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MISSISSIPPIAN AND CAMBRIAN STRATA INTERBEDDING: 200 MILLION YEARS HIATUS IN QUESTION

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Received 25 September 1986, Revised 27 October 1986

Abstract

Two field trips were made to study the supposed unconformity between Mississippian Redwall Limestone and Cambrian Muav Limestone along the North Kaibab Trail, Grand Canyon. Characteristics indicative of unconformable stratigraphic relationships are described. Such characteristics were not observed along the Redwall-Muav contact line. Field evidence supports the belief that continuous deposition of sedimentary strata occurred, one formation on another. Thus there need not be any 200 million year depositional hiatus between the two formations.

Introduction

Geologists believe that there exists a 200 million year hiatus between the top of the Cambrian Muav Limestone and the base of the Mississippian Redwall Limestone-Collier (1980, p. 10). This belief is contradicted by Burdick (1974) who reported that elements of the Redwall Limestone and Muav Limestone were intertonguing with each other to form repeating sequences:

> Now we come to the Cambrian Period, and walking down the trail, we see where the Mississippian will come down to a certain level and then we find a layer of Muav limestone. Still lower we find a layer of Mississippian and again another layer of Cambrian. It is strange that they can jump back and forth, these alternations of rocks over 100 million years. This is called recurrent formation or faunas. Mississippian life is supposed to have ended at the end of that period and an entirely different type of rock should be in the Cambrian. In the Cambrian, the oldest rock, are trilobite fossils and other shell fish, distinctive of that type of rock. When you progress to the Mississippian, you are supposed to be leaving that type of life and coming to another. Instead, we find another layer of Cambrian. Something is wrong. Evolutionists say you can't put evolution in reverse: it is always forward. So here is another puzzle, recurrent faunas. p. 61

If it can be shown that there is no hiatus between the Redwall Limestone and the underlying Muav Limestone, then this conclusion would 1) discredit geologic time as promoted by some geologists and 2) do great damage to the macroevolution model of origins.

Observations

The CRS Research Committee authorized two trips into Grand Canyon in 1986 to study stratigraphic relationships within that area publicized by Burdick (1974). Key exposures exist along the southerly trending, principally southerly descending, sinuous North Kaibab Trail, in the Grand Canyon. Burdick's stratigraphic section is situated just southerly of a National Park Service information sign. The sign identifies to the reader the base of Redwall Limestone lying on top of Muav Limestone. The stratigraphic section can be reached from North Rim, Grand Canyon, commencing at the trailhead for North Kaibab Trail. Merely walk down North Kaibab Trail for a horizontal distance of about 4 miles, dropping vertically about 2000 feet to reach the study site.

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This is very scenic terrain. Except for a drinking fountain atop the Supai Formation there is no available water along higher parts of North Kaibab Trail. Hence it is advised that one bring adequate supplies of water for that trek. It is also advised that the National Park Service be contacted to determine if North Rim is accessible. Since North Rim is above 7,000 feet sea level, this indicates annual early fall closing of North Rim trailhead by snow.

During colder months, Burdick's stratigraphic section can be reached from the South Rim, Grand Canyon. Merely follow the South Kaibab Trail to Phantom Ranch and then ascend the lowest part of North Kaibab Trail to the specific site. This southerly access road involves over 30 miles of hiking and such a trek will require spending at least one night in Grand Canyon.

Nature of The Contact Line

During the 1986 trips, the aforementioned National Park Service sign identifying the contact between the Redwall Limestone and the Muav Limestone was reached. It reads as follows:

AN UNCONFORMITY

> Rocks of Ordovician and Silurian Periods are missing in Grand Canyon. Temple Butte Limestone of Devonian age occurs in scattered pockets. Redwall Limestone rests on these Devonian rocks or on Muav Limestone of much earlier Cambrian Age.

Note — The sign indicates by arrow that at this locality Redwall Limestone lies directly on Muav Limestone. Temple Butte Limestone of supposed Devonian age appears absent.

The supposed unconformity between Redwall Limestone and Muav Limestone is not at all obvious when one attempts to trace the contact along North Kaibab Trail. Commencing from an area about 100 yards northerly of the National Park Service sign and terminating about 100 yards southerly of the sign, all beds seemingly interfingered, one with another. Among strata observed were Muav Limestone beds of blue-gray, micaceous shale exhibiting what has been described as fossil worm tubes— see Figures 1 and 2.

Using the National Park Service sign as the basis for separation of Muav Limestone strata from Redwall Limestone strata, it was determined initially that the yellowish appearing micaceous shales (Figure 2) were the uppermost Muav Limestone beds. Immediately above these shales were more massive beds that typified reddish-colored Redwall Limestone beds. Yet any attempt to trace individual beds laterally southerly or northerly along North Kaibab Trail resulted in a reverse stratigraphic relationship. Allegedly older Muav Formation yellowish beds rested on alleged younger reddish-stained Redwall Limestone beds.* See Figure 3.

