Chapter 74

Late Flood Origin of Submarine Canyons

Uniformitarian scientists postulate submarine canyons were formed by mass flow that began at the edge of the continental shelf. It would take multiple mass flows to accomplish this task. The origin by mass flow is a credible explanation, but there is a key ingredient missing. What would cause the thick sediments to amass near the edge of the continental shelf, over and over again, in the first place? The late Flood runoff can provide the needed sediment.

Canyons Cut after Continental Margin Sediments Deposited

It is unlikely that the large continental shelf-indenting submarine canyons could form after the Flood. There would not be enough time or energy to erode these deep chasms, taking into account the greater precipitation, continental erosion, and lower sea level during the Ice Age.[1,2] The real enigma is: how did the "Grand Canyon" sized submarine canyons on the continental shelf and slope originate?

From the geomorphology of the continental margin, deep submarine canyons must have formed very late in the Flood.[3] They formed *after* essentially all of the continental shelf sediments were laid down, and much of sediment was consolidated to sedimentary rock. Some of the evidence for this is provided by submarine canyons that cut into underwater forearc ridges and basins and the rarity of buried submarine canyons.

Submarine Canyons Carved through Forearc Ridges and Basins

Active or Pacific-type continental margins (see Chapter 30) have been deformed after much of the sediment was laid down. There is generally a ridge and a trough in the sedimentary rocks parallel to the coast or island arc that are due to some kind of buckling phenomenon (Figure 74.1). The troughs have mostly filled up with sediments. The ridge and trough is called a forearc. I have noted that some of the ridges have submarine canyons cut through them (see Chapters 70 and 71). The canyons were formed after the ridge had already formed. The submarine canyon also cuts through the forearc trough *after* these basins were filled with sediment.[4,5,6] These observations indicate nearly all of the sediment making up the continental margin had already been deposited, then the submarine canyon was carved through the forearc basin and ridge.

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[1] Oard, M.J., 1990. *An Ice Age Caused by the Genesis Flood*, Institute for Creation Research, Dallas, TX.
[2] Oard, M.J., 2004. *Frozen In Time: The Woolly Mammoth, the Ice Age, and the Bible*, Master Books, Green Forest, AR.
[3] Oard, M.J., 2001. Vertical tectonics and the drainage of Floodwater: a model for the middle and late diluvian period—Part II. *Creation Research Society Quarterly* 38(2):87-89.
[4] Klaus, A. and B. Taylor, 1991. Submarine canyon development in the Izu-Bonin forearc: a SeaMARC II and seismic survey of Aoga Shima Canyon. *Marine Geophysical Researches* 13:131-152.
[5] Liu, C.-S., N. Lundberg, D.L. Reed, and Y.-L. Huang, 1993. Morphological and seismic characteristics of the Kaoping Submarine Canyon. *Marine Geology* 111:93-108.
[6] Hagen, R.A., H. Vergara, and D.F. Naar, 1996. Morphology of San Antonio submarine canyon on the central Chile forearc. *Marine Geology* 129:197-205.

