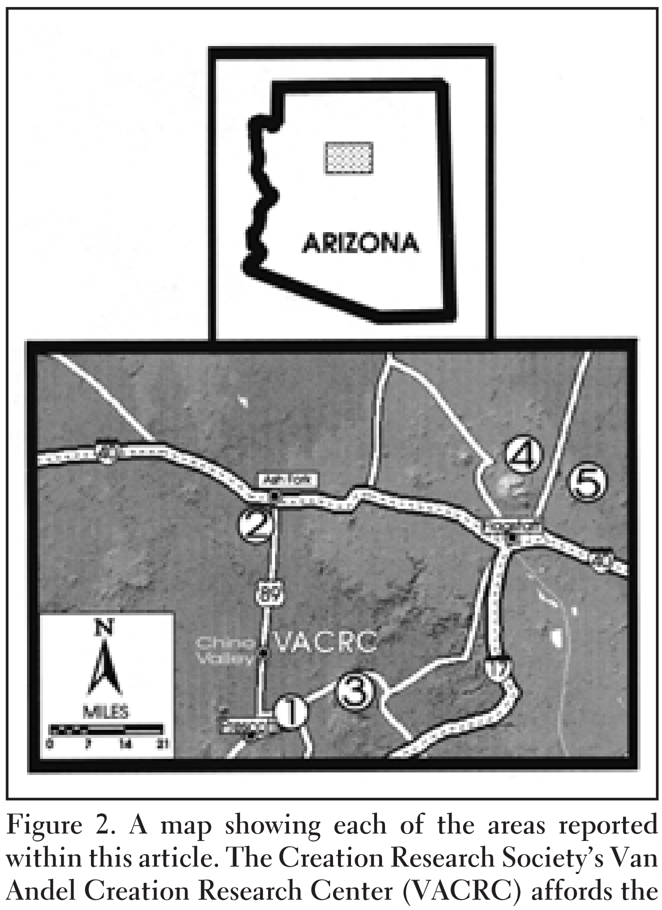

Figure 2. A map showing each of the areas reported within this article. The Creation Research Society's Van Andel Creation Research Center (VACRC) affords the visitor close proximity to several different volcanic terrains. Due to the complexity of the eruptive processes across the area the volcanic rocks range from basaltic (Hawaiian types of lavas and rocks) to rhyolitic (Mt. St. Helens types of lava and rocks). This is truly an excellent place to study volcanic rocks and associated features.

Figure 3. An outcrop of the Granite Dells just north of Prescott. Exfoliation and jointing serve to shape the granite into rounded blocks.

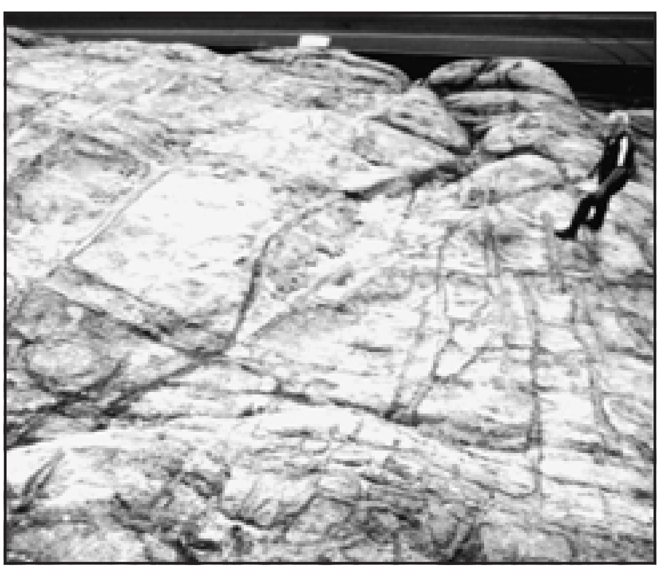

Figure 4. The surface of the granite at Granite Dells is crisscrossed by iron staining which has concentrated along the joints and fractures.

river erosion has exposed these once deep-seated intrusive rocks along the canyon sidewalls. However, the overburden remains intact above the granitic masses. The exposed granite basement rocks within the Transition Zone and Basin and Range were probably emplaced much like the granites found within the Grand Canyon, except the overburden has been removed. This speaks of tremendous erosional energy expended during the Flood!