The previously described Muav Limestone's blue-gray micaceous shale bed seen below the supposed unconformity was traced laterally so that it too could be seen to rest on allegedly older Redwall Limestone strata as illustrated in Figure 3 and the diagram in Figure 2. The described relationships suggest the probable presence of lateral and vertical facies changes within both formations. Lateral and vertical facies changes within both formations indicate the absence of unconformable relationships between the Redwall Limestone and the Muav Limestone. Other alleged Muav Limestone beds observed here include strata described as mottled limestones by McKee (1945, pp. 21-2)— Figure 4. These mottled limestones exist within the Redwall Limestone also.

*Redwall Limestone is actually light gray in color. The red color is due to staining from the overlying Supai.

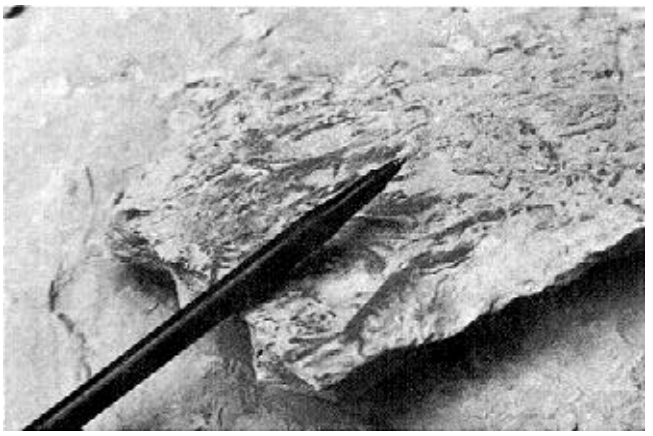

Figure 1. Micaceous shale. There were layers of micaceous shale like this present in both Redwall and Muav Limestones, supporting the idea that these Mississippian and Cambrian deposits were formed almost simultaneously. Note fossil worm tubes.

Muav Limestone and Redwall Limestone strata situated about 50 feet above and 50 feet below the presumed unconformity were searched for erosional features supportive of an unconformity. None was seen. All of the beds were seen to be homoclinal, each bed resting directly on another bed with no known structural deviation. Joint planes commencing in alleged Muav Limestone beds seemingly intersected Redwall Limestone similarly.

If in fact a 200 million year hiatus existed, and if in fact pertinent principles of structural geology and stratigraphy were applied to this stratigraphic section, one would expect to see 1) obvious, pronounced erosional features incised into the highest of Muav Limestone beds, 2) Basal Redwall Limestone beds exhibiting boulders and cobbles of eroded Muav Limestone beds, 3) Muav Limestone beds dipping somewhat more steeply than overlying Redwall Limestone beds, 4) Muav Limestone beds being somewhat more folded than Redwall Limestone beds, 5) more complex joint systems in the Muav than in the Redwall, 6) more faulting in the Muav than in the Redwall, and particularly 7) a decidedly different lithology within each of the formations, due to supposed changing regional environments.

Redwall Strata in Muav Limestone well below the Unconformity

More than 100 yards southerly of the National Park Service sign for the Redwall-Muav contact there is a stratigraphic section which is impressive— see Figures 2 and 5. In this area, there are interbedded supposed Redwall strata, mottled Muav Limestone and micaceous shale. This sandwiched section was observed to be well below the presumed contact, and entirely within the Muav Limestone. Redwall strata are not expected to exist here within the Muav Limestone. Yet these interbedded strata grade abruptly southerly into