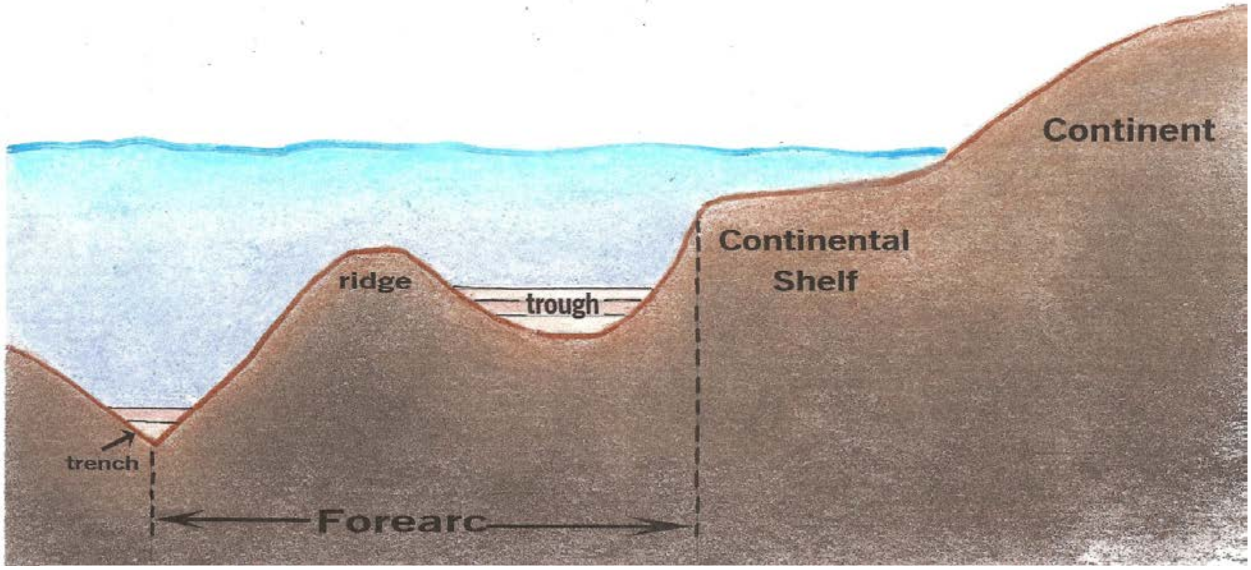

Figure 74.1. The general profile of a forearc ridge and trough off a Pacific-type margin (drawn by Mrs. Melanie Richard).

Rare Buried Submarine Canyons Show Continental Margin Sediments Deposited First

In the uniformitarian model, it is interesting that the continental margin built slowly over 125 million years, yet major submarine canyons have only been cut while all these sediments were deposited. Very few, even modest sized, canyons have been discovered by seismic methods within the continental margin sediments:

> On the other hand, because of the general paucity of seismic-scale exposures of ancient canyon fills, the geological literature on the internal stratal make up of these sediment conduits is sparse and architectural models are far from complete…[7]

This means that the period of deep canyon cutting on the continental margin came after the vast majority of margin sediments had accumulated.

By uniformitarian logic, there should be a huge number of deep submarine canyons buried within the margin sediments. Seismic profiles should reveal these canyons if they exist. However, there is evidence for only a few buried submarine canyons in the strata of the continental margin.[8,9,10] These buried canyons are usually close to the current canyons or within the canyons, representing a phase of cutting and filling in the current canyons. Fulthorpe and others stated in regard to ancient submarine canyons detected within the continental shelf and slope:

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[7] Di Celma, C., 2011. Sedimentary, architecture, and depositional evolution of a coarse-grained submarine canyon fill from the Gelasian (early Pleistocene) of the Peri-Adriatic basin, Offida, central Italy. *Sedimentary Geology* 238:234.

[8] Popescu, I., G. Lericolais, N. Panin, A. Normand, C. Dinu, and E. Le Drezen, 2004. The Danube submarine canyon (Black Sea): morphology and sedimentary processes. *Marine Geology* 206:249-265.

[9] Carlson, P.R. and H.A. Karl, 1988. Development of large submarine canyons in the Bering Sea, indicated by morphologic, seismic, and sedimentologic characteristics. *GSA Bulletin* 100:1,594-1,615.

[10] Normark, W.R. and P R. Carlson, 2003. Giant submarine canyons: Is size any clue to their importance in the rock record? In, Chan, M.A. and A.W. Archer (editors), *Extreme Depositional Environments: Mega End Members in Geologic Time*, Geological Society of America Special Paper 370, pp. 175-190.

> High-resolution multichannel seismic reflection profiles confirm that middle-late Miocene continental slope canyons off New Jersey are rare, in contrast to their prevalence on the slope today.[11]

Galloway and others corroborate the lack of submarine canyons within the continental margin sedimentary rocks:

> The size and abundance of canyons seen in the Pleistocene sequence [of the northern Gulf of Mexico] are atypical of older Neogene sequences. This, too, is a global pattern (Poag, 1992).[12]

So, as we have seen throughout geomorphology, the present is *not* the key to the past. This is probably why most geologists claim to believe in "actualism," so they can claim that some unknown "natural" process formed the geomorphological feature. Actualism is vague, and they still need to come up with a plausible hypothesis for the origin of submarine canyons, as well as other observations and deductions of geomorphology. Those who make this claim are indirectly telling us that the dogma of geology, uniformitarianism, which resulted from rejection of the Flood during the Enlightenment, is not correct. Then these scientists should reanalyze those geological issues resulting from uniformitarianism and see if the Flood should have been arbitrarily rejected—if they are open minded.

The rarity of significant buried canyons also suggests that the continental shelves formed rapidly, before submarine canyons could develop. Only afterwards were submarine canyons excavated.

