The Philosophy of Sequence Stratigraphy Part II—Application to Stratigraphy

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Abstract

To properly evaluate the scientific validity of sequence stratigraphy and its applicability to geologic research within the context of a Biblical worldview requires a basic understanding of the philosophy of science. A review of the philosophy of science, emphasizing its application to geology, was presented in Part I[1]. The principles developed in Part I are now applied to stratigraphy in general. In particular, the "mixed question" problem and effects of disparate worldviews on stratigraphic method and practice are examined. In Part III, principles developed in Parts I and II will be extended to the growing field of sequence stratigraphy.

Introduction

In Part I of this series, the philosophic background necessary to properly evaluate the validity of sequence stratigraphy was established. A review of the philosophy of science was presented, emphasizing the assumptions behind the scientific method and how these assumptions relate to philosophies of earth history. Particular mention was made of the "mixed question" problem, in which investigation of a phenomenon requires input from a plurality of sources and methods. Many of the phenomena investigated by geologists are mixed questions, and thus require input from sources and methods outside of natural science. These inputs are not neutral; they will reflect the philosophies or worldviews that govern them. Geologists who ignore these philosophic principles are virtually certain to err in their interpretation of sedimentary rocks.

In Part II of this series, the philosophic principles developed in Part I are applied to stratigraphy in general. Consistent application of these principles should enable geologists to avoid the many pitfalls that lead to errors in stratigraphic analysis. In Part III, the general stratigraphic principles developed here will be applied to the emerging field of sequence stratigraphy, an area of controversy among both mainstream and diluvial geologists. It should be possible for readers to effectively evaluate sequence stratigraphy based on the principles developed in the series. Readers unfamiliar with geological and philosophical terminology may wish to consult the glossaries at the end of Part I and this paper. Those who have not yet read Part I are urged to do so.

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Although evolutionists uniformly accept the system of stratigraphic correlation known as the geologic column, for creationists, the geologic column remains a topic of considerable controversy. How the geologic column relates to philosophy is not as clear for many, yet resolution of the controversy is dependent on such an understanding. My evaluation of postmodernism and how it is likely to affect the practice of stratigraphy may be of more than passing interest; indeed, Bartlett (1997, p.10) refers to postmodernism in his important creationist treatment of sequence stratigraphy. Having summarized the philosophic influences expressed in the geologic column, I present a more detailed logical analysis of specific stratigraphic methods within the context of mixed questions. Readers may note that in many cases, a stratigraphic method may contain elements that are scientific and elements that are not, and methods that are scientific in theory may not be in practice. Recognition of these distinctions is vital for any researcher who wishes to make use of mainstream publications in his own research. A key goal of stratigraphic research is correlation, the matching of rock units over large areas. However, correlation presents many pitfalls which require skill, training and vigilance to avoid and, in some cases, the process of correlation encounters epistemological problems as well.

Methodological Naturalism and the Geologic Column

Plantinga (1997a, 1997b) and P. Johnson (1995) expose the incompatibility of methodological naturalism[2] with natural science. It takes neither the detective acumen of Sherlock Holmes or Agatha Christie nor the wisdom of Solomon to perceive that for most stratigraphers, biologi-

Table I. Perspectives on historical geology.

Establishment Geologic Paradigm	Diluvial Geologic Paradigm
The present is the key to the past.	**The past is the key to the present.**
Objective: Explain all geologic phenomena in terms of present processes, and, whenever possible, in terms of present rates. Where this fails, invoke cyclical events or intermittent catastrophes.	**Objective**: Explain all geologic phenomena in terms of processes compatible with Biblical events and chronology.
Primary variable: Time.	**Primary variable** Energy.
The EGP is characterized by low-energy processes acting over immense periods of time. Evolutionist catastrophists see energetic processes acting intermittently through great spans of time.	The DGP is characterized by high-energy processes acting continuously over a limited period of time (principally the Deluge). Other geologic events have been much smaller than the Deluge, but have also tended to be brief, energetic events.

cal evolution is *ipso facto* the basis of the geologic column, or that in practice the various stratigraphic methods are intertwined with this assumption. One need read little on the topic to recognize that, ultimately, biostratigraphy[3] is incorporated into all other stratigraphic methods in some way. Methodological naturalism is foundational to the current geologic column.