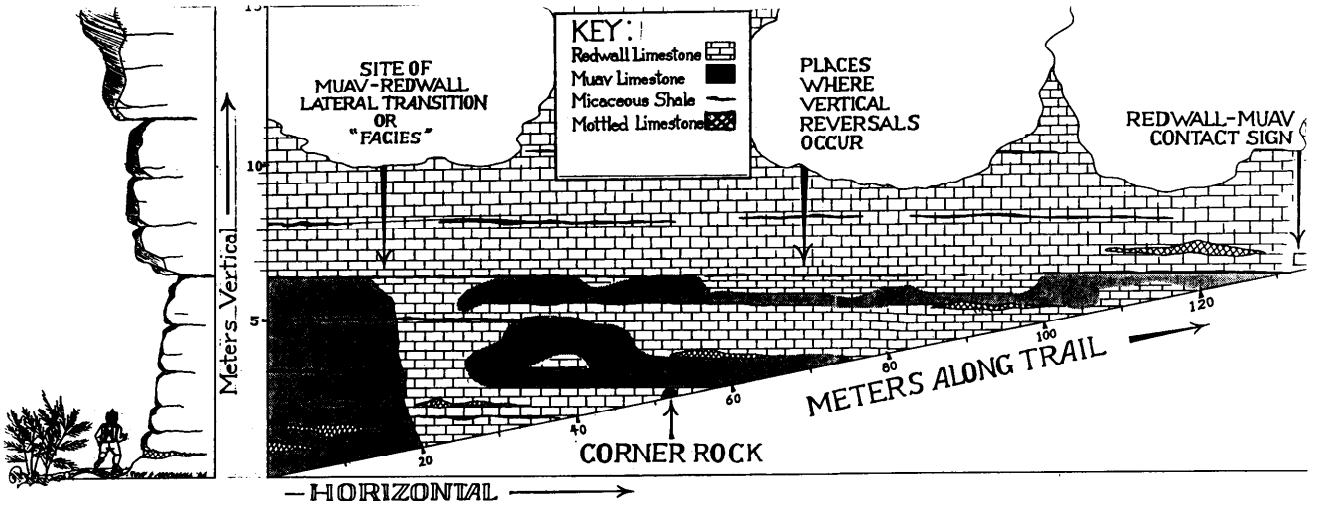

Figure 2. A diagram of the rock strata near the Redwall-Limestone-Muav Limestone contact, North Kaibab Trail, Grand Canyon, AZ. From the starting point at the left, distances were paced along the trail and these three-foot paces were later converted to meters. The trail, which curved in and out, has been drawn straight, with a gradual slope as shown. The "corner rock" sketched here is visible on other figures.

The vertical distance was estimated from other photographs containing a member of our party who was about 5 feet 10 inches tall. See sketch of 510" hiker for vertical perspective. Vertical distances are exaggerated four-fold in comparison to horizontal distances.

Evolutionary geologists assume that Redwall Limestone was deposited 200 million years after the Cambrian Muav Limestone beneath. We found, however, that beds of both were deposited in exactly the same horizontal fashion and there were no signs of the Muav having eroded before the Mississippian Redwall Limestone was laid down. In one place Muav and Redwall clearly graded laterally into each other and they also manifested a vertical intertonguing at other localities. All of these facts support the belief that Redwall was deposited only after shortly Muav Limestone. Diagram drawn by Ross Marshall.

strata which are obviously Muav, by descriptive definition (Figures 2 and 5).

A close-up view (Figure 6) reveals that there is no fault where the interbedded strata grade directly into obvious Muav material.

A Contrasting Post Pre-Cambrian Unconformity

Along a lower segment of the North Kaibab Trail, trending southeasterly towards Phantom Ranch, one can view an undoubted unconformity. In this area, a sedimentary formation, the Precambrian Bass Limestone (basal member of the "Grand Canyon Supergroup") lies unconformably on older, metamorphosed, Precambrian, Brahma Schist. See Figure 7. In this area this unconformity can be discerned readily. The rocks above differ markedly from the rocks below in lithology and in the presence of differing structural elements. There is a somewhat jagged interface between the two formations which is considered to be indicative of an erosional interval of time into Brahma Schist prior to deposition of elements of Bass Limestone.

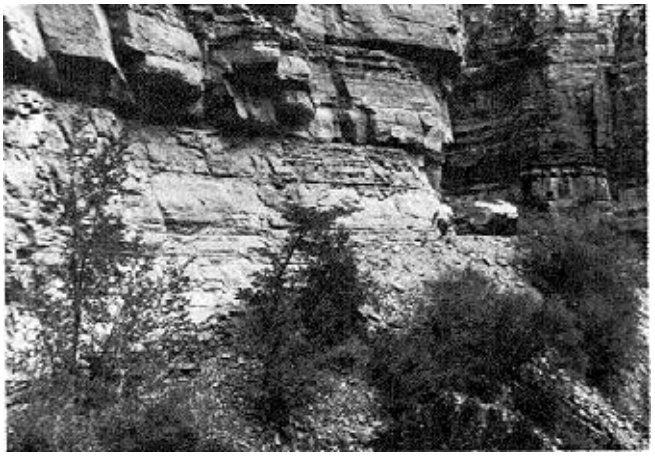

Figure 3. Vertical and horizontal reversals. To the left of W. Waisgerber and the "corner rock" are beds which undergo intertonguing in that there is a transition vertically between such layers as micaceous shale, Muav-like rock and Redwall Limestone. It is obvious as well that the lighter Muav-like material near Waisgerber's head becomes darker laterally, shading into typical Redwall beds. Transitions such as these do not fit with the usual geological concept that vast ages separated the deposition of rocks above and below. Note also the perfectly conformable and horizontal character of all these strata. No marks of any erosion, tilting, or other disturbance are here, suggesting contemporaneous deposition.

DISCUSSION

Formational contacts

When basal strata for one geologic formation (or member) lie directly on uppermost strata of an older formation (or member), in a uniform manner, then it is common practice for a geologist to conclude that the two formations (or members) are conformable. However, should an evolutionary geologist determine on the basis of fossil evidence that there are millions of years of missing geologic time situated between the formations, then he must postulate the existence of an unconformity. Then that evolutionary geologist must search for confirming structural geologic evidence to support his belief. Evidently fossil evidence from the Redwall Limestone and the Muav Limestone have convinced evolutionary geologists that there must be such an unconformity.