Submarine Canyons Carved Very Late in the Flood

This information fits well within Tas Walker's model for the Retreating Stage of the Flood.[13] The sheet erosion of the continents resulted in deposition along the continental margins (see Volume I). And the Channelized Flow Phase, resulted in submarine canyons and the deposition of submarine fans.

How Were the Canyons Carved Late in the Flood?

Now that we have established the timing, mostly pre-Pleistocene within the uniformitarian geological column (see Figure 5.3), we can go into how the canyons were formed. As the continents rose during the Retreating Stage of the Flood and mountains and plateaus became exposed, more and more of the Floodwater became channelized and flowed toward the continental margin. This channelized flow accelerated in some areas since a lot of water was forced to pour through a narrower space--similar to forcing the same amount of water from a wide pipe into a narrow one (see Figure 84.2). The rapid rise of the continent and the sinking of the ocean floor would also accelerate the currents. When the energetic channelized water currents reached the present coastlines, they would have sped across the newly-deposited continental shelf sediments. The transition from the outer edge of the shelf into deep marine

[11] Fulthorpe, C.S., J.A. Austin, Jr., and G.S. Mountain, 2000. Morphology and distribution of Miocene slope incisions off New Jersey: are they diagnostic of sequence boundaries? *GSA Bulletin* 112:817.

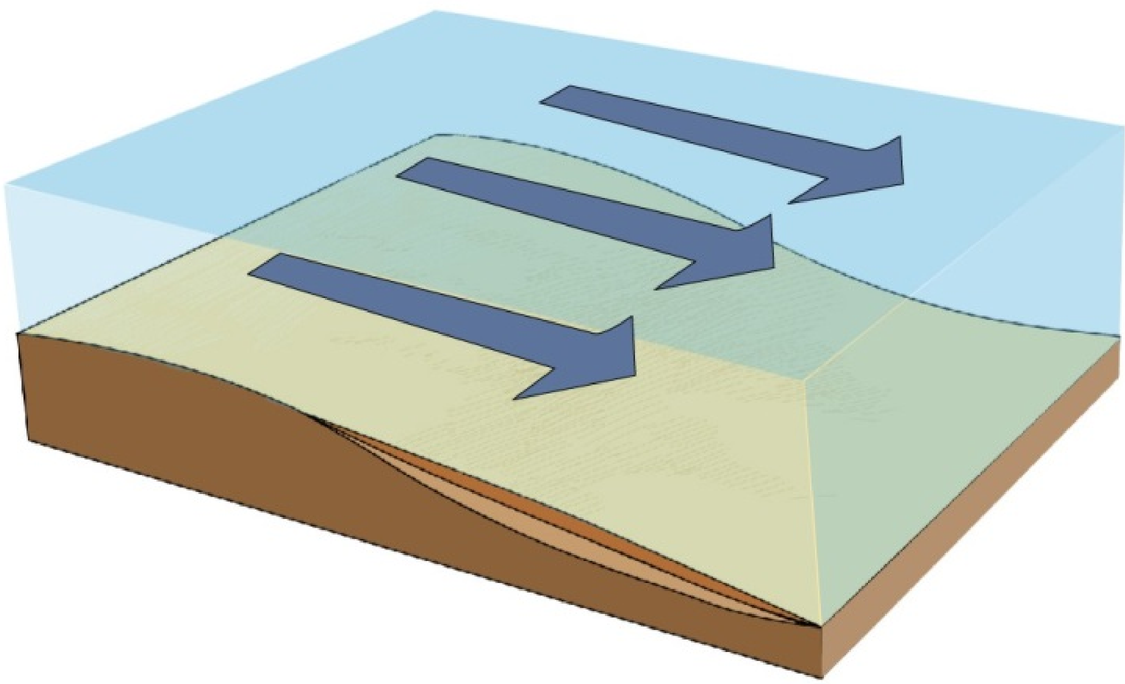
[12] Galloway, W.E., P. E. Ganey-Curry, X. Li, and R.T. Buffler, 2000. Cenozoic depositional history of the Gulf of Mexico basin. *AAPG Bulletin* 84(11):1,771.

[13] Walker, T., 1994. A Biblical geological 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.

