A PRELIMINARY REPORT ON THE GEOLOGY OF SOUTHWEST VIRGINIA

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Abstract

A description is given of the Valley and Ridge Province of Southwest Virginia, including thrust faults, thrust blocks, folded mountains, and windows or "fensters" present in the region. Interpretations which various geologists have given to the area are discussed. These include descriptions of the Cumberland Overthrust, the Kent Window east of Wytheville, as well as other areas. I discuss the plate tectonics (continental drift) scenario as it has been applied to the region, and offer an alternative scenario involving the Genesis Flood, gravity slides, and other agents. 1 point out the missing strata from the Pennsylvanian, Permian, Triassic, Jurassic, and Cretaceus Periods, and most of the Cenozoic Era. I discuss the inconsistency of this with establishment defined geological time.

Introduction

The state of Virginia's established stratal record is separated from east to west into five, south (or southwest) to north (or northeast) trending, physiographic provinces: Coastal Plain, Piedmont, Blue Ridge Mountains, Valley and Ridge, and Appalachian plateau (Figure 1).

This preliminary report will discuss the Valley and Ridge province of Virginia, and offer an alternative, anti-evolutionary, anti-historical geological picture of the origins of the area. A more general creationist description of the Southeastern USA and a mountain building episode (Appalachian orogeny) were given by McQueen (1987).

The Valley and Ridge Province differs from other Virginia physiographic provinces because it is underlain principally by establishment defined early Paleozoic carbonate and elastic strata. Also these strata are significantly folded and faulted. Fold and fault structures can be traced from southwest to northeast for hundreds of miles across Virginia and adjoining states (Frazier and Schwimmer, 1987, p. 324 and Figure 2 of this report.)

In particular, a description of a geological "window" in Wythe county Virginia along with other windows will be given as an example of a possible creationist explanation of the area. A geological "window" or "fenster" from the German word for window, is: "A circular or an ellipsoidal erosional break in an overthrust sheet whereby the rocks beneath the overthrust are exposed" (Bureau of Mines, 1968, p. 1239). An overthrust sheet is: "The block, above a low-angled fault plane, which has been displaced a matter of miles" (p. 783). An overthrust is: "A thrust fault with low dip and large net slip, generally measured in miles" (p. 783).

Geologist have mapped and described a number of thrust faults in the Valley and Ridge province (Frye, 1986). These faults apparently brought older Paleozoic strata onto and over younger Paleozoic strata. In some areas subsequent processes of erosion removed parts of the older strata to reveal younger strata via a geological window.

Thrust Faults Discussion

The faults in Virginia's Valley and Ridge Province are not the tremendous, miles long supposed overthrusts such as Wyoming's Heart Mountain, Montana's Lewis, and Switzerland's Glarus overthrusts that have been discussed in creationist literature by Whitcomb and Morris (1961), Lammerts (1966, 1972), Burdick (1969, 1974, 1975, 1977), and Morton (1987). Hence, even if we accept the Whitcomb and Morris interpretation of those overthrusts, the best interpretation of these lesser examples may not be obvious. Note that discussion of other wrong order formations, and the presence or absence of evidence for thrusting, was given by Slusher (1966) and Burdick and Slusher (1969). Howe (1972) discussed and photographed some overthrusting of pavement caused by the San Fernando earthquake.

Virginia's thrust faults are examples of reverse faults. Reverse faulting occurs when a hanging wall has moved upward with respect to the footwall. A hanging wall is commonly defined as a wall of rock on the upper side of an inclined vein or fault. A footwall lies along the lower side of that inclined vein or fault. Thus, contrasting normal faulting is to be considered present when the hanging wall moves downwards past the footwall. Reverse faults abound in the Valley and Ridge Province of southwest Virginia. Those faults which have been mapped and named include the Fries, the Blue Ridge, the Spurgeon, the Pulaski-Staunton, the Max Meadows, the Poplar Camp Mountain, the Claytor, the Cove Mountain, the Saltville, the Narrows, the St. Clair, the Richlands, the Boissevain, the Copper Creek, the Clinchport, the Hunter Valley, the Wallen Valley, and the Pine Mountain faults (Frye, 1986; Bailey, 1984; Bartlett and Webb, 1971; Marshall, 1959; Harnsberger, 1919; Cooper, 1939; Butts, 1927; Wentworth, 1921; Rich, 1934).

