[19]Garstang, J. and J. B. E. Garstang. 1948. The story of Jericho. Marshall, Morgan & Scott, Ltd., London, pp. 57, 58.
[20a]Albright, W. F. 1961. The archaeology of Palestine. Pelican Books, Baltimore, Md., p. 69.
[b]Piggott, S. 1961. Prehistoric India. Pelican Books, Baltimore, Md., pp. 67, 68.
[c]*Ibid.*, p. 69.
[d]Velikovsky, I. 1955. Earth in upheaval. Doubleday & Co., Garden City, New York, *Op. cit.*, p. 135.
[e]Gen. 13:10.
[21]See Reference #20b, pp. 133, 134.
[22]See Reference #20d.
[23]Herodotus. The histories. Penguin Books, Baltimore, Md., p. 106.
[24]See Reference #3, p. 46.
[25a]Hoggarth, D. G. 1899. Authority and archaeology. Sacred and Profane, John Murray, London, p. 20.
[b]Van Beek, G. W. 1952. Recovering the ancient civilization of Arabia, *The Biblical Archaeologist*, Vol. XV, p. 17.
[c]See Reference #20d.
[d]Erich, R. W. Editor. 1954. Chronologies in old world archaeology, *The Relative Chronology of Mesopotamia.* . . . Edith Porada. University of Chicago Press, p. 135.
[e]Glueck, N. 1940. The other side of the Jordan. American Schools of Oriental Research, New Haven, Conn., p. 90.
[26]See Reference #20d, p. 95.
[27]See Reference #8, p. 148.
[28]Sayce, A. H. Editor. 1876. Records of the past. New Series. Vol. VII, Assyrian Texts, London, p. 131.
[29]See Reference #20a, p. 71.
[30]*Ibid.*
[31]See Reference #19, pp. 76, 77.
[32]Mendenhall, G. E. 1948. Mari and the patriarchs, *The Biblical Archaeologist*, Vol. XI, p. 16.
[33a]Manetho. Translated by W. G. Waddell. 1956. Harvard University Press, Cambridge, Mass., p. 9.
[b]Josephus, F. Translation by W. Whiston. John C. Winston Co., Philadelphia, Bk. I, Chap. VI, paragraph 2.

ADDITIONAL NOTES CONCERNING THE LEWIS THRUST-FAULT

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A paper, "The Lewis Overthrust," by Burdick appeared in the September, 1969 issue of the Creation Research Society Quarterly. Field data was reported that had been gathered in recent years from study of the so-called thrust contact along the visible exposures. The standard physical evidences for thrust or low angle faults are: 1) mylonite or ground-up rock along the upper and nether plates of the natural mill, 2) tectonic breccia, or angular fragments of rock along the contact, and 3) slickensides, or grooves made by the differential movement. In the exposures visited these criteria were missing; therefore the author concluded that the Lewis block may not be a genuine overthrust.

In the summer of 1973 geologists Malcolm Fargher and Walter Peters accompanied the field trip sponsored by the Bible-Science Association under the personal direction of Rev. Walter Lang. Fargher reported the existence of slickensides and other physical criteria in the vicinity of the thrust contact, thus perhaps causing a re-evaluation of previous conclusions regarding the Lewis Overthrust.

Accordingly a special plane was chartered to fly Fargher and Burdick to the scene in October, 1973. Geoffrey McMahon kindly offered to pilot the plane and, as it turned out, pay for a large portion of the expense of the trip.

Introduction

For some time thrust faults have been accepted as a matter of course where the evolutionary order of the fossils in the rocks was inverted, without much recourse to study of the physical criteria. This point of view is well illustrated in a book by Nicholson:

> It may be said that in any case where there should appear to be a clear and decisive discordance between the physical and paleontological (fossil) evidence as to the age of a given series of beds, it is the former that is to be distrusted rather than the latter.[1]

This concept of the "taken for granted" certainty of the evolutionary sequence quite permeated the science of geology. This attitude was further emphasized by Billings:

> Parts of some of the great overthrusts in the Alps were so devoid of slickensides, gouge, and mylonite that they passed unnoticed and were for a time mapped as sedmientary contacts. It was only after paleontological evidence was obtained . . . that the existence of the great faults was recognized.[2]

Eventually some geologists recognized the illogical course others had taken, wherein certain lines of evidence were ignored.