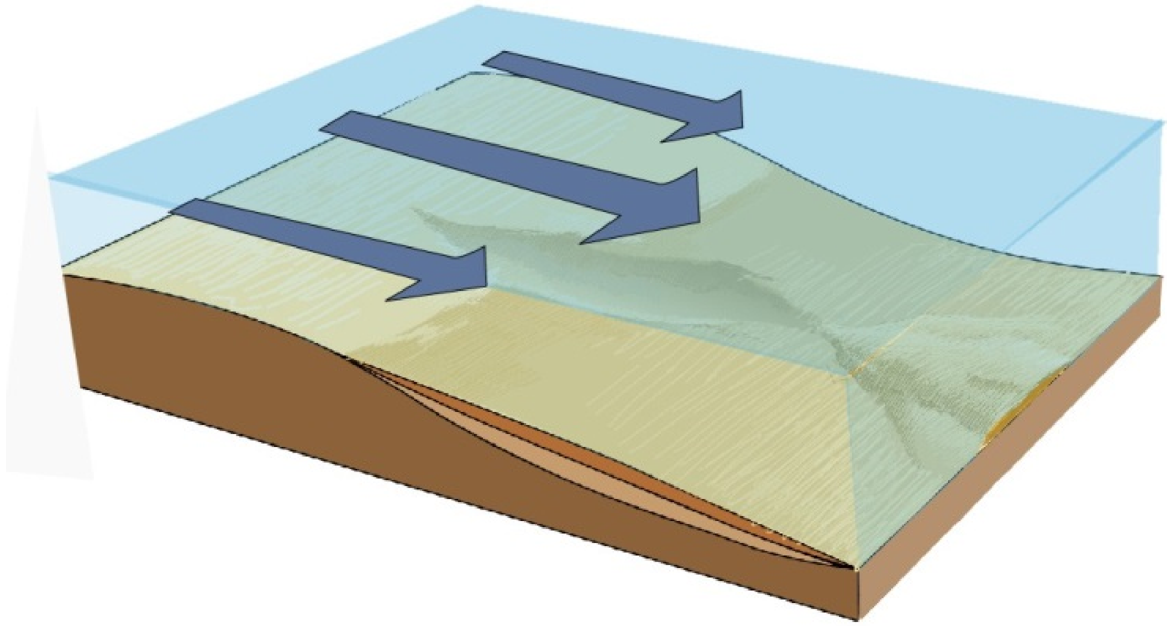
conditions caused the channelized Flood current to decelerate.[14]

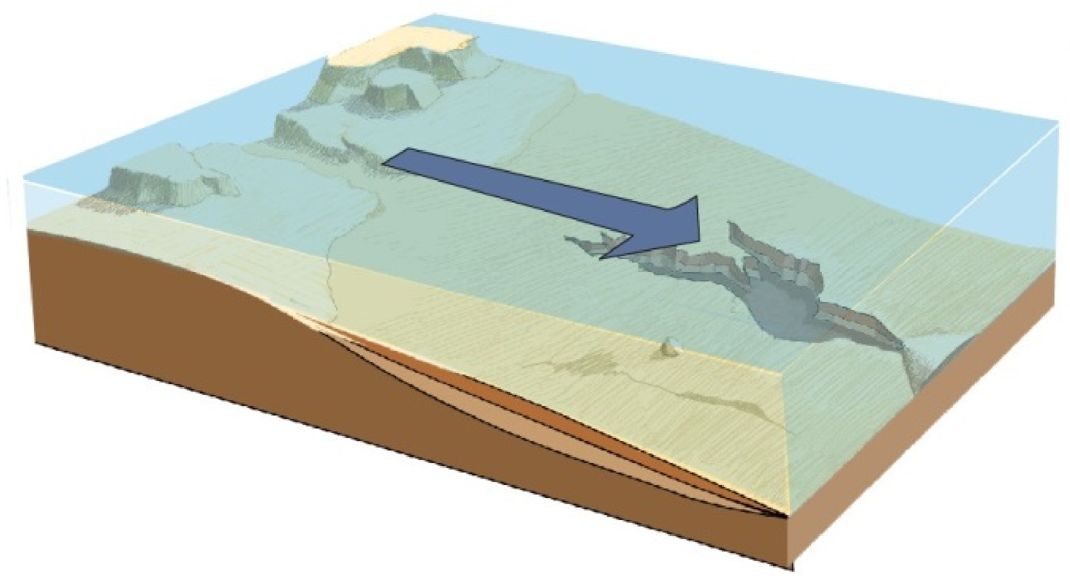
Focused Deposition of a Huge Amount of Debris Followed by Rapid Sliding

I think channelized currents are the key component. They would carry a huge amount of sediment and deposit their load where the currents slowed down, on the outer continental shelf and the upper continental slope. The rapid accumulation of these masses of sediment would be unstable and tend to tumble in mass flows down the continental slope. Rapid canyon cutting would ensue with further delivery of sediments funneling into the canyon, continuing the deepening process, like a chain reaction. Figure 74.2 gives the reader a rough idea as to how submarine canyons were formed.