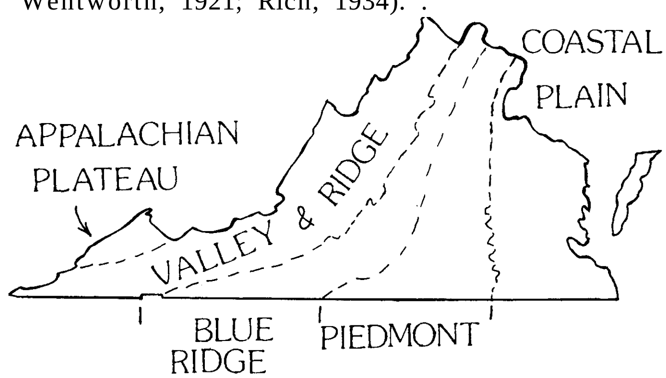

Figure 1. The map of Virginia, showing its division into the Appalachian Plateau, Valley and Ridge, Blue Ridge, Piedmont, and Coastal Plain Provinces.

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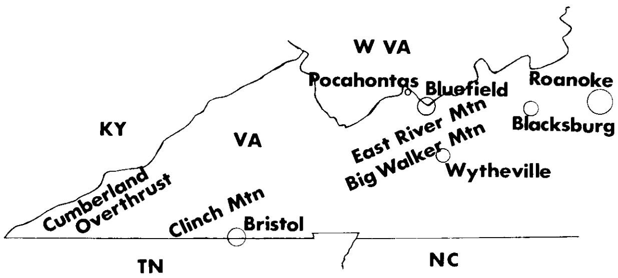

Figure 2. A map of Southwest Virginia showing prominent cities and geological features.

In southwest Virginia the surface expressions (traces) for these reverse faults trend from southwest to northeast until the Roanoke bend. At the Roanoke bend, the fault traces turn to trend more northerly to parallel the axial length of Shenandoah Valley. Except for the Pine Mountain fault, which is terminated abruptly by cross-faults (the Jacksboro fault on the southwest and Russells Fork fault on the northeast), they generally just "die out" or "fade away." The reverse faults appear not to be terminated or offset by vertically inclined cross (slip or transcurrent) faults. If reverse faulting in the Valley and Ridge Province were created by deeply seated stresses moving from southeast to northwest, then one would expect to find in the field a greater number. of vertically inclined, offsetting cross faults of males displacement. Plate tectonics theory indicates the necessity for movement of underlying basement rock as well as overlying Paleozoic strata. Thus the Pulaski Thrust Fault could not be mapped so nearly straight, but would be offset in places.

Consider the Cumberland overthrust block (Figures 3 and 4). This block of establishment acknowledged allochthonous rock is delimited by the nearly straight edges (traces) of various faults. Along its northwest side is the Pine Mountain thrust, along the southeast is the Wallen valley thrust, along the southwest is the Jacksboro tear fault, and along the northeast is the Russells Fork tear fault. The Cumberland overthrust block has been reported to have been displaced northwesterly a distance averaging six miles (Wentworth, 1921). The Cumberland overthrust is situated at the extreme northwest side of the Valley and Ridge province, abutting the Appalachian Plateau province. In the Appalachian Plateau province, near surface strata are assigned to younger Paleozoic formations which are considerably less folded and faulted than are older Paleozoic formations within the Valley and Ridge province.

It is suggested that a reasonable interpretation for more intensive folding and more severe faulting within the Valley and Ridge province is that (1) there was uplift of the Blue Ridge province, (2) concurrent downdrop of the Appalachian Basin, westerly beyond the Appalachian Plateau province, followed by (3) gravity sliding of Valley and Ridge strata downwards northwesterly, from the crest of the Blue Ridge province towards the Appalachian Plateau. Only at the far northeasterly and southwesterly ends of this structural and stratal sequence was compression and skewing sufficient to produce tear (transverse) faults such as the Jacksboro and Russells Fork tear faults.