Reed (1996a, p.7) observes the effect of naturalism/materialism on geology:

> The geologic column is an integral part of a naturalist worldview.... The connecting link between naturalism and uniformitarianism is evolution: *Evolution is the modern naturalistic explanation for the existence and character of phenomena, and is also the basis for interpreting the observed rock record into the geologic column*.
>
> The circle is completed by the geologic column providing key 'evidence' for historical evolution, and for evolution providing the 'scientific' basis for naturalism.... *beneath the tautology lies a more basic relationship that is destructive of the scientific method itself*. This relationship is one that does not allow separation between the extrascientific parent system and derivative scientific models. Thus, these models are not truly open to revision and rejection by empirical investigation.
>
> In geology, the application of this system is monolithic (emphasis mine).

The geologic column is the expression of the ruling geologic paradigm of the scientific establishment, referred to here as the establishment geologic paradigm or EGP. The EGP represents the postchristian majority opinion. The diluvial view (Table I), which typified "modern science" (Schaeffer's term for preDarwinian science) and has experienced a revival, most notably since the publication of *The Genesis Flood* (Whitcomb and Morris, 1961), probably represents the majority opinion among modern creationist geologists[4]. Considerable variation exists within the EGP, especially between quietist and neo-catastrophist camps, but both are firmly committed to a naturalistic worldview. Bartlett (1997, p.11) shows the close philosophic ties of these two camps:

> Indeed, a close review of current literature on the impact hypothesis (Shaw, 1994) reveals *a new epistemological strategy* for uniformitarians: if periodicity (cosmic resonances or chaos theory) is demonstrable in the larger equation of catastrophe, then catastrophe as known by the revelationist is not catastrophic (emphasis mine).

By contrast, the diluvial geologic paradigm (DGP) is overtly revelationist, emphasizing the unique role of divine judgment in earth history (Genesis 6:5–7,11–13; 7:1–8:5; 8:20–22. I Peter 3:18–20. II Peter 2:1–3:13). The DGP

[2]The term "methodological naturalism" is sometimes used to assert the need to exclude the supernatural from scientific research, as opposed to *metaphysical naturalism*, which denies the supernatural altogether. In reality, science cannot be properly practiced by pretending the supernatural does not exist, but rather by recognizing the limitations of the scientific method and the nature of mixed questions. Plantinga (1997a, 1997b) elucidates this distinction effectively, as did Schaeffer (1976, p.167ff.). Part I of this series showed the incompatibility of metaphysical naturalism with natural science.

[3]By this I mean biostratigraphy as practiced, not biostratigraphy in an empirical sense. The spatial distribution of fossils can be studied without reference to evolution or time, though in practice it is not.

[4]A number of other ideas have been promoted, but many of their proponents no longer hold to the Biblical view of natural history espoused by the Creation Research Society. Most of these are variations of "neocuvierism."

and EGP, as illustrated in Table I, are stereotypes or benchmarks to facilitate comparison.

The EGP is virtually synonymous with the geologic column. Many creationists from *The Genesis Flood* on have adopted the geologic column to some degree, albeit with a compressed chronology. Some have recommended that the geologic column be recognized as factual or substantially correct (Garner, 1996; Garton, 1996; Ritland, 1981, 1982; Robinson, 1995, 1996, 1997; Snelling et al., 1996). Woodmorappe (1981) provided a pioneering inductive evaluation of the geologic column. Reed (1996a, p.6) approached the issue deductively, demonstrating the extrascientific nature of historical geology in general and the EGP in particular:

> The most severe deficiency in the geologic column is its inextricable linkage to the naturalist-uniformitarian system, and its resulting inability to define and defend its axioms on a metaphysical level.

Creationists can as easily blur the distinctions when addressing "mixed questions." However, the DGP has the *potential* to provide a coherent and correspondent description of natural history.

> Naturalists have not, and probably logically cannot provide a non-theistic formulation that would justify those axioms foundational to modern science. Simultaneously, it has been demonstrated that the Biblical Christian framework passes these same formal tests. That comparison alone is sufficient to demonstrate that the naturalist system is false and that the Biblical Christian system provides a valid framework for earth history analysis (Reed, 1996a, p.12).

Most creationists do not appear to recognize the inextricable connection between the geologic column and methodological naturalism. Harmonization of Biblical history and the geologic column (or at least elements of it) has been the *modus operandi* of creationist geologists in recent decades. As Froede (1998, p.2) aptly put it, "Most, if not all, of these attempts to reconcile Scripture to the global evolutionary stratigraphic column have come at the expense of the biblical record." They have also come at the expense of the scientific data.