[14] Barnette, D.W. and J.R. Baumgardner, 1994. Patterns of ocean circulation over the continents during Noah's Flood. In, Walsh, R.E. (editor), *Proceedings of The Third International Conference on Creationism*, Technical Symposium Sessions, Creation Science Fellowship, Pittsburgh, PA, pp. 77-86.





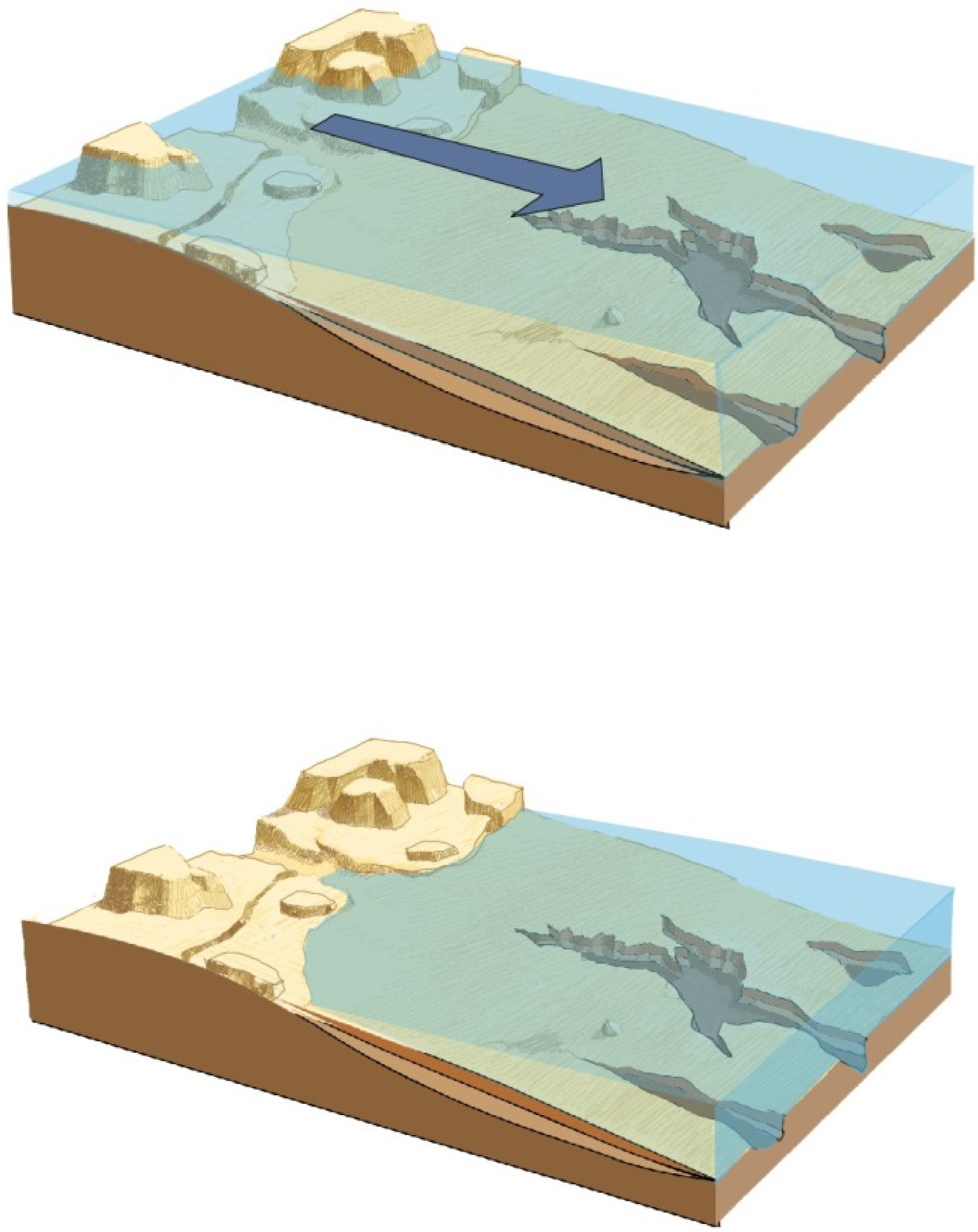


Figure 74.2. Postulate origin of submarine canyons during the Channelized Phase of the Flood after the continental margin sediments deposited as a sheet along the edge of the continents (drawn by Peter Klevberg and modified by Bryan Miller).
a) Deposition on the continental shelf and slope during the Sheet Flow Phase of the Flood.
b) Sheet flow transforms into channelized flow carrying debris to the shelf edge.
c) More and more land becomes exposed as the submarine canyon becomes deeper and deeper while the valley being formed on land.
d) The submarine canyon erosion continues while small canyons form on the continental slope.
e) The Flood has ended. Note that submarine canyon reflects the topography on the land. Other submarine canyons would form by slumping and sliding on the oversteepened continental slope either at the end of the Flood or in post-Flood time

This is what some uniformitarian geologists postulate, although they cannot account for the focused sediments. Andrew Green writes:

> This study envisions a different scenario: terrigenous sediment was *rapidly* delivered to the shelf-edge wedge and the ensuing shelf-edge instability initiated the slope rilling stage … All canyons have experienced a *single episode* of terrestrial input and shelf-edge wedge creation which is interpreted as being the primary mechanism for the initiation of downslope erosion (emphasis mine).[15]

Green does recognize that during the past 2 million years or so, the continental shelves have been sediment starved and so the present is not the key to the past. So, submarine canyon initiation was a single episode of rapidly accumulating sediments, in local areas, near the edge of the continental shelf. Métivier and others further add that once a canyon is started it tends to focus sediments causing further erosion by downslope mass flow deepening the canyon.[16]

The Example of the Var Submarine Slide

Recent information on mass movement of the Var slide in the Mediterranean Sea, off Nice, France, provides insight as to how the rapid excavation of submarine canyons could have happened (see in-depth section at the end of the chapter). Researchers noted debris that accumulated at the shelf edge, flowed downslope, accelerated, and eroded a channel within the existing Var Submarine Canyon as it accelerated. The speed probably reached in excess of 100 mph (160 kph)!

