



Theoretical geology

Daniel Mikeš

Stellenbosch University, Stellenbosch, South Africa (mikes@sun.ac.za/+27218083522)

Theoretical geology

Present day geology is mostly empirical of nature. I claim that geology is by nature complex and that the empirical approach is bound to fail. Let's consider the input to be the set of ambient conditions and the output to be the sedimentary rock record. I claim that the output can only be deduced from the input if the relation from input to output be known. The fundamental question is therefore the following: Can one predict the output from the input or can one predict the behaviour of a sedimentary system? If one can, than the empirical/deductive method has changes, if one can't than that method is bound to fail. The fundamental problem to solve is therefore the following: How to predict the behaviour of a sedimentary system?

It is interesting to observe that this question is never asked and many a study is conducted by the empirical/deductive method; it seems that the empirical method has been accepted as being appropriate without question. It is, however, easy to argument that a sedimentary system is by nature complex and that several input parameters vary at the same time and that they can create similar output in the rock record. It follows trivially from these first principles that in such a case the deductive solution cannot be unique.

At the same time several geological methods depart precisely from the assumption, that one particular variable is the dictator/driver and that the others are constant, even though the data do not support such an assumption. The method of "sequence stratigraphy" is a typical example of such a dogma. It can be easily argued that all the interpretation resulting from a method that is built on uncertain or wrong assumptions is erroneous. Still, this method has survived for many years, notwithstanding all the critics it has received.

This is just one example of the present day geological world and is not unique. Even the alternative methods criticising sequence stratigraphy actually depart from the same erroneous assumptions and do not solve the very fundamental issue that lies at the base of the problem. This problem is straightforward and obvious: a sedimentary system is inherently four-dimensional (3 spatial dimensions + 1 temporal dimension). Any method using an inferior number or dimensions is bound to fail to describe the evolution of a sedimentary system.

It is indicative of the present day geological world that such fundamental issues be overlooked. The only reason for which one can appoint the so-called "rationality" in today's society. Simple "common sense" leads us to the conclusion that in this case the empirical method is bound to fail and the only method that can solve the problem is the theoretical approach. Reasoning that is completely trivial for the traditional exact sciences like physics and mathematics and applied sciences like engineering. However, not for geology, a science that was traditionally descriptive and jumped to empirical science, skipping the stage of theoretical science.

I argue that the gap of theoretical geology is left open and needs to be filled. Every discipline in geology lacks a theoretical base. This base can only be filled by the theoretical/inductive approach and can impossibly be filled by the empirical/deductive approach. Once a critical mass of geologists realises this flaw in today's geology, we can start solving the fundamental problems in geology.