Many creationists appear oblivious to the fact that an empirically defined sequence stratigraphy and the geologic column are mutually exclusive (Jeletzky, 1978). There is a good reason for this ignorance. *Sequence stratigraphy as currently practiced is not empirically defined.* This does not, however, preclude development of an empirically defined sequence stratigraphy any more than an empirically defined lithostratigraphy, magnetostratigraphy or biostratigraphy. Unfortunately, as long as the prevailing paradigm is derived from the naturalist worldview, the geologic column will remain an unrecognized "mixed question." As if the philosophic straitjacket surrounding stratigraphy were not bad enough already, we are about to be plunged into the morasse of postmodernism.

Postmodernism

Postmodernism denies absolute truth, denies that one viewpoint can be valid and another invalid; in short, it is relativism. Postmodernism has subtle ties to the anachronistic empiricism or naturalism of the scientific establishment and that subconsciously pervasive philosophical reaction against it, existentialism. Postmodernism is the child of our time. To the extent that postmodern views affect stratigraphy, the result will be a further devolution of the discipline.

Naturalism/scientism did not arise in a vacuum. It, too, is clearly a child of its time (Taylor, 1991). During the "golden age" of quietism, Carl Becker (1932, p.5) pointed out, "Whether arguments command assent or not depends less upon the logic that conveys them than upon the climate of opinion in which they are sustained." A stakeholder in the humanist establishment, Becker's words imprison himself with the irony of Caiaphas (John 11:49–52). And modern stratigraphic concepts—evolutionist or creationist—have also arisen within specific historic and social contexts. The practice of science is not essentially objective (Lumsden, 1992; McGhee, 1987; Moreland, 1989; Pearcey, 1989).

Postmodernism is not a new philosophy—that would be a new "modernism"—but a denial that any particular system of thought can be superior to others, in any objective sense true, or correspondent in any understandable way. It can be thought of as the social outworking of existentialism (Breisach, 1962), described as an "antiphilosophy" by Schaeffer (1976, p.207), and as the natural consequence of the epistemological failure of the naturalistic/materialistic worldview. Phillip Johnson (1995, p.119) also notes the antiphilosophical nature of postmodernism. Gordon Clark (1978) decimates empiricism (naturalism/materialism) on epistemological grounds. Sire (1988) shows how this incoherence in naturalism leads logically to extreme skepticism and finally nihilism. Dembski (1993, p.2) describes how postmodernism (pluralism/contextualism/deconstructionism) is incoherent: "Here in a nutshell is the fallacy of contextualism, a fallacy that results from asserting with too much confidence that there is nothing about which we can legitimately have confidence" (Dembski, 1993, p.2). (For a succinct description of postmodernism in a nonscientific context, see the appendix.)

But does this mean that neither objective truth nor genuine communication is possible? The postmodernist says

Yes. His is a nihilistic epistemology incompatible with the metaphysical basis of natural science (Schaeffer, 1968, p.104; Schaeffer and Koop, 1979, pp. 368,369; Sire, 1988). Postmodernism/contextualism has profound implications for science. Although it arose outside the scientific establishment, it has shifted the prevailing worldview, with profound implications for the paradigms it spawns (cf. Figure I in Part I of this series). Indeed, postmodernism threatens to destroy the scientific enterprise outright.

Bartlett (1997, p.10) documents this using a critique of Gould:

> The problem is existential dichotomy. The result is philosophic tension. Gould's methodological uniformitarianism (space-time invariance) is potentially fatal to his substantive uniformitarianism (rate, material conditions, and ultimately periodicity) since in an existential universe there is no regularity, no uniformity (beyond the moment) to describe. This situation is not producing rationality in geology—postmodern geology. Only confusion has arisen from Gould's dichotomy, a disorderliness of the post-modern mind inflicted upon secular, geologic science.

The hypocrisy of postmodernism is easily exposed. A former coworker of mine, while an English major at the University of Colorado, "deconstructed" several of her deconstructionist professor's writings (Sanchez, 1998). He was not amused! "The fallacy of contextualism involves a fallacy of self-referential incoherence" (Dembski, 1993, p.2). To insist on causality without an epistemological basis (i.e. pragmatically) is to assert rationality irrationally.

To date, the majority of geologists—at least in my experience—appear to be "traditionalists," holding to a modern rather than postmodern worldview, but how long can this continue while postmodern influences grow? Neither postmodernism nor naturalism is logically coherent. Neither postmodernism nor naturalism can produce a scientifically sound approach to stratigraphy. Postmodern influences can only further muddy the waters of an already turbated discipline, further obscuring the mixed question nature of stratigraphy and rendering rational debate infeasible.