Extrapolating this result to the scale of the Flood provides a catastrophic mechanism for the *rapid* origin of submarine canyons. The amount of debris eroded during the channelized erosion of the continents and deposited in spots on the continental margin was likely a thousand to ten thousand times higher than the sediment observed eroding a notch in the Var Submarine Canyon during the Var submarine slide. Once a canyon began to form in the continental margin sediments late in the Flood, its walls would tend to funnel the erosive debris down the incipient canyon, further accelerating the debris flow and enhancing erosion, creating a chain reaction.[17]

According to the Flood model, there should be masses of cobbles and boulders deposited in the canyon and in the submarine fan outside the canyon because of the rapid transporting mass flows. After the excavation of the submarine canyon at the end of the Flood and in the post-Flood period, the currents and mass flows slowed. The canyon and fan would then have been covered by finer-grained sediments. Confirming this, the Var slide eroded much of the finer-grained sediments from the Var submarine canyon and fan and exposed *well-rounded boulders*, molding them into ripples composed of coarse gravel.[18] Investigators think these boulders were deposited during earlier Ice Age submarine debris flows,[19] but this is hypothetical. They could have easily been transported in the late Flood channelized flows that cut the submarine canyons, just as the subsequent fine-grained sediment covering them would be expected in the post-Flood

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[15] Green, A., 2011. Submarine canyons associated with alternating sediment starvation and shelf-edge wedge development: Northern KwaZulu-Natal continental margin, South Africa. *Marine Geology* 284:123, 125.
[16] Métivier, F., E. LaJeunesse, and M.-C. Cacas, 2005. Submarine canyons in the bathtub. *Journal of Sedimentary Research* 75(1):7–8.
[17] Mulder, T. and J. Alexander, 2001. The physical character of subaqueous sedimentary density flows and their deposits. *Sedimentology* 48:287.
[18] Mulder, T., B. Savoye, and J.P.M. Syvitski, 1997. Numerical modelling of a mid-sized gravity flow: the 1979 Nice turbidity current (dynamics, processes, sediment budget and seafloor impact). *Sedimentology* 44:305-326.
[19] Klaucke, I., B. Savoye, and P. Cochonat, 2000. Patterns and processes of sediment dispersal on the continental slope off Nice, SE France. *Marine Geology* 162:405-422.

period.

