COMMENT ABOUT FOSSIL REEFS

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I was recently asked to review a paper dealing in part with some 50 fossil "Rainbow Reefs" found in northwestern Alberta. This demanded that I look into the geologic literature about this famous group of reefs. In summary, their validity as authentic reefs is both undemonstrated and questioned. Based on our present knowledge, it does not appear that they present a very significant challenge to the biblical model of origins. This note is just a summary I will send for reference use, to a select few who have requested this, and to others who might be interested in the reef problem. It may end up later on my webpage: *www.sciencesandscriptures.com.*

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"Coral reefs" are often cited as challenges to a biblical interpretation of origins because they seem to require such a very long time to grow. Christopher Gregory Weber in his article "The Fatal Flaws of Flood Geology"[1] specifically discusses the fossil Rainbow Reefs and Daniel E. Wonderly. in his "Neglect of Geologic Data"[2] provides traditional and supplemental interpretations of the Rainbow Reefs that would require lots of time. Davis Young and Ralph Stearly[3] speak of "the large regional Devonian reef track in Alberta, Canada" in their book "The Bible, Rocks and Time." They further indicate that such accumulations "of bound marine framework organisms, often buried under hundreds to thousands of feet of overlying strata, are major 'monkey wrenches' for any universal catastrophic scheme." I have discussed at length several other fossil reefs in the article "Fossil Reefs and Time,"[4] The brief comments below are an addendum to that discussion.

The Rainbow Reefs are dated as Devonian. You cannot see them since they are all underground. They are studied using cores from oil well drillings and configurations are largely determined by seismic reflection data. A majority of them have provided commercial quantities of oil and/or gas, hence are of considerable interest. Some of the reefs have been drilled into at several localities. The reefs are up to 830 feet thick and can be several miles wide. The edge slopes are from 20-35° from the horizontal and the reefs are often designated as "pinnacle" or "atoll" depending on size or the presence of a depression in the mid-region that is sometimes interpreted as a lagoon.

The seminal reference dealing with facies analysis of these reefs is by Roger Langton and George Chin.[5] They describe a typical reef with a central core of massive stromatoporoids (somewhat sponge-like, but could be a coelenterate) and reef debris around the outside as expected for a normal reef. These authors also include extensive massive sandstone (arenite) layers in the reef structure which is not very easy to explain for a wave exposed structure like a reef. V. Schmidt, D. A. McDonald, and I. A. McIlreath[6] describe a few significant evaporite layers (traditionally interpreted as caused by evaporation of seawater) in the reefs. In subsequent descriptions of these reefs, other authors such as Michael Hiskevrich;[7] D. E. Barss, A.B. Copland, and W. D. Ritchie;[8] simply follow Roger Langton and George Chin's traditional interpretations.

On the other hand, V. Schmidt, D. A. McDonald, and I. A. McIlreath,[9] who provide an extensive study of reef cementation details, have another view of how they formed. Instead of "ecologic reefs" which would have grown slowly over time, they describe these reefs as "cementation reefs" which formed by cementing reef rubble. Such an interpretation allows for rapid formation as expected during the Genesis Flood. These authors are not at all advocating a Flood model, but do state that the reefs are "primarily products of pervasive cementation of mechanically deposited skeletal debris." The two paragraphs quoted below elucidate their interpretations.

> "Yet, were they really ecologic reefs? Langton and Chin (1968) point out the abundance of rudite [rubble] and arenite [sand] matrix and concentrated debris zones throughout the organic reef phase. Barss et al. (1970) suggest there is a lack of framestones and that the periphery of the reefs consists of a tremendous amount of coarse bioclastic material with initial dips of up to 25° in the fore-reef beds. In fact, critical examination of Rainbow reef-core facies shows that nearly all the original carbonate was mechanically deposited. The amount of in situ skeletal framework is so small and its distribution is such that Rainbow reefs cannot be called ecologic reefs. They were not wave resistant as a result of an in situ skeletal framework, rather it will be shown here that their positive topography was mainly the result of pervasive cementation of mechanically deposited skeletal debris. The Rainbow reefs then are "cementation reefs" or cementation framework reefs in terms of Heckel's (1974) classification of reefs.
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> "In the past, core from Rainbow reefs has been examined in terms of looking for reef-building organisms (even the presence of fragments being enough to suggest the existence of a solid framework) and then relating other lithofacies in terms of the organic reef. However, the same core can also be interpreted differently, recognizing the importance of marine cementation and evaporitic intercalation within the reefs. In fact, it will be shown that the Rainbow reefs consist mainly of repeated intervals of predominantly marine lithofacies interrupted by a subordinate, essentially non-fossiliferous evaporitic carbonate lithofacies."