Structural Studies

Some years ago a mechanically minded geologist and engineer by name of Field called atten-

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tion of paleontologists and others willing to listen that, even with the most competent rock, there was a theoretical limit to the size of a block of rock that could be pushed over another block. Field maintained that as the size of the block to be moved increased, so would the energy required to move such a block.

Further he pointed out that on the average rock surface, the crushing strength of rock would be exceeded after the block of the thrust exceeded about half a mile. With larger thrust blocks, supposing sufficient moving force, the thrust block would fracture and end up a mass of rubble, with little if any forward movement.

This interpretation jolted paleontologists and stratigraphers. Evolutionism was at the crossroads—some adequate mechanical solution must be discovered, or biological evolution was clearly in deep trouble, and would soon become merely another speculation that failed the test; the assumed evolutionary sequence of advancing life during the geologic ages as evidenced supposedly by the fossils in the rocks would end up as just that—another assumption.

Some scientists began to wonder how such vast blocks of the earth's crust could be moved over foundation rocks without disturbing the overall horizontal stratification of the beds, without faulting and indeed making a mass of rubble of the whole block. The writer first began to doubt the validity of these giant so-called overthrusts upon hearing a remark Dr. Leith, structural geologist, made in class at the University of Wisconsin: "I often wondered what giant lubricator was used to enable such giant blocks of earth's crust to slide over their base without rendering the beds a mass of rubble."

A. C. Lawson stated that there is a limiting factor on the theoretical size of overthrust blocks beyond which no rock was strong enough to withstand the stress without crushing:

> This estimate . . . serves to indicate an approximate limit to the extent of a thrust plane in the direction of slip. . . . It is apparent that the mechanics of an overthrust are not well understood, or that these thrusts are not overthrusts.[3]

The writer's observations concerning true overthrusts, where the physical criteria are evident, is that the thrusts are of small size, perhaps half a mile in width, such as the Santa Rita Overthrust.

William Bowie,[4] of the U.S. Coast and Geodetic Survey, has spent much time in the study of isostasy and the mechanics of earth movements and appears well qualified to express an opinion, "The theory that a mountain system has been caused by lateral thrusts originating from a distance supposes a very anomalous condition."

Hubbert and Rubey[5] have studied the mechanics of earth thrusts and have concluded that, for large thrusts, the pressure required to move blocks of earth crust would far exceed the crushing strength of the most competent rock unless some compensating factor were discovered that would help to equalize the stress required. They advanced the *theory of pore water pressure* to partially float the thrust plate, thus reducing the coefficient of friction.

However, since the specific gravity of most rock is at least 2½ times that of water, pore water pressure could not entirely eliminate friction.

K. J. Hsu[6] pointed out that Hubbert and Ruby had overlooked the coefficient of cohesion factor. Unfortunately, instead of pursuing the more straightforward approach of discarding the "must order" of fossils, Hsu tried to invent a more difficult solution, that of flowage at 300-400 degrees centigrade. He thus introduced metamorphism, which is not applicable certainly in much of the Belt Series sedimentary strata overlying the Cretaceous shale or limestone of Glacier Park. The more or less horizontal sedimentary stratification is not disturbed enough for flowage.

The present writer has not studied the good thrust contact on Chief Mountain, but some years back Dr. Walter Lammerts[7] did make such an examination and photographed a regular sedimentary contact with only a few inches of clay along the contact, which is common along unconformities or paraconformities, representing a change of type of sedimentation, or an hiatus between pulses of the same type.

Recent Observations

Burdick reported, in the September 1969 issue of the *Creation Research Society Quarterly,* observations made at various points along the thrust contact of the Lewis Overthrust where the actual contact was visible.