Plate Tectonic/Historical Geology Interpretation

It is stipulated that plate tectonic (continental drift) paradigms are widely accepted by academia currently. One description concerning the origin of the Valley and Ridge province was offered by Frye (1986). Thus in late Ordovician time the Taconic orogeny caused the Smith River allochthon to move over the Blue Ridge province, doubling the crustal thickness. The area that was to become the Valley and Ridge province sank to depths beyond where sunlight could penetrate. As a consequence of crustal sinking here, later sediments were deposited periodically in the form of sands and muds.

West and southwest of Virginia, marine waters remained shallow enough for carbonate (limestone and dolostone) deposition to continue. The broad syncline with the Clinch sandstone, which today covers East River Mountain (a mountain which trends southwest to northeast) and Big Walker Mountain (a long folded mountain running the same direction) and some other lesser folds were formed during this time. Later during Silurian and Devonian times, warm shallow seas returned to deposit carbonate sediments. Then came another mountain building episode, the Acadian Orogeny. During the Acadian Orogeny, a second attendant deepening of the continental sea occurred within the future Valley and Ridge Province, as a second microcontinent docked on North America.

By Mississippian time the latest deepened basin was nearly filled with sediments, and then came the Alleghanian Orogeny, a third uplift of a repeated cycle of crustal uplifts and attendant crustal downdropping along Appalachia. At this time the Iapetus Ocean lay to the east of what would be the future North America. The Iapetus Ocean was closed and the supercontinent, Pangaea, was formed. Then during Triassic time, the modern Atlantic ocean and Gulf of Mexico came into existence and western and eastern continents began to take shape. Apparently sedimentation processes ceased within the Valley and Ridge Province during and after Triassic times.

The Problem of Missing Geologic Time

According to stratigraphic data (Frazier and Schwimmer, 1987) deposition of sedimentary strata ceased within most of the westerly half of Virginia after the Mississippian Period. Younger (coal bearing) formations generally were deposited to the west, within the Appalachian Basin of which westernmost Virginia is considered a part. Thus within *most* of the westerly half of Virginia, there is lost virtually all evidence of the existence of the Pennsylvanian, the Permian, the Triassic, the Jurrassic, and the Cretaceus Periods, and most of the Cenozoic Era. A major exception would be Ice Age deposits along

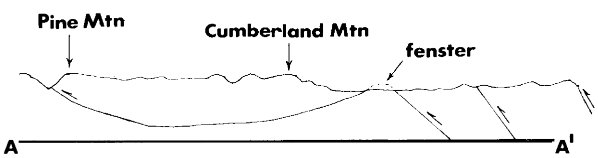

Figure 3. A cross section showing the Cumberland Overthrust Block along the line A—A' of Figure 4.

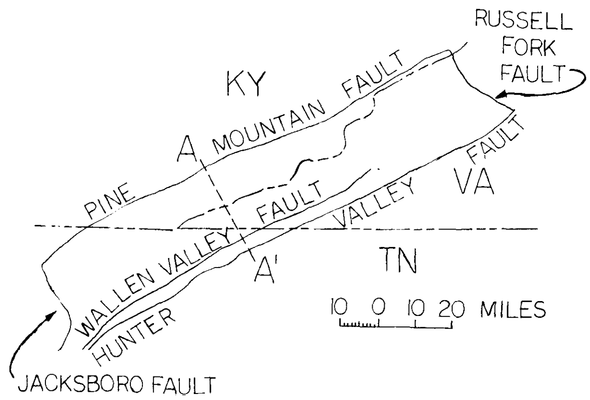

Figure 4. The Cumberland overthrust block, which appears to have been thrust from southeast to northwest. The Pine Mountain, Wallen Valley, and Hunter Valley faults are thrust (reverse) faults whereas the Jacksboro and Russell Fork faults were Tear or Cross faults.

with associated fossils, which are particularly well known within and near Saltville, Virginia (Bird, 1985).

In the opinion of the writer, the accounting of lost geologic time in any state is generally ignored by the geological profession. Lost geologic time is not readily explainable via geological evidence because the evidence is missing. Thus professional explanations which have been offered regarding missing time are decidedly speculative and subject to revision. Burdick (1977) documented the evolutionists' attempted use of overthrusts and quiet periods to obliterate strata.