Extrusives

Extrusive volcanic rocks cover much of Arizona. The VACRC facilities are built on extrusive rocks. Many studies have been conducted in an effort to explain these volcanic rocks within the history of the state (e.g., Lynch, 1982; Reynolds, Welty, and Spencer, 1986; Vanden-Dolder, 1991). They testify to historical periods of intensive magmatic activity. Evidently these igneous rocks formed in a variety of environments, both subaerial and subaqueous. In some cases the resulting volcanic features are recognized even by uniformitarians to have formed rather recently, within the last 2,000 years. Obviously, the timing of all of these magmatic episodes has a place within the Young-Earth Flood model, which is yet to be determined.

There are many volcanic areas in and around Arizona, such as the Mexican Volcanic fields, hydrothermal breccia pipes on the Colorado Plateau, hydrothermal environments within the Transition Zone, and volcanic features within the Basin and Range. Hence, there are plenty of volcanic features for a lifetime of investigation. Here we present a very limited sampling of some of the sites surrounding the VACRC where various types of igneous rocks were examined and are interpreted within the young earth framework.

Basalts of the Chino Valley

The VACRC is located within Chino Valley which in many places is capped by the Hickey Basalt. Because of the large areal extent and thickness of this basalt layer it should probably be considered a subaerially emplaced flood basalt. Approximately one mile northeast of the facility is a prominent outcrop of this basalt which has become exposed as a result of the erosion associated with the outfall of Sullivan Lake (Figure 6).

Figure 5. A closeup photograph of jointed granite showing the “rings” of iron which form within the granite This particular feature is commonly referred to as Liesegang rings.

Figure 6. Columnar basalt outcrops in drainage channel which originates from Sullivan Lake. This former lava flow is identified as the Hickey Basalt, and it covers much of north-central Arizona.

We would interpret this basalt flow as probably having formed following the withdrawal of the Floodwater during the Ice Age Timeframe. This is because no structures or features are present which would suggest a Floodwater related subaqueous environment during its emplacement. In fact, the basalt exhibits large-scale vertical columnar jointing, and is not highly vesicular. Both of these conditions suggest probable slow subaerial cooling.

Other volcanic strata found throughout Chino Valley (Krieger, 1965; Stefanov, 1993) require further investigation and interpretation within our young earth framework.

Monogenetic Volcanic Ash Deposits

Within the Transition Zone to the north of the VACRC (five miles south of Ash Fork) are several “borrow pits” near some low-lying cinder cones (Location 2 in Figure 2). The sidewalls within these pits exhibit volcanic strata which reflect andesitic volcanic activity which is commonly associated with the formation of cinder cones

Figure 7. A typical cinder cone with an ash-pit along its side. Strombolian style eruptions usually form this type of volcano. The ash generated is not fine-grained, but rather occurs as cinders (like you find in a gas barbecue grill). The explosive eruption does not carry the cinders far from the throat of the volcano.

(Figure 7). These deposits appear to reflect a strombolian eruptive style yielding typically monogenetic deposits. Figures 8 and 9 show volcanic layers along the sidewalls of the pit which have differences in both color and texture. However, these variations do not require different volcanic sources or even different periods of eruption. Rather, they indicate that the eruptive style varied as water (probably groundwater) interacted with the magma during the eruption. The lighter layers reflect what were likely "wet" phreatic explosions or eruptions which generated the fine-grained ash, while the darker and more coarse-grained layers reflect "dry" cinder-producing eruptions. As groundwater came into contact with the erupting magma it created a difference in eruptive styles even from the same vent! The contact between each of the layers is sharp (no paleosols were noted) and this indicates that volcaniclastic deposition was continuous.