1) Marias Pass: Here is a definite unconformity, where the underlying Cretaceous shale has been faulted and has a westward dip of about 45 degrees. The contact between the overlying Altyn dolomite and the underlying Cretaceous shale was examined.

Although dipping at about 45 degrees westward, the Cretaceous surface had been eroded and truncated before the overlying Belt Series dolomite was precipitated. Subsequent to the Altyn precipitation both strata were again warped or tilted a few degrees further westward; however, at the contact, there was no physical sign of differential movement, such as gouge, breccia or slickensides.

The Appekunny formation, overlying the Altyn, consists of greenish shales and argillites; and, on top of that, lies the red Grinnell argillites, a very conspicuous formation.

Although no apparent movement has occurred at the Precambrian-Cretaceous contact, there is plenty of evidence of movement in the Belt Series, caused by or accompanied with strong metamorphism. (The term *argillite* signifies a metamorphosed shale or slate.)

The movement has indeed been so intense that in places the original flat-lying shales have been raised 90 degrees and stand on edge, similar to the vertical slabs in Mount Ishbell near Banff in Canada. The rotational metamorphic movement has in one place thinned out the Altyn dolomite to a thin sliver.

All in all Marias Pass is not a place to study thrusting but metamorphism, and it is not along the so-called thrust contact, but above that between Precambrian Belt series formations. The movements were more rotational than translational.

2) **Dry Creek at Two Medicine:** This location has been studied several times. There is a very striking contact where the Altyn dolomite lies on the black Cretaceous shale; a sharp contact with no ground-up rock, breccia, nor physical evidences of a giant thrust as one might suspect.

In the summer of 1973 United Nations geologist Malcolm Fargher visited the location with the Bible Science field trip. He subsequently reported what he believed to be evidences of thrusting. This necessitated another visit to the location promptly before Malcolm returned to the Isle of Man.

A special expedition was hastily organized. Mr. Fargher had not visited the Marias Pass contact, but he pointed out places in the area where both Cretaceous shale and Precambrian Altyn dolomite had been disturbed and deformed, though not at the same locations. If the shale had been much disturbed to the point of metamorphism, we would have found schist rather than shale.

Mr. Fargher pointed out that much of the overlying dolomite had been deformed to the point of brecciation, even low grade metamorphism. The crushing and brecciation was local, however, which helped explain why no gouge layer appeared at the Precambrian-Cretaceous contact.

At the Cretaceous contact, the rock was not sufficiently competent—it had been crushed and brecciated before it could be translated as a thrust block. There was no uniformity of tectonic activity along various contacts of the Lewis overthrust, as one would expect if the thrust block had acted as a unit. Deformation was local in character and varied from place to place.

About a mile south of the Dry Creek contact, the Altyn had been tightly folded into sharp anitclines at two places. Thus one can conclude that the crushing strength of the Altyn had been surpassed long before a major thrust could develop.

3) **Roes Creek Contact:** This contact had been visited many times. In *The Geological Story of Glacier National Park*, James Dyson has written, concerning the Roes Creek contact:

> At only one location does a trail provide a close approach to the actual contact between Belt and Cretaceous rocks. The latter site occurs along Roes Creek only a few hundred yards from Rising Sun campground.

A razor-sharp contact is apparent between the underlying black Cretaceous shale and the overlying buff colored rock which at first appeared to be the Belt Series dolomite, indicating a sedimentary contact rather than a thrust fault contact. The Cretaceous shale was replete with clam shells, some index fossils for the Cretaceous.

In the summer of 1973 Malcolm Fargher had critically examined this area, and concluded that what appeared to be Altyn dolomite was actually limestone, and perhaps not Belt Series rock at all. Near the contact the rock in question actually had contained sea shells, and inside was black in color like the shale; yet, the mineral composition was definitely neither Cretaceous shale nor Belt Series Altyn dolomite. The final conclusion seemed to be that many contacts, along radically distinct types of rock, contained mineralogy of both rocks. This appeared to be true of Roes Creek. However there was no evidence of thrusting.