Application of Logical Criteria to Stratigraphy

What is the first question a geologist is asked about a given stratum or formation? Almost invariably, it is "How did it form?" Man seems to have an inexorable yen for understanding the past (this includes those who claim no interest in history!). The *science* of stratigraphy (i.e. descriptive stratigraphy) cannot answer this question. The *science* of stratigraphy must, by the defining criteria of the scientific method, limit itself to empirical sources of knowledge[5]. Both the EGP and DGP reflect philosophic biases based on their disparate views of history. They differ in that the DGP allows for historical knowledge to be provided from historical sources (viz. the Bible), while the EGP does not. A natural history developed for stratigraphic purposes may have value if its mixed question nature is recognized. *Historical stratigraphy*[6] might be an appropriate term for this approach.

The *science* of stratigraphy must meet scientific criteria:

- *Relevance*: Stratigraphic schemes must provide effective taxonomic structures for description of strata.
- *Testability*: Stratigraphic schemes must be empirically derived (attributes, scalars, vectors).
- *Compatibility with Previously Well-Established Hypotheses*: Stratigraphic schemes must be logically consistent with accepted axioms (e.g. cross-cutting features).
- *Predictive or Explanatory Power*: Stratigraphic schemes are superior which provide an adequate basis for development of statistical models.
- *Simplicity*: Stratigraphic schemes are superior which rely on fewer external hypotheses and require fewer cases of special pleading.

Historical stratigraphy must meet mixed question criteria:

- Recognition of the assumptions of the historical approach (e.g. EGP vs. DGP)
- Clear distinction between types of analysis required to adequately address the mixed question. In the case of historical geology, these will be principally history and science.
- Clear distinction between the types of data acquired, each type analyzed according to its method, with means for evaluation, testing, and verification/falsification according to the respective method. In the case of historical geology, these methods will be principally the historical method and the scientific method.
- A means for integrating the various analyses into a workable model. An historical stratigraphic model should exhibit predictive power in the same sense as a scientific model (e.g. lateral extent of beds and facies changes).

In theory, *scientific stratigraphy* may be practiced in a philosophically inconsistent way by those holding the naturalist/uniformitarian worldview or in a philosophically consistent way by those holding the Biblical/Christian worldview. Both may be careful and relatively impartial

[5]The *science* of stratigraphy concerns itself with mineralogy and petrology, grain size and sorting, color, thickness, bedding, and similar properties and gradients in these properties, and their spatial relationships.

[6]Some might argue that the term should be "historiographic stratigraphy," being a mental picture of past events, but the distinction between *historiographic* and *historical* has not been made in geology—historically!

observers and prudently differentiate their observations from their interpretations. Lack of personal objectivity may prevent this in practice, but the results should be the same if definitions of empirical methods are observed.

In both theory and practice, *historical stratigraphy* cannot be consistent between the EGP and DGP because of its nonempirical nature. The approaches to the mixed question of earth history are very different, as pointed out by Reed (1996b, p.215) using terminology of R.C. Sproul:

> The Biblical alternative to uniformitarian natural history will be distinct because the acceptance of a 'university' framework of knowledge results in the application of a multidisciplinary method, recognizing that no single branch of knowledge is competent for a complete analysis. This approach is consistent with the Biblical Christian framework, since truth is expected to be present in all disciplines, and to be consistent between them. Science by itself is inadequate to provide an interpretation of natural history, although there are facets of natural history that require scientific analysis.

Davison (1995, p.237) writes: "A re-occurring problem in this exercise was the dependence on others' evolutionary-based interpretations—certainly not the ideal for trying to do a Flood-based interpretation...." His experience is far from unique. It shows that a basic understanding of the philosophical underpinnings of science in general, and geology in particular, is vital to a successful effort in stratigraphic analysis.

A Review of Stratigraphic Methods

Stratigraphy is not a single method, but a field of study that utilizes many methods. Many geologists who are familiar with these methods are not cognizant of the philosophic principles which underlie them (Part I of this series), of the mixed question nature of many of the phenomena they investigate, or even of the fundamental logical criteria presented above. Failure to recognize the mixed question nature of some popular stratigraphic methods has produced "mixed" results for many researchers, further reducing the potential for scientifically valid and productive stratigraphic research. Readers of geologic literature must be aware of these defects to prudently judge what they read. Recognition of the strengths and weaknesses of various stratigraphic methods is doubly important for the geologic researcher. Common stratigraphic methods are here summarized and evaluated.

Stratigraphy *as a science* (i.e. descriptive stratigraphy) has been promoted by advocates of the EGP. This is often stressed by the North American Commission on Stratigraphic Nomenclature (1983), including the following:

> The objective of a system of classification is to promote unambiguous communication in a manner not so restrictive as to inhibit scientific progress. To minimize ambiguity, a code must promote recognition of the distinction between observable features (reproducible data) and inferences or interpretations.
>
> Stratigraphic classification promotes understanding of the geometry and sequence of rock bodies. The development of stratigraphy as a science required formulation of the Law of Superposition to explain sequential stratal relations. Although superposition is not applicable to many igneous, metamorphic, and tectonic rock assemblages, other criteria (such as cross-cutting relations and isotopic dating) can be used to determine sequential arrangements among rock bodies (p.847).