Not Related to the River, But to the Valley

So, now we can understand how rivers are related to submarine canyons. In the formation of submarine canyons, it is not the river that is significant, but the *valley or canyon that reaches the coastline*. Rivers commonly take advantage of the valley left by the channelized flow on land. Evolutionary geomorphologist, Lester King, stated submarine canyons commonly are *reflections* of the topography of the adjacent land: "In this way coastal hinterlands and shelf areas show remarkable geomorphic homologies [similarities] throughout a long history."[20] King went on to relate the coastal valleys and canyons, as well as the offshore submarine canyons, to the differential vertical tectonics between the continents and the oceans within the uniformitarian paradigm of long ages and turbidity currents:

> Following the great monoclinal tiltings of the continental margin towards the sea, the rivers of the mainland have been entrenched by 350-550 metres [1,150-1,800 feet]. These entrenchments are continued (by turbidity current action) across the shelf, and submarine canyons are numerous along the edge of southeast Africa.[21]

At the time King wrote, it was widely believed that turbidity currents eroded submarine canyons. This is no longer held today. The main point is that submarine canyons were carved while the adjacent continent was *rising* and the ocean basins sinking. King's conclusions fit precisely with how submarine canyons would form during the differential vertical tectonics that took place during the Channelized Flow Phase of the Flood.

Looking at the data through the Flood paradigm, channelized Floodwaters would carve out land valleys at the same time as the submarine canyons were formed. Channelized erosion explains the valley inland of Monterey Bay that is surrounded by mountains to the north and south.[22] The mountains north and south of Monterey Bay fed the Floodwaters into the future Monterey Bay. Elkhorn Slough could be a shriveled remnant of this late Flood erosion and explain why there is no connection between the present day Salinas River and the head of Monterey Submarine Canyon (see Chapter 72). After the Flood, rivers would flow down many of the coastal valleys, but not all of them because some of the areas had a dry post-Flood environment. This would explain the common, but not necessary, association of rivers with submarine canyons. Many scientists have rightly interpreted this association as significant to the origin of submarine canyons.[23] The Flood model also explains canyons that are not associated with rivers or seaward of arid lands, like those off of southern Baja California and the Sahara Desert.[24,25,26]

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[20] King, L.C., 1983. *Wandering Continents and Spreading Sea Floors on an Expanding Earth*, John Wiley and Sons, New York, NY, p. 199.
[21] King, Ref. 20, pp. 208-209.
[22] Eittreim, S.L., R.J. Anima, and A.J. Stevenson, 2002. Seafloor geology of Monterey Bay area continental shelf. *Marine Geology* 181:3.
[23] Nagel, D.K., H.T. Mullins, and H.G. Greene, 1986. Ascension Submarine Canyon, California—evolution of a multi-head canyon system along a strike-slip continental margin. *Marine Geology* 73:286.
[24] Shepard, F P. and R.F. Dill, 1966. *Submarine Canyons and Other Sea Valleys*, Rand McNally & Company, Chicago, IL, pp. 101-130.
[25] Shepard, F.P., 1981. Submarine canyons: multiple causes and long-time persistence. *AAPG Bulletin* 65:1,062-1,077.
[26] Krastel, S., T.J.J. Hanebuth, A.A. Antobreh, R. Henrich, C. Holz, M. Kölling, H.D. Schulz, K Wien, and R B. Wynn, 2004. Cap Timiris Canyon: a newly discovered channel system offshore of Mauritania. *EOS* 85 (42):417, 423.

Meanders in submarine canyons are difficult to explain from turbidity current erosion within the uniformitarian paradigm.[27] On land, running water is assumed to be responsible for cutting entrenched meanders. But what processes cut canyons and sculpted channels in the deep sea?[28] Within the Flood model it is possible that entrenched meanders on land were also formed underwater (see Chapter 61). Tight "gooseneck" meanders and cutoff meanders on submarine canyons and fans probably require a low velocity channelized current. It is more difficult to envision slow currents during canyon formation, but the meanders on the steep slope are not very tight. So, these continental slope meanders may have begun with a slightly meandering, mass flow and gradually deepened.