These deposits represent one or more volcanic eruptions which probably occurred during the Ice Age Timeframe. This interpretation is based on the variation in "wet" and "dry" volcanic deposits which suggests that groundwater played a major role in particulate formation, and in the style of the eruption. The missing paleosol(s) suggests that little time passed as layer followed layer in forming these deposits.

Complex Subaerial Volcanic Deposits

Another location within the Transition Zone near Mingus Mountain (approximately 18 miles to the east of the VACRC), provides exposures of subaerially derived rhyolitic volcanic deposits (Location 3, Figure 2). These strata reflect volcanic activity similar to that experienced at Mount St. Helens (i.e., a plinian style eruption). Figures 10, and 11 show a succession of volcaniclastics which correspond (from bottom to top) with several base surge layers which are followed by an air-fall ash layer, and capped by a blocky rhyolitic lava flow. The sharp contacts between the different layers suggests that little to no time passed between deposits. The source volcano for these deposits is unknown. We propose that these deposits likely formed in the Ice Age Timeframe, recognizing that

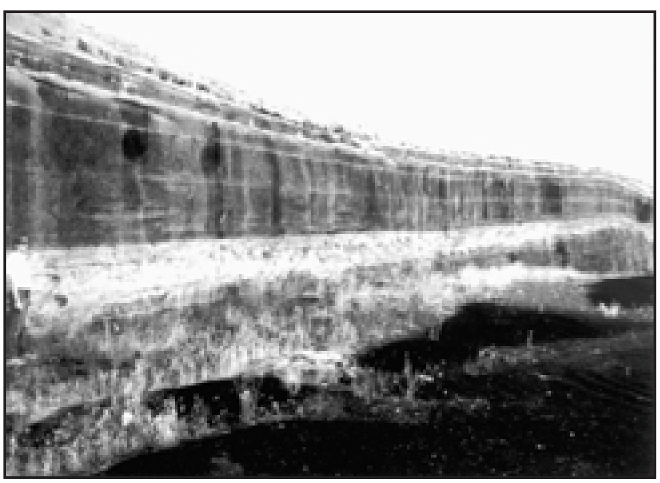

Figure 8. A sidewall of an ash pit showing the variation in strata. The dark material is coarse-grained, horizontally-bedded scoriaceous cinders while the lighter layers are finer-grained volcanic ash. The differences were the result of water contact with the magma which varied the eruptive style of the volcano, and produced the variation in volcaniclastics.

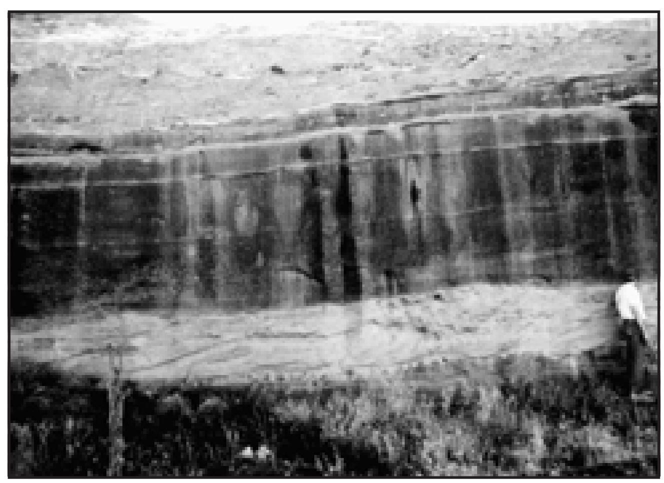

Figure 9. Another photograph showing the alternating layers of scoriaceous cinders and ash along the sidewall. If "time" passed between eruptions then a paleosol or other feature should be reflected along contacts between layers. None were noted. This indicates that this was indeed a monogenetic eruption (i.e., almost continuous until the volcano ceased erupting—permanently).