4) **Cut Bank Contact:** This contact, well up on a mountain side had been pointed out to this writer on previous trips but had not been reached because of a swiftly running stream. However, in the summer of 1973, Mr. Fargher found the shortest route to the contact up a canyon where a branch stream flowed down the mountain.

This contact line was different from anything previously seen in the Park by the author. The contact was razor sharp, with no gouge, nor brecciation in the overlying Altyn dolomite, as had been the case at Dry Creek. But at Cut Bank the situation was reversed—the underlying Cretaceous shale had been severely broken and brecciated.

Had this been caused by overthrusting, both surfaces should have been brecciated, with slickensides and gouge. Therefore a logical conclusion would be that the brecciation of the shale took place before the overlying Altyn had been deposited. So here again the evidence does not appear to fit the thrust fault model at all.

5) **Crowsnest Pass:** This is located along the highway at the Continental Divide at the bound-

Figure 1. Altyn dolomite (light colored) resting on black Cretaceous Shale. Altyn dolomite is overlain by metamorphic Grinnell Precambrian Schist-movement apparently involved Precambrian rock, not along supposed thrust plane.

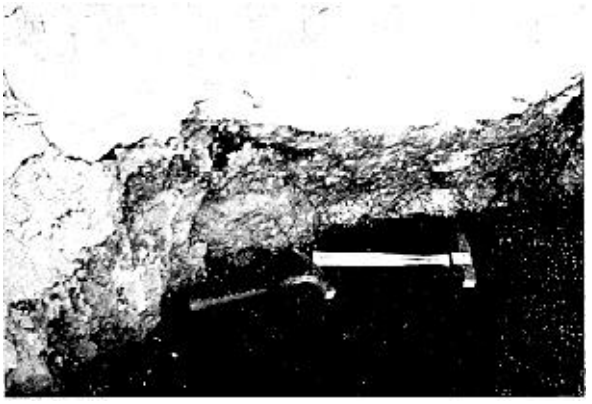

Figure 2. Thrust contact: Altyn-Proterozoic Precambrian dolomite resting on black Cretaceous shale at Dry Creek-Two Medicine location.

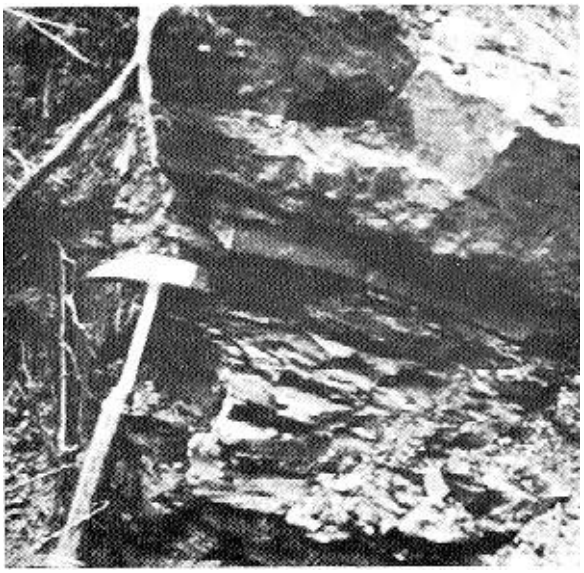

Figure 3. Roes Creek contact, Glacier Park. This is a knife-blade contact between the lower formation of cretaceous shale and overlying limestone. (The junction, slightly convex upward, extending from just over the head of the hammer, can be seen much better in color; the two kinds of rock being different.) The overlying rock actually contains some fossils, and seems to be a transition bed with some features of both Cretaceous and Belt Series rocks.