As was mentioned previously, some relationships between formations (or within formations) are undeniably unconformable. If for example the subjacent formation is metamorphic, whereas the superjacent formation is sedimentary, the result can be described as an unconformable relationship— a nonconformity. A nonconformity is illustrated in Figure 7.

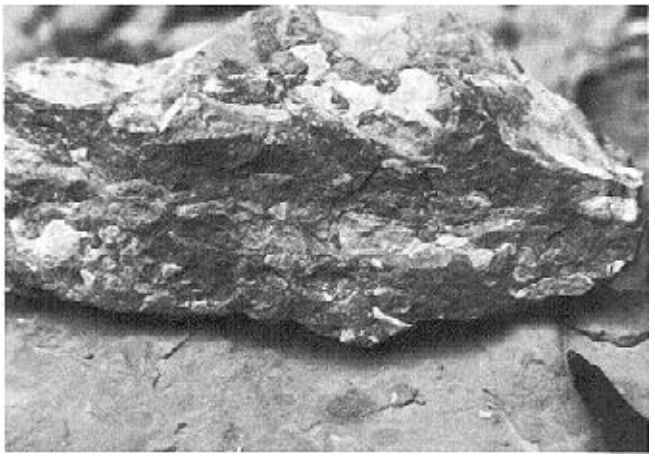

Figure 4. Mottled limestone. Mottled limestone of this type was found in both the Muav and Redwall-like deposits below the supposed contact surface. Its presence in patches within both types of strata is another evidence favoring simultaneous deposition. McKee (1945) discusses this mottled limestone as part of typical Muav formations.

If subjacent strata are folded or significantly inclined, more than superjacent strata, this describes another kind of unconformable relationship— the angular unconformity. Thus there is the existence of hiatuses between formations (or members) when these stratal elements exhibit angular unconforming relationships or nonconforming relationships.

One other stratigraphic relationship between formations (or members) is commonly described as a disconformity. A disconformable relationship supposedly exists when two formations exhibit similar structural geologic elements except that the lower formation may have been incised. Basal strata for the higher formation then fill in the notches and grooves brought about by prior erosion of the uppermost part of the older formation.

The Redwall/Muav contact is evidently a disconformity by definition. Yet in the previously mentioned study site along North Kaibab Trail, strata did not reveal notches and grooves to confirm the current geologic conclusion that a disconformity existed.

How do most geologist account for the various Paleozoic deposits in Arizona?

According to historical geologists, Cambrian, Devonian and Mississippian strata were formed when a broad, onlapping sea moved into Northern Arizona to cover the general area with sediments. Certain "isopach" maps which were drawn by a previous investigator (McKee, 1951) reveal depths of respective formations suggestive of Cambrian, Devonian and Mississippian oceanic advances. Because Cambrian, Devonian and Mississippian strata do not associate with the so-called Defiance Positive area of northeastern Arizona, it is presumed that Cambrian, Devonian and Mississippian seas never covered that area.

Following recession of the post-Cambrian (and Ordovician and Silurian) sea, the advancing Devonian sea deposited sediments well to the west of the Defiance Positive area suggesting that the Defiance Positive area had been extended farther westerly than it had been during Cambrian times. Thus areas such as North Kaibab Trail were supposedly above sea level and hence not covered by Devonian sediments.

Following recession of post-Devonian seas, the advancing (onlapping) Mississippian sea covered a greater area than did Devonian seas. This resulted in the covering of Devonian strata where Devonian strata had been deposited. Where Devonian strata were absent, such as along North Kaibab Trail, Mississippian seas deposited sediments directly on Cambrian deposits. Such a historical geological scenario pleads for a hiatus of 200 million years between Mississippian and Cambrian depositional sequences. A 200 million year hiatus demands an undoubted unconformity between Mississippian and Cambrian deposits.

Continuing the historical geological scenario, Ordovician and Silurian seas supposedly receded from the Grand Canyon region. Consequently, one would expect to find fauna-dated Ordovician and Silurian strata somewhere in the general region, particularly in areas to the south. McKee (1951) raises a very significant, unresolved geologic time and time-rock problem by writing: "Strata of the Ordovician period are confined to the southeastern and possibly to the northwestern parts; those of the Silurian are not known within the state." p. 484.

McKee's comment above merely reinforces the belief by the writers of this paper that geological time as developed in western Europe during the 19th century cannot satisfy the stratigraphy of the Rocky Mountain region of North America. Because 19th century western European geologic time was adopted by 20th century North American geologists, mid-20th century consequences have been monumental non-solvable stratigraphic correlation problems across North America. It is not at all surprising that the Redwall Limestone-Muav Limestone hiatus cannot be confirmed by an undoubted unconformity.