Figure 10. This exposure near Mingus Mountain shows a succession of volcanic deposits which are typical to the eruptive outpourings of stratovolcanoes such as Mount St. Helens. The "source" direction could not be determined.

further refinement regarding the timing and conditions associated with the formation of these volcanic deposits, within the framework of the Young-Earth Flood model, will require additional field work.

Volcanoes on the Colorado Plateau

Numerous volcanoes and associated features are located on the Colorado Plateau (Location 4 and 5, Figure 2). This area contains stratovolcanoes (similar to Mount St. Helens), cinder cones, lava domes, and lava fields (Figures 12 and 13). We believe that the majority of these volcanoes were active in a post-glacial setting (i.e., Upper Ice Age/Lower Present Age Divisions). Some of these volcanoes erupted as recently as 934 years ago! In fact, many still retain their youthful conical shape which likely reflects an arid environmental setting like that experienced by the region today.

Conclusion

In this article we have provided a broad overview of just a few locales which illustrate different types of intrusive and extrusive igneous rocks found near the Van Andel Creation Research Center, Chino Valley, Arizona. Many more excellent outcrops exist within this area which have yet to be investigated and interpreted within the framework of the Young-Earth Flood model. We propose that the exposed intrusive igneous rocks found within this broad area reflect the high-energy geologic forces which

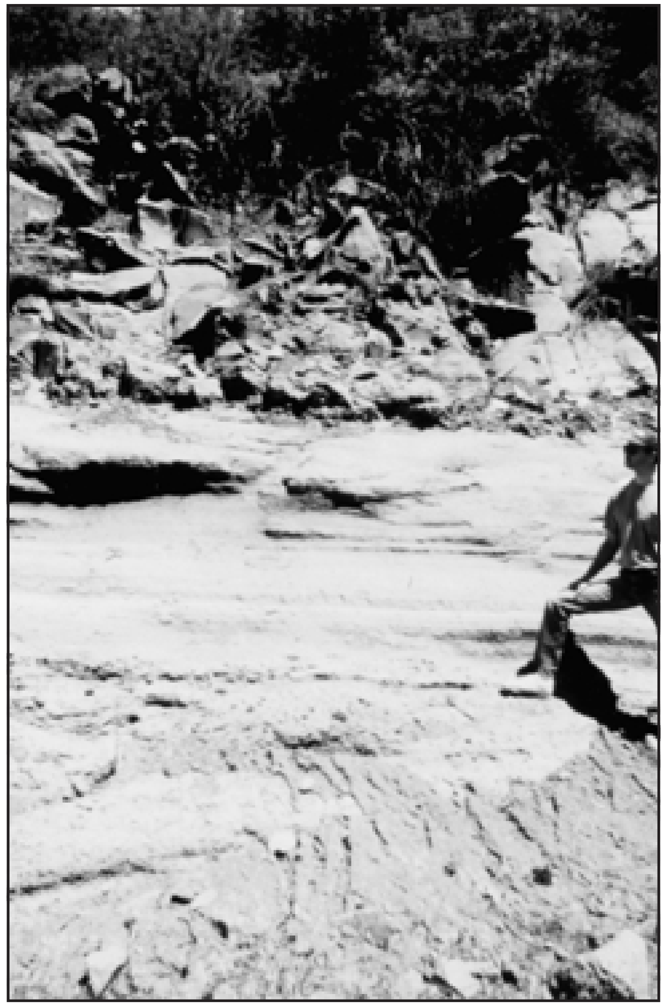

Figure 11. A photograph showing the transition in volcanic rocks from several base surge layers, to an air-fall deposit, followed by a blocky lava flow. The sharp contacts between layers indicates that these deposits followed in rapid succession and little time passed between each deposit. No features were noted which might indicate that scouring removed an older "paleosurface" as the next layer of volcanic rock was deposited.

likely created and exposed them during the Flood. It would appear that most of the extrusive igneous rocks were formed in a post-Flood environment, although detailed investigations might demonstrate various strata formed subaqueously during the Flood. Plenty of work remains to be conducted in understanding the geology of this area. Thankfully, the Van Andel Creation Research Center provides an excellent base from which these activities can occur. Much has been written about the igneous rocks of this area within a uniformitarian position, and we need to use that information and combine it with our own observations to reinterpret the strata within the framework of the Young-Earth Flood model.