Of course, evaporites can also be easily transported as illustrated by the evaporite turbidites found in the Mediterranean region.[10]

In the last paragraph of this study the authors state that "A high percentage of Paleozoic and Mesozoic reefs are cementation reefs." They do not give any data to support this statement, but in the context of their study expertise, there may be some validity to the assertion.

On the other hand, Christopher Gregory Weber in the article "Fatal Flaws of Flood Geology" mentioned earlier, while referring specifically to the Rainbow Reefs states: "they look just like modern barrier reefs, not like piles of loose coral that the tidal

waves of Noah's Flood threw together by chance."[11] Conversely, J. E. Klovan of the Department of Geology at the University of Alberta has another view. In comparing the Devonian reefs of western Canada with modern reef analogues, he opines that "close analogies between recent and ancient reefs cannot be made at a specific level of study."[12] He also states that: "The role of frame builders is still a matter of debate. The dearth of three-dimensional framework in many ancient reefs has led to a gradual change in the conceptual model of the organic reef [ecologic reef] from that of a reef wall to that of a thin discontinuous rim." In other words finding those organisms (frame builders) that would provide the wave resistance of our modern reefs is difficult.

This trend in reef reinterpretation suggested above is likely reflected in the case of the huge, 800 meters thick Hochkönig Massif Reef Complex in the Northern Calcareous Alps, south of Salzburg, Austria. There, "the central reef area consists of relatively widely spaced [5% in the report] small patch reefs that did not develop wave-resistant reef framework structures." [13] The remaining 95% falls in the rubble category. This, of course, challenges the suggestion that this ever was a real wave-resistant reef structure.

One of the characteristics expected for a real reef is resistance to ocean waves. Hence, orientation in a position of growth of frame builders, such as coral and algae, that would provide wave resistance, would seem to be a valid but not exclusive criterion. The necessity of upright frame builders is expected, but has not been established. Lance Hodges and Ariel Roth[14] point out that some small ancient reefs do show preferred orientation of frame builders. However, hardly any studies at all quantify orientation, and casual comments about some organisms being upright seem to be accepted as sufficient.

One orientation study of the sponges (there are some sponges and not many corals) of the famed Capitan Reef, by arguably, the leading fossil reef authority of his time, Al Fagstrom, and O. Weidlich[15] claims that 74% of the sponges in this reef are upright. This report in the leading Geological Society of America Bulletin is surprising because the calculations are based on looking at the shape of flat horizontal cross sections of sponges in the reef without considering that, in that kind of surface examination, half of them instead of being upright could be bottom side up as expected for random catastrophic deposition. Furthermore, by assuming that any sponge leaning clear down to 60° from the vertical, and by using other generous criteria, they concluded that 74% of the sponges were upright. It very much appears that they were dealing with random orientation of the sponges, since 74% upright is very close to what would be expected from random orientation using their generous criteria to define uprightness. Just by extending the definition of uprightness alone to 60° from the vertical would give you 67% uprightness in a horizontal section of random oriented sponge sample if you assume none are bottom side up. Rachel Wood, J. A. D. Dickinson, and Brenda Kirkland-George had previously reported on many upside-down sponges in the Capitan Reef under the title: "Turning the Capitan Reef upside down: A new appraisal of the ecology of the Permian Capitan Reef, Guadalupe Mountains, Texas and New Mexico."[16] These latter authors claim that lots of sponges grew upside down inside cavities in the reef. I wrote to Al Fagstrom about these matters and in his kind reply he mentioned that they had

discussed the Wood et al. report, but considered it "anecdotal." I have seen a number of upside down sponges in the Capitan Reef. The lesson is that even apparently authoritative quantitative reports about reefs in leading geological journals may need to be carefully reevaluated.

I once attended a fossil reef workshop at a Geological Society of America meeting. I was especially interested in learning about what is a real reef, but we were told in the very first minute of the workshop, that the question of what was a reef would not be considered. All "reefs" were to be considered valid.