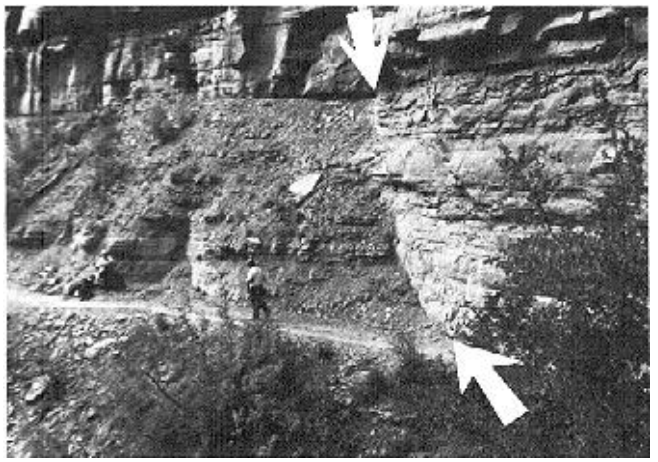

Figure 5. Lateral transition or facies shift from a sandwich of Redwall, micaceous shale, mottled limestone and Muav to solid Muav. At the right a sandwich of Redwall, micaceous shale, mottled limestone, and Muav-like beds grade laterally into a solid deposit (left) of Muav. A facies relationship of this type would be expected only if both the Mississippian and Cambrian rocks were being deposited at approximately the same time. J. Meyer is seen left and W. Waisgerber to the right. The arrows point to the top and bottom of this line of lateral transition.

Figure 6. View of the lateral transition. Even upon close analysis there is no sign of faulting at the line where the sandwich of rocks (see Figure 5 caption) grades laterally into pure Muav Limestone.

Mississippian (Redwall Limestone) and Devonian (Temple Butte) strata reported as unconformable

At places throughout the Grand Canyon region, Mississippian Redwall Limestone is known to rest on Devonian Temple Butte strata, rather than on Cambrian Muav Limestone. A number of workers have studied and described that Mississippian-Devonian contact. Based on established geologic criteria, some exposures reveal an apparent unconformity, and thus Walcott (1888, p. 438) wrote concerning the lower Carboniferous, which is synonymous with the Mississippian, that:

> A plane of unconformity by erosion, not dip, was found between the Carboniferous and Devonian, and also a strongly marked fauna compared with the Tonto beneath and Carboniferous above.

McNaire (1951) also viewed the Mississippian-Devonian contact as apparently unconformable:

> The contact between the Mississippian and Devonian rocks can be identified by a change in the weathering of outcrops. The weathered surface of the Devonian is brown gray and the Redwall is light gray. The erosion surface between the two systems is irregular. and in many places the basal 2-10 feet of the Mississippian contains angular blocks of Devonian Limestone. Although local scattered chert nodules occur in the upper part of the Devonian limestones, the Mississippian contains much more chert. In many places a thick, conspicuous band of dark-weathering, chert-bearing limestone, 20-60 feet above the base of the Mississippian, gives a clue to the position of the contact. p. 518.

McKee and Gutschick (1969) found in western localities of Arizona that:

> Surfaces of relief developed on pre-Mississippian rocks of western Grand Canyon consist chiefly of small hills and shallow depressions ranging from a few feet to an observed maximum of about 10 feet within horizontal distances of 100 to 200 feet. At one locality, Havasu Canyon, pre-Mississippian erosion is recorded in the form of a beveled surface developed on folded Devonian rocks . . . The folding here apparently was accomplished before consolidation of the strata, possibly the result of overloading. . . In most of western Grand Canyon and in a few places to the east, the lowest member of the Redwall is a cliff-forming limestone, whereas the underlying Devonian strata are dolomite and form a series of ledges. In other areas, however, Mississippian dolomite rests upon Devonian dolomite so that recognition of the uppermost Devonian depends largely upon distinctive lithology and primary structural features within that system. p. 16

Stoyanow (1948) also implied that in his study this contact between Mississippian and Devonian strata was unconformable as witnessed by its uneven character: "The Redwall Limestone— the lower Mississippian stratigraphic unit of north-central Arizona— rests on the uneven surface of different older strata." p. 314. Longwell (1928) likewise wrote of an unevenness at the contact between Carboniferous and Devonian strata in the Muddy Mountains of Nevada:

> The base of the Carboniferous in the Muddy Mountains is marked by an irregular surface, which appears in section as a slightly wavy line at the top of light-colored limestones assigned to the Devonian. p. 28.