Missing strata in the Valley and Ridge Province includes those that should have been deposited during the age of the dinosaurs (the Permo-Mesozoic). In the western United States, dinosaur fossils are plentiful in beds assigned to the late Jurassic Morrison formation. These strata are thought to be principally fluviatile (continental) in origin, as opposed to marine. Since the Valley and Ridge Province supposedly possessed a continental environment after Pennsylvanian times, why do we not see dinosaur laden fluviatile strata anywhere to the west of the Blue Ridge Province? For creationists, the presence of a geologic hiatus within the Valley and Ridge Province calls into question the very existence of establishment geological time. Can any scientist believe that all of the evidence for sedimentation and erosion within the province, from the Permian Period to the latest part of the Cenozoic Era, can be so completely removed?

Bailey (1984) refers to a type of poorly-sorted sandstone made up of sharp-edged grains, called graywacke. Graywacke is commonly encountered in Appalachian coal mining operations. It is believed that the source for these deposits was unstable terrain. Thus rapid deposition of sliding materials did not allow for sorting of the materials by either marine or continental waters. Based on existing evidence, a chain of volcanic mountains supposedly existed to the east of the coal bearing regions of what is now Kentucky, Tennessee, West Virginia, and extreme western Virginia at the time organic material was being deposited and coal was being formed. Why is it that such geologically older evidence exists while evidence for later geological activity is missing from the Valley and Ridge Province?

A chronological alternative to this time problem was given by Waisgerber 1987. Waisgerber concluded that Paleozoic, Mesozoic, and Cenozoic Eras need not represent consecutive intervals of geologic time. For example, in the Grand Canyon region of western United States, supposedly successive Paleozoic and Mesozoic strata reveal within each locality formations indicative of (1) deep marine environments, overlain by (2) near-shore and non-marine formations, followed by (3) on-shore, wind blown deposits, (4) overlying marine formations, with or without (5) beds containing coal. The Paleozoic and Mesozoic strata elsewhere in North America may well represent sequences that respond in part to concurrent environments rather than geologic time. Other comments on the effect of different environments can be read in the paper by Howe (1987) and others in the Mini-symposium on Orogeny.

A Preliminary Interpretation of the Cumberland Overthrust Block

The following is an interpretation of the Cumberland overthrust which is believed to be consistent with creationist/diluvialist/young earth ideas. As already mentioned, the thrusts are thought to have been produced by gravity slides downward northwesterly from the Blue Ridge Province. The Blue Ridge Province may have been higher and the Valley and Ridge Province, steeper in slope, in times past due to uplift under the Blue Ridge Province. The Cumberland overthrust block of southwest Virginia, eastern Kentucky, and northeastern Tennessee began its motion by ramping up to the Chattanooga shale and then thrusting forward along this very weak shale formation. The formation may well have been saturated at the time. The thrust block was originally topped by Silurian Clinch sandstone and then Chattanooga shale.

Then Mississippian formations and Pennsylvanian formations (including Harlin and Wallins Creek coal beds) were deposited along the lip of the thrust block and also to the northwest of it. These Carboniferous beds hide the lip of the block and render uncertain an exact distance for overthrusting. Wentworth (1921), Butts (1927), and Rich (1934) concurred in estimating an average of six miles for this thrust block. A maximum of 10 miles is suggested for the southwest part along the Jacksboro Tear. A minimum of two miles is suggested near the Russells Fork Tear fault, along the northeast part of the block. Younger Mississippian and Pennsylvanian formations seem to have been moved about two miles on elements of the Chattanooga shale by continued northwesterly movement of the block.

The Wallen Valley and Hunter Valley faults to the southeast were also produced about this time. An anticline existed between the Wallen Valley fault and the Carboniferous deposits further northwest. The anticline was created because the Cumberland block ascended up and over strata within the Chattanooga shale. The crest of this anticline, the Powell Valley Anticline, was subsequently eroded away, forming what is now the Powell River valley, southeast of Cumberland Mountain. Erosion exposed the fault line and windows (fensters) discovered by Butts in the 1920's near Rose Hill, Virginia (Figure 3; Butts, 1927,

Plate 2). It could be that some Mississippian strata subsequently covered the crest of the Powell Valley Anticline. Current evidence for such a covering is not known.