Other than the acceptance of isotopic dating (probably a faulty interpretation of radioisotope data—cf. Austin, 1988, 1992, 1994, 1996; Austin and Snelling, 1998; Brown, 1994; Chaffin, 1987; Gill, 1996; Helmick and Baumann, 1989; Jeletzky, 1978; Johansson, 1993; R. Johnson, 1993; Molén, 1991; Snelling, 1995, 1998; Woodmorappe, 1979, 1999), and probably the tectonic rock assemblages (often interpreted based on biostratigraphy), these statements support a purely descriptive (i.e. scientific) approach to stratigraphy. The North American Stratigraphic Code contains many other imperatives to distinguish between data and interpretation and maintain the time independence of descriptive methods, including lithostratigraphy, magnetostratigraphy, and biostratigraphy. Sequence stratigraphic methods are especially seen by some to afford freedom from historic bias: "Sequence stratigraphy represents a breakout from the intellectual-philosophic Bastille of uniformitarian time" (Bartlett, 1997, p.12). However, some stratigraphic methods (e.g. geochronology) are clearly extrascientific.

Several stratigraphic methods are in common use. Often these are combined in actual practice. A review of current stratigraphic methods is presented in Table II. Also indicated is whether the methods as defined by various authorities contain descriptive (i.e. scientific) elements or genetic (i.e. historic) elements. Minor variations and purely theoretical (i.e. extrascientific) approaches have been omitted.

Of the 13 stratigraphic methods listed, six are defined as purely descriptive, i.e. time-independent, techniques. These include lithostratigraphy (and lithodemic stratigraphy), magnetostratigraphy, biostratigraphy, allostratigraphy, and seismic stratigraphy. Unfortunately, these definitions do not translate into common practice. Observe the philosophic inconsistency in other citations from the North American Stratigraphic Code:

> Stratigraphic procedures and principles, although developed initially to bring order to strata *and the*

Table II. Summary of Current Stratigraphic Methods.

Stratigraphic Method	Ref[1]	Desc[2]	Gen[3]	Remarks
Lithostratigraphy	N	✔		Empirical in theory but not usually in practice
Lithodemic stratigraphy	N	✔		Extension of lithostratigraphy to nonstratiform earth materials
Magnetostratigraphy	N	✔		Empirical in theory but not usually in practice
Biostratigraphy	N	✔		Empirical in theory but virtually never in practice
Pedostratigraphy	N	✔	✔	Requires "recognition" of ancient soil horizons/weathering profiles
Chronostratigraphy	N		✔	Purely theoretical historical construct; rock units chosen as material referents for specific geochronologic intervals
Polarity-chronostratigraphy	N	✔	✔	A chronostratigraphic framework in which to place magnetic data ("magnetic sequences")
Allostratigraphy	N,B,W	✔		Empirical in theory and more-or-less in practice; limited applicability
Seismic Stratigraphy	W	✔		Potentially empirical, though purely geophysical unless nonempirical ideas are introduced; source of sequence stratigraphy.
Sequence Stratigraphy ("Classical" or "Exxon" approach)	B,W	✔	✔	Several ill-defined parameters, including some which are genetic; several *a priori* assumptions; limited to marine sedimentary basins with passive margins
Genetic Stratigraphic Sequences ("Depositional Episode," "Flooding Surface," or "Galloway" approach)	B,W	✔	✔	Several ill-defined parameters; overtly genetic; several *a priori* assumptions; limited to marine sedimentary basins with passive margins
Transgressive-Regressive Cycles	B	✔	✔	Several ill-defined parameters; overtly genetic; several *a priori* assumptions; limited to marine sedimentary basins with passive margins
Event Stratigraphy	W,S		✔	Highly genetic in emphasis on "event;" concentrates on small scale (bed), in which are some descriptive components; often combined with sequence stratigraphy

[1]References: B–Bartlett (1997), N–North American Stratigraphic Code (1983), W–R. Walker (1990), S–Seilacher (1991)
[2]Descriptive (empirical, scientific) method
[3]Genetic (nonempirical, speculative, historical) method

events recorded therein, are applicable to all earth materials, not solely to strata. They promote systematic and rigorous study of the composition, geometry, sequence, *history, and genesis* of rocks and unconsolidated materials (p.847, emphasis mine).