Figure 12. The San Francisco Peaks are a complex of stratovolcanoes which grew to overlap each other, and then later the center of the structure collapsed. It has the same "horse-shoe" shaped as Mount St. Helens, but without a lava dome within the interior.

Figure 13. Looking southeast from U.S. Highway 89 toward O'Leary Peak. This is a dormant volcano northwest of Sunset crater, within the San Francisco volcanic field. O'Leary Peak is capped by a dacite lava-flow dome, formed in the final eruption. The volcanic peak rises approximately 1970 feet above the surrounding area.

Glossary

Andesite—A dark-colored, fine-grained extrusive rock. See volcanic rock types.

Basalt—A dark-colored, fine-grained dense extrusive rock. See volcanic rock types.

Extrusive—Said of an igneous rock that has erupted onto the surface of the Earth. Extrusive volcanic rocks include lava flows, volcanic ash and cinders, etc.

Intrusion—The process of magma emplacement into overlying rock. This activity results in the formation of a pluton of rock mass of granitoid texture.

Liesegang rings—Secondary, nested rings or bands caused by rhythmic precipitation within a fluid-saturated rock. Also known as Liesegang banding.

Monogenetic eruption—A volcano formed from almost continual eruptive activity, where the resulting deposits are all derived from a single source.

Phreatic explosion—A volcanic eruption and/or explosion that occurs due to the contact of magma with water. In our case this explosion/eruption occurred due to contact with water probably beneath the ground surface (i.e., groundwater).

Rhyolite—A light-colored, fine-grained extrusive rock. See volcanic rock types.

Stratovolcano—A volcano constructed of alternating layers of lava and pyroclastic deposits (e.g., Mount St. Helens).

Strombolian eruption—This eruptive style produces frequent, but moderate-sized eruptions. Typically the lava is basaltic to andesitic and of sufficient viscosity (it is "sticky") allowing entrapped gases to build-up pressure which is released in repetitive small explosions. The lava exploding from the throat falls to the sides and results in the formation of a steep-sided cone of interbedded lava and sometimes tephra (i.e., ash). Lavas flows typically breach the flanks of this style volcano, and can flow for great distances (up to several miles).

Volcanic Rock Types—As a generality, volcanic rocks fall into four basic categories based on changes in the content of magnesium/iron and quartz. *Basalt* has little to no quartz and has the highest amounts of magnesium and iron, making it a dense, dark, and heavy rock. *Andesite* has some quartz and less magnesium/iron. *Dacite* is even more quartz rich with still less magnesium and iron. *Rhyolite* has the greatest amount of quartz and little to no magnesium or iron, making it a less dense, lighter-colored rock. Other minerals (e.g., Ca-, Na-, and K-aluminosilicates) form minor components within these volcanic rocks

Volcaniclastic—Volcanic materials that are in particulate form such as clasts, ash, cinders, etc.

Volcanology—The branch of geology that deals with volcanism, its causes and phenomena.

Acknowledgements

The authors thank the Van Andel Foundation and our colleague, Dr. John Meyer, for making this excellent facility possible. Additionally, we thank the many donors to the Creation Research Society Research Fund, interest from which has financed a portion of this study. Dr. E. L.

Williams kindly reviewed and supplied helpful comments on an earlier version of this manuscript. The peer-review comments were also most helpful. We give all the glory to God our creator for this opportunity to study His creation in the area surrounding the VACRC.