Two other authors noting an unconformity between Devonian and Redwall strata include S. S. Beus (1969, p. 130) and E. D. McKee (1969, p. 83)

But uncomformity at some Mississippian and Devonian contacts is questionable

Various workers have reported that in certain sites the Mississippian Redwall strata rest conformably on the underlying Devonian. Thus after a study of these contacts in several localities, Noble (1922) concluded that:

> . . . if an unconformity separates the Temple Butte limestone and the Redwall limestone in the region which I have examined, it is so obscure and exhibits so little irregularity that it can be detected only by obtaining determinable fossils in the strata within which it lies. Certainly no surface of erosion exists which is at all comparable in irregularity

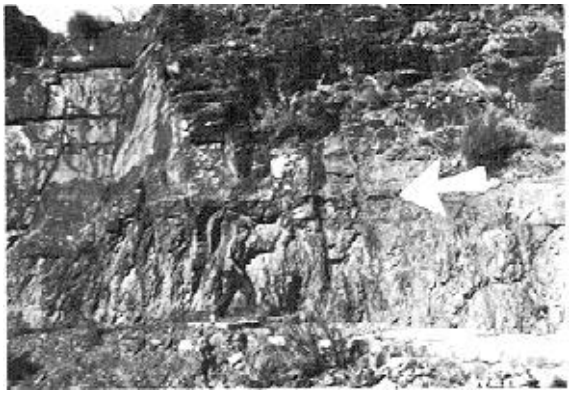

Figure 7. A nonconformity. There is obviously nonconformity here in line of arrow separating the Precambrian Bass limestone above from the twisted and eroded Brahma schist metamorphic strata below. No clear indicators of unconformity like these were visible where Mississippian contacted Cambrian far above. E. Williams is seen hiking here.

with that which separates the Tonto group from overlying beds. p. 54.

One page earlier, Noble made this same point after noting that although Walcott found a line of erosion separating Redwall Limestone from Devonian layers at Kanab Creek:

> . . . I am unable confidently to trace this unconformity in the region between Garnet Canyon and Cottonwood Creek and at all places to separate Devonian beds from the Redwall limestone. p. 53.

Describing the contact line between the Martin formation (also Devonian) and Redwall Limestone in central Arizona, Huddle and Dobrovolny (1952) indicated that: "*Although the contact appears to be conformable,* there was probably a break in deposition between the Martin formation and the Redwall limestone." p. 81 (Emphasis added). McKee and Gutschick (1969) noted that:

> At 11 of 21 localities examined, including most of those in eastern Grand Canyon, no evidence of an erosion surface could be detected at the contact: the surface appeared even and flat . . . Where evidence of an erosion surface is obscure, recognition everywhere of the basal contact of the Redwall Limestone is not easy . . . In summary, no large uplift such as would result in conspicuous dissection of the region or in an angular unconformable relation between formations is represented at the base of the Redwall. Nor is there any strong evidence that a major uplift in surrounding areas furnished large amounts of gravel across the surface. pp.16, 18.

In a later paper, E. D. McKee (1976) admits to an apparent enigma:

> Evidence that an unconformity occurs between rocks of Devonian age and those of Mississippian age in Grand Canyon is furnished both by the physical record and by faunal evidence of a hiatus. *Nevertheless, the boundary between rocks of these two systems is in most places difficult to recognize. Nowhere has any angular discordance been recognized and in only few places, mostly in western Grand Canyon, have conspicuous relief and local conglomerates been observed.* p. 54 (emphasis added)

Shelton (1966) likewise affirms that:

> The extraordinary flatness of the disconformable contact at the base of the Redwall limestone, which generally lacks even the minor channeling seen beneath the Temple Butte, implies that the landscape that developed in the interval between the accumulation of the two formations possessed remarkably little relief. p. 276

That there is conformability between Mississippian Redwall and Devonian strata becomes even more thought provoking when contrasted with observed aberrant stratal relationships between lithologic members within one formation— the Mississippian Redwall Limestone. Thus McKee and Gutschick reveal the existence of a striking unconformity and irregular contact between the Mooney Falls member and the Horseshoe Mesa Member of the Redwall— see Figure 24, p. 58 of the McKee and Gutschick paper of 1969. Here then could be another enigma for the stratigrapher. Why would lithologic members within one formation exhibit more pronounced stratal differences than occur between members of entirely different formations such as Mississippian and Devonian?

Cambrian-Devonian contact is unrecognizable in some localities

Although we had not intended to study existing contacts between Cambrian and Devonian, we located two references describing these. At such sites evolutionary geologists would also argue that many millions of years are missing and they would expect to find unconformities. Beus (1969) notes, on page 130 however, that: "The Devonian-Cambrian boundary is difficult to recognize in many sections owing to the similarity of lithology and absence of fossils in adjacent strata." Likewise McKee (1969) intimated that although erosional marks of unconformity were present, sometimes there was a lack of stratigraphic discordance that might otherwise have been expected:

> Erosion surfaces may be the time equivalents of great numbers of strata elsewhere in the geological column. Thus, between rocks of Cambrian and Devonian age in eastern Grand Canyon is an *unconformity involving no recognizable discordance in stratification,* yet marked by many irregularities or by erosion and representing a hiatus of considerable magnitude. (Emphasis added) p. 83.