Preliminary Interpretation of Other Portions of the Area

I have already mentioned the Wallen Valley and Hunter Valley thrust faults. The Cumberland overthrust block brought Clinch sandstone to the surface. The Clinch Sandstone is an erosion resistant, ridge forming formation responsible for the existence of Wallen ridge northwest of the Wallen Valley thrust fault. The next block, southeast of the Cumberland Overthrust Block, appears responsible for a syncline being brought to the surface. The Clinch sandstone associates with this syncline also. This syncline lies under Powell Mountain and Newman ridge. Farther southeast, one crosses in succession the Clinchport fault, the Copper creek fault, the Saltville fault, and (crossing into Tennessee) the Pulaski fault. All of these bring early Cambrian Rome Formation strata or Honaker Formation strata over younger Paleozoic formations (Frye, 1986; Bartlett and Webb, 1971).

Clinch Mountain, situated between the Saltville and the Pulaski faults, is another southwest to northeast trending ridge underlain by erosion resisting, ridge forming Silurian Clinch sandstone. Except for Quaternary deposits, this area, which is southeast of Cumberland Mountain and the Cumberland overthrust, does not yield formations which are younger than the Mississippian Period. Coal has not been found here; it exists farther to the northwest. Also, known thrust faults here reveal displacements measuring in thousands or even hundreds of feet rather than on the order of miles (Bartlett and Webb, 1971). Consider another traverse through the Valley and Ridge province. This traverse, or cross section, commences at the state line in the Pocahontas-Bluefield, Virginia area through a point two miles east of Wytheville, Virginia. The Appalachian plateau lies northwest relative to Bluefield, Virginia. There, Pennsylvanian formations exist along a southwest to northeast trending line, southeast of Pocahontas, and parallel to the Abbs Valley anticline. The Pocahontas Number 3 coal seam, as much as 15 feet thick in some places (Harnsberger, 1919), was responsible for the prosperity of Pocahontas, from 1883, when economic mining began, to the mid-part of the 20th century and beyond.

In this region, southeast of Bluefield, lower Cambrian rocks have been thrust over and onto Mississippian formations via the St. Clair Fault. East River Mountain, Buckhorn Mountain, Rich Mountain (which is really the same as Wolf Creek Mountain except for a man-made cut through a pass made for Highways I 77 and US 52), Big Walker Mountain, Cove Mountain, and Draper Mountain are geomorphically related ridges which are underlain by the ubiquitous former, the Silurian Clinch sandstone. Overthrusting along St. Clair, Narrows, Saltville, Cove Mountain, and Pulaski Faults, and other thrusts to the southeast, contributed to raising these ridges. Existing less significant ridges not underlain by Clinch Sandstone are supported by Mississippian Price sandstone or other ridge forming strata (Frye, 1986). The aforementioned thrusts appear to have been moved northwesterly on either elements of the Cambrian Rome Formation, the Ordovician Martinsburg formation, or the Devonian Chattanooga shale. Exceptions are where the strata cut across other formations as they ramp up to the next higher decollement. The faults appear not to extend down southeasterly to reach and involve the Precambrian basement rock (Frye, 1986).

Field Observations

A few miles east of Wytheville, Virginia there is an interesting window or fenster, the Kent Window, which appears to verify the structural geology of the region. Marshall (1959) interpreted existing geological conditions to be the result of the lower Cambrian Rome formation being thrust northwesterly over younger formations along the Pulaski thrust fault. Processes of erosion then removed a significant part of the thrust block. Thus within a geological window, about two miles in width, between Max Meadows and Wytheville, there is revealed younger Paleozoic strata of the footwall of the block. Higher ridges to north, east, south and west, are underlain by older Paleozoic formations of the hanging wall block. After Marshall mapped the area, he hypothesized the need for deformation by compressive forces which produced initially a recumbent overturned fold. Then continued application of compressive forces resulted