Vertical and overhanging walled submarine canyons likely formed *after* the Flood, as detailed in Chapter 70. Scientists have observed periodic sand flows traveling down Scripps Submarine Canyon. These flows start shallow and flow along the bottom. They could easily erode the bottom of the walls of the canyon and eventually result in vertical or overhanging walls, as those found in upper Scripps Canyon.

One further point to make in regard to submarine canyons is that they are a global phenomenon. They are found off of all of the continents and along wide continental shelves like the Bering shelf off Alaska (see Figure 70.4). As with other mysterious landforms, this confirms the *global extent* of the Flood.

The Var Submarine Slide (in-depth)

In 1979, a muddy slide barreled down the Var Submarine Canyon into the Mediterranean Sea off Nice, France. The Var Submarine Canyon comes close to the coastline and is closely associated with the Var River, which deposits deltaic sediments at the head of the canyon. The submarine slide began while workers were extending the Nice airport toward the sea. This started a landslide, and muddy material accelerated down the canyon, causing a tsunami and submarine cable breaks in the deep sea. Scientists discovered that at a depth of 3,300 foot (1,000 m) the mass movement had eroded a thin chute within the submarine canyon, 80 to 130 feet (25 to 40 m) deep and 490 to 980 feet (150 to 300 m) wide.[18] The flow also severely eroded the walls of the submarine canyon. Large objects were carried deep into the canyon. A piece of a bulldozer from the airport extension was discovered on a 100-foot (30 m) high terrace 4,600 feet (1,400 m) below sea level. After exiting the canyon mouth, the Var slide transitioned into a turbidity current, spread out, and decelerated. An analysis of this event provides a mechanism for the rapid excavation of submarine canyons.[18,19,29]

Although the Var slide was confined to the Var Submarine Canyon, the details of the slide provide insight into the rapid erosion of submarine canyons from mass flow late in the Flood. The muddy slide picked up sand which increased its density, resulting in a stronger gravitational force for downslope movement. The flow then became a debris flow and continued to accelerate down the steep slope of the submarine canyon. The speed reached a surprising 50 to 95 mph (80 to 152 kph)! It is believed to have eroded the thin chute within the submarine canyon. The flow slowed as the debris was diluted by water and encountered a lower slope seaward of the canyon

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[27] Hagen, R.A., D.D. Begersen, R. Moberly, and W.T. Coulbourn, 1994. Morphology of a large meandering submarine canyon system on the Peru-Chile forearc. *Marine Geology* 119:7-38.

[28] McGregor, B.A., 1984. The submerged continental margin. *American Scientist* 72(3):275-281.

[29] Piper, D.J.W. and B. Savoye, 1993. Processes of late Quaternary turbidity current flow and deposition on the Var deep-sea fan, north-west Mediterranean Sea. *Sedimentology* 40:557-582.

mouth. It changed from a debris flow into a turbidity current before finally coming to rest in the deep sea. The main question is how the chute was eroded since debris flows are not considered particularly erosive (see Appendix 23).

I think the answer to the origin of submarine canyons lies in a suggested new classification of mass movements also called "sediment gravity flows." This is based partly on theory and partly on observations of the Grand Banks and the Var Submarine Canyon landslides. The Grand Banks submarine slide is discussed in Appendix 23. Mulder and Alexander summarize the new classification.[30] This classification is not much different from the past, but it adds a significant process that may be a key to understanding the origin of submarine canyons. This new category is called a "concentrated density flow". It contains more sediment than a turbidity current, but less than a hyper concentrated or debris flow (see Appendix 23). A concentrated density flow is *erosive* and can move downslope at *high* speeds.

Observation indicates slides, slumps, and debris flows quickly transform into concentrated density flows on steep slopes.[30] Mass movement velocity increases on steep slopes and in channelized flows in canyons.[31] Concentrated density flows can rapidly pick up sand and gravel, which increases the density of the flow, aids in the bottom erosion, and increases velocity. This process is like a chain reaction and is called "igniting" by some researchers.[32] This type of flow is likely to provide the key for explaining the explosive excavation of submarine canyons during the Channelized Flow Phase late in the Flood.

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[30] Mulder and Alexander, Ref. 17, pp. 269-299.
[31] Mulder and Alexander, Ref. 17, p. 287.
[32] Parker, G., 1982. Conditions for the ignition of catastrophically erosive turbidity currents. *Marine Geology* 46:307-327.