References

Austin, S. A. 1984. Rapid erosion at Mount St. Helens. *Origins* 11(2): 90–98.

———. 1986. Mount St. Helens and catastrophism, in Walsh, R.E. et al., editors,

———. 1991. Mount St. Helens: A slide collection for educators. Geology Education Materials. El Cajon, CA.

Froede, C. R., Jr. 1995. A proposal for a creationist geological timescale. *CRSQ* 32:90–94.

———. 1995. Stone Mountain, Georgia: A creation geologist's perspective.

———. 1997. Xenoliths in Stone Mountain Granite: Evidence for rapid emplacement and cooling of the granitic magma.

———. 1998.

Froede, C. R., Jr., G. F. Howe, J. K. Reed, J. R. Meyer, and E. L. Williams. 1997. An overview of the geomorphology of Arizona. Van Andel Creation Research Center Report Number 1. *CRSQ* 34:68–74.

Froede, C. R., Jr., E. L. Williams, and J. Brelsford. 1998. Panola Mountain, Georgia: Exfoliation evidence in support of Flood exposure. *CRSQ* 35:41–44.

Jenny, J. P. and S. J. Reynolds. 1989. (editors). *Geologic evolution of Arizona*. Arizona Geological Society Digest Number 17. Tucson.

Krieger, M. H. 1965. *Geology of the Prescott and Paulden Quadrangles, Arizona*. U.S. Geological Survey Professional Paper No. 467. Washington, D.C.

Lipman, P. W. 1984. The roots of ash flow calderas in Western North America: Windows into the tops of granitic batholiths. *Journal of Geophysical Research* 89(B10):8801–8841.

Lynch, D. J. 1982. *Volcanic processes in Arizona*. Arizona Bureau of Geology and Mineral Technology. *Fieldnotes* 12(3):1–9.

Nations, D. and E. Stump. 1996. *Geology of Arizona*, second edition. Kendall/Hunt Publishing. Dubuque, IA.

Reed, J. K., C. R. Froede, Jr., and C. B. Bennett. 1996. The role of geologic energy in interpreting the stratigraphic record. *CRSQ* 33:97–101.

Reynolds, S. J., J. W. Welty, and J. E. Spencer. 1986. Volcanic history of Arizona. Arizona Bureau of Geology and Mineral Technology. *Fieldnotes* 16(2):1–5.

Snelling, A. A. and J. Mackay. 1984. Coal, volcanism and Noah's Flood. *Creation Ex Nihilo Technical Journal* 1:11–29.

Stefanov, W. L. 1993. *Geologic map of volcanic rocks along the east side of central Chino Valley, Yavapai County, Arizona*. Arizona Geological Survey Contributed Map CM–93–E. Tucson.

VandenDolder, E. M. 1991. The once and future past. Arizona Geological Survey. *Arizona Geology* 21(3):2–3.

Walker, T. 1994. A Biblical geologic model, in Walsh, R.E. (editor), *Proceedings of the Third International Conference on Creationism*. Technical Symposium Sessions. Creation Science Fellowship. Pittsburgh, PA. pp. 581–592.

G. K. Chesterton on Missing Links and Monkey Men

Nearly all the "skulls," out of which Missing Links and Monkey Men have been made, have been only bits of bone. I do know that even of these bits of bone there are only about two or three in the whole world. But as long as those bits of bone were supposed to point, like the pebbles in the fairy-tale, along a particular path, a very gradual upward path of evolution, of scientific progress, nobody dared to suggest that such evidence was rather slight. Nobody ventured to complain that one skull was insufficient, or that one scrap of one skull was insufficient. Any minute bit of any mouldy bone was good enough for the purpose, so long as the evolutionists recognised it as a good purpose. Anything proved anything, so long as it proved the proper, progressive, really evolutionary thing.

"Outlines of History"
The Illustrated London News
13 January 1923