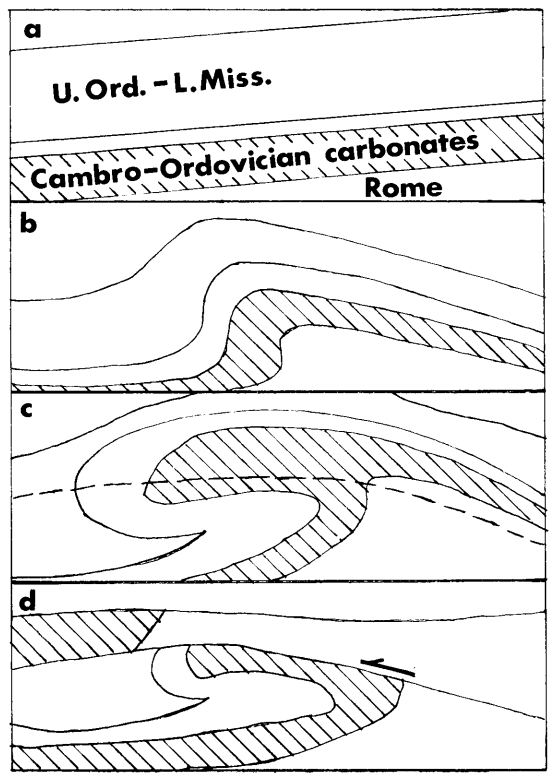

Figure 5. An interpretation of the Kent Window area, differing from that of Marshall only in placing more emphasis on gravity sliding rather than compression. The time frame would also be in agreement with creationist ideas. Part a shows the sediments as they would have deposited, before the uplift under the Blue Ridge Province started the gravity slide. Part b shows the resultant formation of anticline. Part c shows the recumbent (overturned) anticline and the formation of a shear zone along the dotted line. Part d shows the shearing off of the top part of the recumbent anticline. This brought the Rome formation into contact with the rocks now exposed within the window.

in shear zone. Thrusting along the Pulaski fault upwards northwesterly resulted in the removal of the upper part of the recumbent anticline (Figure 5). The Rome formation was described by Marshall as red, green, and yellow shales and siltstones with intercalated impure limestones and dolomites. Younger formations native to the area are principally carbonates. These are assigned to the Elbrook, Conococheague, Beekmantown, Mosheim, Lenoir, Feltzer, and Liberty Hall Formations.

Marshall did not find any part of the Rome Formation to be resting on Precambrian basement rock. Rather Rome Formation strata rests directly on younger Paleozoic formations with a tectonic breccia separating the subjacent younger formations from a superjacent older Rome formation. I have visited and studied the area, and Marshall's conclusions appear logical. A question remains however: Did such geological activity require millions of years to produce the current Valley and Ridge Province?

Conclusion and Summary

The Valley and Ridge province can be interpreted within a catastrophic Flood deposition of the Cambrian Rome through Mississippian formations along a southwest to northeast trending strip which is presently about 30 miles wide, followed by gravity slides due to the basement rock being uplifted with a crest near the Blue Ridge. Pennsylvanian and later formations are not found in this area, with the exception of very recent Quaternary deposits along the flood plains of streams and valleys. This is inconsistent with the necessity of millions of years of geologic time.

The gravity slides might be blamed on the uplift or swelling of the Precambrian basement, cresting at the Blue Ridge. Morton (1986, pp. 75-76), discussed the possible mechanisms for thrusting. He rejected a Hubert and Rubey mechanism where a layer of high pressure water partially supports the weight of the upper thrust block and allows sliding. The reason is that the water should spew out once the block cuts the surface.

Valley and Ridge Province thrust faults may have occurred while the Cambrian to Mississippian Flood deposits were still saturated. Thus the weak shales of the Chattanooga Shale (or other weak shale formations) were further weakened by saturation. Bailey (1984) points out that silt and clay are not easily set in motion, but once started (as in California mud slides), and the particles are separated from each other, the smaller particles will flow along easier and settle out with greater difficulty. Bailey states: ". . . movement of a thoroughly wetted clay can occur at an angle as low as 1 degree." (Bailey, 1984, p. 31).

Morton's criticism of Hubert and Rubey may be overcome by hypothesizing that all of the rocks in both the hanging wall and the foot wall were also saturated. Thus when the formation reached the ground surface, water would continue to associate with rocks in the hanging wall, the foot wall, and the fault zone. The driving forces behind gravity sliding would continue to move the hanging wall until such a time as resisting forces brought the sliding to a halt. Folding of strata would precede thrusting. In my opinion such scenarios as discussed above are more consistent with a Flood model. The scenarios appear not to support millions of years of induration of the sediments, followed by thrusting. Gravity sliding appears more consistent with rapid, dynamic (catastrophic) activity, and not with slow evolution of both the Earth and its inhabitants.

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