A total of 2,470 reefs are listed in a data base for Phanerozoic reefs.[17] However, there are many problems with the identification of fossil reefs. There is pronounced disparity in defining what a reef is. A simple localized increase in the thickness of a sedimentary layer, as seen in the lower layers at the Goosenecks of the San Juan River, Utah, can be considered a reef,[18] but fossils are sparse there. In many studies that concentrate on availability of fossil fuels, the question of reef authentication is not important and not evaluated. Fossil reefs are notoriously smaller than living counterparts. An extreme example is some small "dome-shaped structures at least 20-30 cm in width and 5-10 cm in height"[19] are called reefs. Several specialists point out that fossil reefs are different from our present living reefs[20] but attempts at considering them similar prevail. Part of the problem is that the assumption that these fossil reefs grew over time is not challenged and the questions pertinent to a biblical model of origins are not asked.

One is disappointed in some of the argumentation by those who advocate that fossil reefs present an unquestionable challenge to the biblical account of beginnings. If you read the original descriptive scientific literature, one soon realizes that too often there is a difference between what is actually seen and the broad assumptions that usually follow. Furthermore, one soon realizes that, as is the case for the Rainbow Reefs[21] and several other major fossil reefs,[22] alternate interpretations that are strongly compatible with the biblical model of beginnings, are often provided in the traditional secular scientific literature.

ENDNOTES

[1] Weber CG. 1980. The fatal flaws of flood geology. Creation/Evolution 1:24-37.
[2] Wonderly DE. 2006. www.wonderlylib.ibri.org/Wonderly-Neglect, viewed 2012.
[3] Young DA, Stearley RF. 2008. The Bible , rocks, and time. Downers Grove: IVP Academic, p 300.
[4] Roth AA. 1996. Fossil Reefs and Time. Origins 22:86-104.
[5] Langton JR, Chin GE. 1968. Rainbow member facies and related reservoir properties, Rainbow Lake, Alberta. AAPG Bulletin 52:1925-1955.
[6] Schmidt V, McDonald DA, and McIlreath IA. Growth and diagenesis of Middle Devonian Keg River cementation Reefs, Rainbow Field, Alberta. 1980. Notes for SEPM Core Workshop No. 1. Denver, Colorado. Edited by Halley RB, USGS; Loucks RG, Univerity of Texas. Tulsa, OK: SEPM.
[77] Hiskevich ME. 1970. Middle Devonian reef production, Rainbow area, Alberta Canada. AAPG Bulletin 54:2260-2281.

[8] Barss DL, Copland AB, Ritchie WD. 1970. Geology of Middle Devonian reefs, Rainbow area, Alberta, Canada. In: Geology of giant petroleum fields. Halbounty MT, editor. AAPG Memoir 14.
[9] See endnote 6.
[10] Schreiber BC, et al. 1976. Depositional environments of Upper Miocene (Messinian) evaporite deposits on the Sicilian Basin. Sedimentology 23:729-760.
[11] See endnote 1.
[12] Klovan JE. 1974. Development of western Canadian Devonian reefs and Comparison with Holocene analogues. AAPG Bulletin 58:787-799.
[13] Slatterley, AK. 1994. Sedimentology of the Upper Triassic Reef Complex at the Hochkönig Massif (Northern Calcareous Alps, Austria. Facies 30:119-150.
[14] Hodges LT, Roth AA. 1986. Orientation of coral and stromatoporids in some Pleistocene, Devonian, and Silurian reef facies. Journal of Paleontology 60:1147-1158.
[15] Fagstrom JA, Weidlich O. 1999. origin of the upper Capitan-Massive (Permian), Guadelupe Mountains, New Mexico-Texas: Is it a reef? GSA Bulletin 111(2):159-176.
[16] Wood R, Dickinson JAD, Kirkland-George B. 1994. Turning the Capitan Reef upside down: A new appraisal of the ecology of the Permian Capitan Reef, Guadalupe Mountains, Texas and New Mexico. Palaios 9:422-427.
[17] Kiesling W, Flugel E, Golonka J. 1999. Paleoreef Maps: Evaluation of a comprehensive database on Phanerozoic Reefs. AAPG Bulletin 63:1552-1587.
[18] Wengerd SA. 1951. Reef limestones of Hermosa Formation, San Juan Canyon, Utah. AAPG Bulletin 35:1038-1051.
[19] Adachi N, Ezaki Y, Liu J. 2011. Early Ordovician shift in reef construction from microbial to metazoan reefs. Palaios 26:106-114.
[20] E.g., Blatt H, Middleton G, Murray R. 1980. Origin of sedimentary rocks. 2nd ed. Englewood Cliffs, NY: Prentice Hall, p 447; Ladd HS. 1950. Recent reefs. AAPG Bulletin 34:203-214; see reference No. 12 above.
[21] See endnote 6
[22] See endnote 4.