Correlation is a procedure for demonstrating correspondence between geographically separated parts of a geologic unit. The term is a general one having diverse meanings in different disciplines. *Demonstration of temporal correspondence is one of the most important objectives of stratigraphy* (p.851, emphasis mine).

A pedostratigraphic unit is the part of buried soil characterized by one or more clearly defined soil horizons containing *pedogenically formed minerals* and organic compounds (p.849, emphasis mine).

Many upper Cenozoic, especially Quaternary, deposits are distinguished and delineated on the basis of content, for which lithostratigraphic classification is appropriate. However, others are delineated on the basis of criteria other than content. *To facilitate the reconstruction of geologic history, some compositionally similar deposits in vertical sequence merit distinction as separate stratigraphic units be-*

> *cause they are the products of different processes; others merit distinction because they are of demonstrably different ages* (p.849, emphasis mine).
>
> Major objectives of stratigraphic classification are to provide a basis for systematic ordering of the *time* and space relations of rock bodies and *to establish a time framework for the discussion of geologic history* (p.849, emphasis mine).
>
> [Biologic remains are uniquely important because] *the irreversibility of organic evolution* makes it possible to partition enclosing strata temporally. Third, biologic remains provide important data for the *reconstruction of ancient environments of deposition* (p.849, emphasis mine).

The committee obviously had trouble keeping its worldview from showing! Notice how many times time, process, and blatant belief in organic evolution enter the definitions of methods intended to be scientific. Even methods defined in empirical terms have been affected by nonempirical (i.e. extrascientific or metaphysical) concepts. Can a "mixed" method produce a strictly scientific result? Can a researcher schooled in EGP methods produce objective results without a conscious effort? Are "data" really data?

There are good reasons for this loss of objectivity, including observer bias and the difficulties of the task (R. Walker, 1990, p.777): "In many local studies, facies descriptions may be so complex that they go beyond our interpretive abilities. The first way to simplify a complex scheme is to group facies perceived to be similar and/or genetically related...." This shows the importance of recognizing the mixed question nature of natural history research. What a researcher observes, records, and even subconsciously interprets is an outgrowth of his paradigm, the result of his preconceptions. When attempting to account for past events, such bias is inevitable. *Using stratigraphic "data" from methods defined as scientific may result in acceptance of historical interpretations incompatible with a Biblical worldview.* This problem arises because unscientific and unbiblical concepts are absorbed in the practice of stratigraphic methods.

Correlation: The Achilles' Heel of Stratigraphy

Correlation is the act of identifying various rock bodies over a laterally extensive area as pertaining to each other, for example, as part of the same rock unit, stratum or formation. This is a major goal of stratigraphy, enabling one to understand the relation of a given stratigraphic unit within the context of regional geologic processes. Correlation is what the geologic column is all about—on a global scale, through all of earth history. Global correlation is what sequence stratigraphy is about. Stratigraphic methods are means of defining, describing and correlating stratigraphic units. As demonstrated above, a number of troubling deficiencies have been identified in these methods. Combinations of these methods inherit the doubtful elements of their weakest links. This is also true of correlation in general.

A still deeper and more disconcerting issue is raised at an epistemological level by the results of an experiment by Zeller (1964). In an effort to test the veracity of the stratigraphic methods used to correlate cyclic sediments, he created some *random* sedimentary columns, which several geologists readily correlated with the real section he supplied. Not surprisingly, their stratigraphies differed, but they defended their respective stratigraphic columns vigorously.

> From the preceding story, it will be seen that our stratigraphic section, composed of randomly selected lithologies, does indeed show most of the characteristics that can be expected in a truly cyclic sequence. At this point the reader may wish to complain that the writer has gone too far in making up samples with which to taunt his colleagues. Let the reader be assured, however, that the writer's humble efforts at creating confusion are of truly minute proportions when compared to those of nature (pp.635, 636).

Without a continuous excavation or uninterrupted string of boreholes, stratigraphy depends on correlation of data from scattered outcrops, isolated boreholes, or geophysical methods. Even when data are relatively abundant, stratigraphic correlations are often interpretive, classifying strata as "diachronous" and attempting to define them chronometrically (North American Commission on Stratigraphic Nomenclature, 1983).