Perhaps this contact and many others previously assumed to be unconformable should be reanalyzed in greater detail.

Mississippian-Cambrian contact at the North Kaibab Trail as reported in literature

We examined the literature to determine if other workers had viewed and commented on the relationship of Redwall Limestone on Muav Limestone along North Kaibab Trail. We located only a few scattered remarks concerning this contact and only one closeup diagram. Walcott (1888) wrote concerning various places where he saw Redwall Limestone resting directly on what he called the "Upper Tonto" (probably Muav Limestone) that: "The line of unconformity is slight and often none exists except to the eye of the geologist looking at that exact horizon for it." p. 438. Our observations would support Walcott's analysis as we found no line of unconformity.

Schuchert's observations (1918, p. 361) were evidently different from these, however, in that he reported: "The Redwall usually reposes disconformably on the Muav member of the Tonto formation of Cambrian, age . . ." McKee and Gutschick (1969) merely quoted Stoyanow's (1948) one sentence statement: "The overlap of the Redwall Limestone on the Cambrian platform is well shown in the Grand Canyon sections." p. 314. McKee and Gutschick published a diagram of the North Kaibab Muav-Redwall contact showing a surface with wavy undulations. But the only comment they made about the drawing (their Figure 4b which is reproduced herewith as our Figure 8) was that the contact was an "unconformity" with "Irregular wavy surface of Muav Limestone" having "relief of 1-2 feet in areas of channeling" p. 625. We found no such undulating channels in our observation of this same contact.

On their Table 2 (1969, p. 18) McKee and Gutschick have put an asterisk beside all strata having well preserved fossils. It is informative that they did not use an asterisk beside the rocks at the North Kaibab Trail contact in question. Evidently this indicated that they did not find enough fossils there to allow proper paleontological evaluation. Further fossil analysis of these particular strata should be carried out.

As was true in our own study along the North Kaibab Trail, Noble (1914) experienced great difficulty trying to determine just where the Cambrian strata stopped and the Mississippian began in Bass Canyon because fossil and lithologic data failed to suggest an unconformity:

> Because of the lack of fossils and the failure to detect the line of erosion that would mark a division between the Muav Limestone and the Redwall in Bass Canyon it has been necessary to fix tentatively the base of the Redwall by means of lithology. The Muav Limestone is here overlain by alternating layers of calcareous sandstone and dense blue-gray crystalline limestone, which have a thickness of 110 feet. These layers are taken *arbitrarily* as the base of the Redwall. (Emphasis added) p. 66.

It is obvious that in Bass Canyon, as well as along the North Kaibab Trail, the contact line is not easily discerned. Further studies of this Bass Canyon contact should be undertaken. Such a situation casts great doubt on the concept that 200 million years elapsed between the deposition of the two formations.

Undoubtedly the Redwall-Muav stratigraphy along North Kaibab Trail has been studied by other geologists. Yet no other papers than these few mentioned here have been found by the writers of this paper. E. D. McKee, who did so much to publicize the stratigraphy of the Grand Canyon region, died in 1985. Consequently a very valuable resource for continued study of Grand Canyon was lost with his death. His colleague, R. C. Gutschick, informs us (1986) that E. D. McKee published no more material on this North Kaibab Trail contact than what we have discussed here. Another accomplished field geologist, G. Billingsley (1986) states that the literature citations on this contact given here are all those of which he is aware. Readers are asked to help. Any information regarding other pertinent papers will be appreciated.

Evolutionary geologists, by virtue of their training, must insist on the presence of an unconformity between the Redwall Limestone and the underlying Muav Limestone. According to those geologists who accept "geologic time" as taught in many colleges and universities, the Muav is part of the Cambrian system whereas the Redwall is part of the Mississippian system. Therefore it is to be expected that professional papers include sketches which illustrated supposedly unconformable conditions. Figure 8 is one example of such a sketch. We found no such unconformity.

Other sketches illustrate the Mississippian-Cambrian contact as an erosional feature which associates with brecciated material— see Nations and Stump (1981), their Figures 3-5, p, 21. The precise locations of such surfaces within Grand Canyon are not apparent because authors do not discuss the sites.

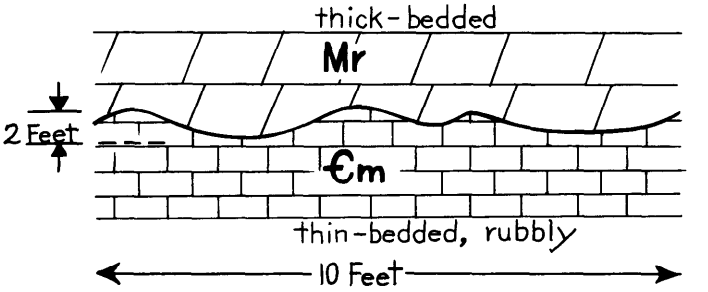

Figure 8. Figure 4b after McKee and Gutschick (1969, p. 17) They labeled this figure as follows"Basal contact of Redwall Limestone. (b) Kaibab trail, north." Their designation Mr stands for Redwall Limestone and Cm for Cambrian Muav. Note that they show an undulating line of erosion between these two strata. We would estimate this undulation to involve an amplitude of about two feet in places, according to their figure. On page 625 of their paper they refer to this as an "Irregular wavy surface: with relief of 1-2 feet." Nowhere along the North Kaibab Trail could we find any contact that resembled this drawing. It is not clear why there is this strange discrepancy between their findings and ours. Redrawn by Ross Marshall.