Figure 4. This shows the Colenia Algae, an index fossil for the Precambrian Belt Series rocks near Logan Pass, near Continental Divide.

ary between Alberta and British Columbia. Here the overlying Precambrian Belt Series Altyn lies apparently conformably on the underlying Cretaceous limestone which is coal-bearing at the mining town of Frank, where a disastrous slide buried the town half a century ago.

A sharp contact is visible although the rock beds lie at an angle of about 40 degrees. There is a very slight brecciated seam of an inch or so, as one would expect from the differential movement due to folding. However no thrust-fault evidence.

Conclusion

To sum up, the following by Dr. R. C. Emmons of the Geology Department of the University of Wisconsin seems appropriate:

> Under-thrusting and upwelling appear to have bypassed the usual period of scrutiny, into one of intransigent acceptance, and are widely invoked, though unestablished in the geologic literature, as for example is over-thrusting. Both vagrant concepts have assumed a sacrosant status under geophysical husbandry that denies communion to opposition.[8]

References

[1]Nicholson, Henry Alleyne. 1897. Ancient life history of the earth. D. Appleton Co. New York, N. Y., p. 40.

[2]Billings, Marland P. 1955. Structural geology. Prentice-Hall, New York, N.Y., p. 151.

[3]Lawson, A. C. *Bulletin of the Geological Society of America.* 1922. Bulletin 33, p. 340.

[4]Bowie, William, Isostatic investigations, etc. Special Publication 99, 1924. U.S. Coast and Geodetic Survey.

[5]Hubbert, M. King and William Ruby. 1965. Role of fluid pressure in mechanics of overthrust faulting, *Bulletin of Geological Society of America,* p. 470.

[6]Hsu, K. J. 1969. A preliminary analysis of the statics and kinetics of the Glarus overthrust, *Ecology Geologicae Helvetiae,* 62:143-154.

[7]Lammerts, Walter E. 1972. The Glarus overthrust, *Creation Research Society Quarterly,* 8(4):251-255.

[8]Emmons, Dr. R. C. 1973. Underthrusting and overthrusting, *Geotimes,* Washington, D. C.

VARIATION AND FIXITY IN NATURE

FRANK L. MARSH*

This article is the substance of a paper delivered at Lansing Community College, Lansing, Michigan, in October, 1973, as part of a Special Creation-Evolution Seminar, and is presented here as being of interest to a larger number of people. Using quotations from writers who assume evolution, the author points out that there is no evidence, from fossils or from anything else, for the vast changes between kinds, which are required according to the evolution model. The evidence may be used much more conclusively to support the special creation of the various kinds, followed, in some cases, by their limited diversification.

Introduction

I am most appreciative of this opportunity of speaking to you on the subject of origins. We might gain the impression occasionally that there are really a great many points of view on this subject. However, with regard to which views are really of importance in this fair land of ours, I think my erstwhile professor of zoology at the University of Chicago, Dr. Horatio Hackett Newman, very definitely cleared the air, as follows:

> There is no rival hypothesis [to evolution] except the outworn and completely refuted one of special creation, now retained only by the ignorant, the dogmatic, and the prejudiced. (p. 407, *Outlines of Zoology*)

(Once upon a time, after he had written this book, I received an A in a course on genetics under Dr. Newman because no opportunity had arisen for him to discover that I was a special creationist.)

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In titling this present Seminar on origins, I note that you agree with Newman as to which points of view in this specific area are the most important. Your name for this course reads, *Special Creation—Evolution Seminar.* I am delighted to know that among the professors of Lansing Community College (LCC) there is a breadth of mind which leads them to wish to study both sides of the problem of origins.

To discover from whence we came, I submit, is a very honorable quest. Some extremely important matters of the present time, and of the future, hang upon our origin as an order of beings. Tonight for a few minutes I invite your thinking upon this important topic by way of observable variation and fixity among fossil and living things.

One of the obvious characteristics of our living world, which make it so attractive to most of us, is the fact of variation in color, form, and structure. What a delight it is to stroll down the aisles of a good dog, or cat, or pigeon, or rabbit show, and along the lanes of the horse, cattle, pig, and