What is so disconcerting about Zeller's results is that they demonstrate that *no unique stratigraphic solution is possible. All correlation, even that free from EGP bias, even that which eminently "makes sense," can never be more than tentative.* Some researchers have been perceptive enough to acknowledge this (Howe and Williams, 1994), but most are not. Miall (1992) repeated Zeller's experiment using four randomly generated columns and the Vail Curve. They all correlated extremely well. An essential issue escapes the notice of many researchers unfamiliar with the philosophical principles presented above: *Only one fictitious correlation is required to discredit a deductive stratigraphic framework* (i.e. paradigm). This is the fallacy of "historical science"[7]: the "best reconstruction" of the past may be as far from the truth as the least tenable, and without the aid of history, we can never know.

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[7]The term "historical science" is here used to refer to that common practice of misapplying the methods of natural science to historical study. See Table III in Part I.

Conclusions

- Methodological naturalism and natural science are incompatible.
- Methodological naturalism is foundational to the geologic column.
- The Establishment Geologic Paradigm (EGP) is virtually synonymous with the geologic column. Much controversy exists in creationist circles regarding the degree of validity of the geologic column. Much of this controversy results from a lack of understanding of the "mixed question" nature of the problem.
- To the extent that postmodern views affect stratigraphy, the result will be a further devolution of the discipline.
- Scientific (i.e. descriptive) stratigraphy must satisfy scientific criteria; historical stratigraphy must satisfy historical criteria. Scientific stratigraphy may theoretically be practiced by diluvialists and evolutionists alike with free exchange of data, though in practice this is often precluded by a lack of personal objectivity. Historical stratigraphy (which embraces most in practice) is nonempirical by nature and cannot be exchanged with worldviews holding incompatible historical beliefs.
- Of 13 common stratigraphic methods, only six are defined as purely descriptive. Unfortunately, not even these are commonly free of extrascientific or metaphysical input in practice.
- An empirically defined sequence stratigraphy and the geologic column are mutually exclusive. Sequence stratigraphy as currently practiced is not empirically defined, though this does not preclude development of an empirically defined sequence stratigraphy.
- All correlation, however scientifically practiced and eminently pleasing, can never be more than tentative. Without historical attestation, genetic relationships cannot be known with certainty.

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Appendix

Gene Edward Veith (1998) provided the following description of postmodernism within the context of American politics, but it is independent of application and so clear that it is worth quoting in its entirety.

> There was a time when the biblical worldview was taken for granted, when historical facts, the laws of nature, logical ideas, divine revelation, and moral principles were all issues of truth. Call this time of openness to outside reality "premodern." The narrowing of the mind began in the 18th century when "modernists," giddy with the promise of science and the dream of Enlightenment progress, claimed that the only truths were those testable by scientific rationalism.
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> The modernist confidence in naturalist reason is now passé; Christians can applaud that. But while many are taking advantage of the decline of modernism to rediscover biblical realism, the cultural mainstream has turned to postmodernism, a worldview that tries to do without truth altogether.
>
> For postmodernists, truth is merely a "construction" by the culture or by the individual. We construct our beliefs, so that what is true for me may not be true for you. Truth, as they say, is relative. Morality depends on the individual's choice. Religion occupies a private corner of the brain, as a source of personal serenity, but not a set of truth claims about ultimate reality, much less a relationship with an external, demanding, sovereign God.
>
> The rejection of truth in postmodernism means that attempts to persuade are construed as acts of oppressive power. Since everyone's beliefs have equal validity, "you don't have the right to impose your beliefs on anybody else." Logical contradictions are OK. The willingness to change one's story is a function of the ability to "reinvent" oneself.
>
> In the postmodernist dismissal of truth, image is everything. The meaning of words is not fixed but a function of "interpretation," so that the speaker, listeners, and spin-doctors can construct their own meanings for them. What matters is not substance but projecting a positive image.

Glossary

allostratigraphy: a stratigraphic scheme which categorizes rock units base on their geometric (spatial) relations within a sedimentary basin

chronostratigraphy: a scheme of time units devised for interpretation of geologic (stratigraphic) data

contextualism: the view that propositions can only be understood within the social or cultural contexts in which they were formulated

cross-cutting relations: in igneous and metamorphic terranes, relative age can often be inferred from observing which rock units cut through others, etc.; this is the basis of lithodemic stratigraphy

deconstructionism: an approach widely used in current literary criticism whereby the ideas of contextualism and the existential denial of substantive communication are

applied to literature to "deconstruct" it, denying the possibility of knowing the author's intent, and evaluating it based on the critic's perceptions

existential: pertaining to the philosophy of existentialism, which emphasizes the subjective (nonempirical), personal, moment-by-moment nature of individual existence; it is a reaction against empiricism/positivism and differs from postmodernism in asserting the need for personal action and responsibility within the context of relativism

genetic: pertaining to mode of origin

isotopic dating: idea that absolute (chronometric) ages can be inferred from ratios of radiogenic isotopes