Contacts viewed in the study area along North Kaibab Trail by the writers of this paper have been deemed conformable. The so-called unconformity could not be determined because the uppermost Muav Limestone grades laterally and vertically into Redwall. No erosional features were seen. See Figure 2 herein for our interpretation.

Conclusions

1. The unconformity supposedly separating the Redwall Limestone from the underlying Muav Limestone does not exist. Consequently there cannot be any 200 million year hiatus.
2. Since the 200 million year hiatus cannot exist, the dating of Redwall Limestone and Muav Limestone as Mississippian and Cambrian, respectively, cannot be valid.
3. Because the Paleozoic periods shown above cannot be valid, then the longer time unit known as Paleozoic Era cannot be real.
4. Since Paleozoic Era cannot be a real geologic time unit, historical geologic time must be suspect.
5. Because historical geology is suspect, the mega-evolutionary model cannot be confirmed by historical geology because there is no true definition of geologic time.
6. Since the evolution model cannot be sustained historically, it behooves all scientists to search for alternative models as regards the origin of the earth, the origin of life on earth, and the time necessary to effect such origins.
7. The various formations within the Grand Canyon area could have been deposited one formation on another without the need for millions of years of depositional time and millions of years of unaccountable time (hiatuses).

Acknowledgements:

We thank C. L. Burdick for his original perception in discovering the anomaly which is under study here. We are grateful to the Research Committee of CRS for supporting this project from interest of the Laboratory Project Fund and we thank all the people who have

made this research possible by their contributions to that fund. We appreciate the art work of Ross Marshall and the able assistance in manuscript preparation by Phyllis Hughes. We are grateful to J. R. Meyer for assistance in the field and for comments concerning the preparation of the manuscript.

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THE DILEMMA OF A THEISTIC EVOLUTIONIST: AN ANSWER TO HOWARD VAN TILL

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Received 30 October 1986; Revised 4 November 1986

Abstract

Regardless of the attack of a theistic evolutionist, the gravitational contraction theory arguments used by creationists are still valid. Some other young earth arguments are discussed.

Introduction

The theistic evolutionist is a classic example of an antagonist trapped between the horns of a dilemma. He cannot have his cake and eat it. The argument is sharply defined when one horn of the dilemma is a recent creation and the other horn is evolution. These are mutually exclusive positions.

It takes but one proof** of a young-age limit on the earth, the moon, or the sun to refute the whole gamut of evolution. There are many proofs. Lord Kelvin gave two young-age proofs that have never really been falsified. Lord Kelvin chided the evolutionary geologists for their ignorance of the fact that limits on the earth's age can be established from straightforward physics. There is much more evidence of a young-age of the earth, moon, and sun now than at the time of Kelvin.

Two attributes of a valid proof are: 1) Founded on sound physical theory. 2) Consistent with the scientific evidences.

There is no lack of scientific evidences of a young age for the earth, moon, sun, and some of the other astronomical bodies. There is no lack of sound physical theories upon which to found those proofs. The problem is with the attempts of evolutionists (theistic and secular) to gloss over the physical theory and to suppress the evidence.

Theistic Evolutionist Van Till's Strategy

In a recent paper theistic evolutionist Howard J. Van Till, Professor of Physics and Astronomy at Calvin College, Grand Rapids, Michigan, challenges the scientific evidences and theoretical support for a recent creation. His paper is entitled "The Legend Of The Shrinking Sun: A Case Study Comparing Professional Science and Creation-Science' in Action" (Van Till, 1986, pp. 164-74). His strategy is:

1) Attack the credibility of all creationist scientists, the *ad hominem* approach.

2) Concentrate on one young-age case he thinks is most vulnerable.

3) Cite a multiplicity of conflicting papers to give the appearance of neutralizing the evidence.

4) Claim that this demonstrates the lack of credibility of all young-age evidences.

5) Gloss over the fact that he never provides evidence for the billions-of-years age position he holds.

One can dismiss his *ad hominem* attack on the credibility of creationist scientists. The eight creationist scientists whom he attacks all have equal or better professional credentials than Van Till.

Van Till objects to creationist scientists raising so many cases for a young age. He classifies them as nonprofessionals who merely list young-age arguments

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**From valid logic and the scientific evidence.