Law of Superposition: doctrine that superjacent strata are younger and subjacent strata older than a given stratum

lithodemic stratigraphy: stratigraphy of nonstratiform rocks based on relative dating criteria (i.e. cross-cutting relations)

methodological naturalism: view that science must be practiced *as if* the supernatural did not exist, as opposed to metaphysical naturalism, which asserts this point outright.

nihilism: denial of being or ultimate reality

passive continental margin: the edge of a continent (shelf and slope) that is relatively stable relative to eustatic changes as opposed to, for example, a zone of active subduction

pedogenic: formed from soil

pedostratigraphy: correlation of rock units based on inferred paleosols ("fossil soil horizons")

pluralism: view that a diversity of worldviews, belief systems or philosophies should be tolerated or promoted

revelationism: belief that true knowledge has been transmitted from God to man

seismic data: subsurface information obtained in the form of wave transmission rates and patterns of reflection and refraction; other geophysical methods are often used in conjunction with seismic

sedimentary basin: a relatively depressed topography which affords accommodation space for deposition of sediments

sedimentology: the study of sediments, sedimentary rocks and sedimentary processes

tectonic: pertaining to forces and movements in the earth's crust

temporal: related to time, occurring during a particular period in time

Vail Curve: the curve of relative sea level or eustasy (promoted by Peter Vail et al. at Exxon and revised by Haq et al.)

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CENTJ: Creation Ex Nihilo Technical Journal

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Book Review

Ota Benga; The Pygmy in the Zoo, by Phillips Verner Bradford and Harvey Blume St. Martin's Press, New York. 1992, 282 pages, $22.95

Ota Benga was a "pygmy" brought to America by anthropologist Samuel Verner, and eventually found his way (or more accurately was forced) into a zoo, specifically in the monkey house of the Bronx New York Zoological Park. It is in many ways also the story of the good and bad fortune of Verner himself, but more so the story of early 1900s America and race and evolution theory. Indeed, Ota often gets lost in the story which is supposed to be about him (Bergman, 1993).

The people who visited the zoo knew the purpose of the exhibit and indeed, some objected to it on the grounds that it was a deliberate attempt to try to prove evolution. The blatant racism, though, is nowhere as clear as the statements of the contemporary evolutionists, many of whom made it quite clear that they believed the "Negro race" is less evolved than Caucasians, and less worthy as human beings to inherit the earth. The existence of pygmies, many felt, made a lie of the teaching of Genesis that all men are brothers, all descendants of Adam and Eve. What further proof did they need than a living, breathing, evolutionary link who was clearly not the equal of the white man, but who certainly was more than just a monkey?

This well written in-depth story illustrates the results of Darwinist racism and its impact in American society, especially American science. The story reads like a novel, and includes much anthropological insight into central Africa. It also includes a great deal of information on how Africans were once treated by whites—in this case the Belgian government—an important part of which was their almost unshakable perception that the pygmies and the central Africans in general were racially inferior, and of less value and worth than whites.

Importantly too, one gains an appreciation of Ota and his incredible skill in surviving his world, and how without him and other pygmies many whites, even Verner himself, would likely have died in the African jungles. Once in America, Ota assimilated western society living skills to help him survive in a world hostile to him. Although whites were intrigued with pygmies, the pygmies were likewise intrigued with whites—and many could flawlessly imitate their behavior, such as their folding or unfolding of maps, cursing at mosquitoes, or writing notes in their journals (p. 145). Interestingly, Ota's view of evolution was like the pygmies of Africa, who were "very partial about how they apply the theory of evolution. When it comes to white men descending from the apes, they say they knew it all along" (p. 157).

The account also makes Ota a real, living person with thoughts, feelings, and fully human emotions. This background makes displaying him in a zoo and the words of his contemporaries all the more ironic. Unfortunately, the "primitive race" concept is still very much with us, and reviewing the life of Ota shows that, although he was culturally different, he was a very intelligent person in his own world (a world in which the whites were stupid and bumbling).

The story ended not long after Ota was released from the zoo when, in 1916, he tragically committed suicide with a gun. Thus ended the forced isolation from his family and people caused by the whites, most of whom were murdered by the "evolutionarily superior" race bent on exploiting their land and property. The work contains scores of reprints of contemporary newspaper accounts about the affair which tell much about the racism of Darwinism at the time.

The story of Ota Benga is only one of the many tragic fruits of early 1900s evolutionism, but one which contains a lesson that forces us to acknowledge the validity of the Christian teaching that all humans are brothers and sisters, all descendants of Adam and Eve.

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