Genesis and Historical Geology: A Personal Perspective

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ABSTRACT

Sedimentation experiments using heterogeneous mixtures of particles carried by flowing water have shown that the strata and sedimentary layers produced are generally distinct from one another, contrary to the stratigraphic principles of superposition and continuity. These principles overlook the hydraulic conditions necessary for sediment transport in transgressions. However, the relationships between observed contemporaneous hydraulic conditions and sedimentary structures can be used to determine the hydraulic conditions responsible for the sedimentary deposits of the geological record. Thus further flume experiments are now being undertaken in the hydraulics laboratory at the Colorado State University (Fort Collins) to produce a data set of 10,000 results from which the relationship between current speed and particle size can be determined. By these means it is already possible to show that the diluvial conditions of the year-long Biblical Flood were sufficient to deposit the sedimentary sequences of the geological record (for example, of the Grand Canyon region, USA).

My religious instruction started when I was 10 years old. I believed in the historical reality of Genesis. Shortly afterwards, in a secular school, I commenced a course of natural science which included historical geology. This taught a long chronology of the Earth and corresponding evolution of the species, which seemed to me to contradict Genesis. Subsequently, I received a scientific education at the French *Ecole Polytechnique,* then pursued a professional business career. I have never forgotten the feeling these contradictions had on me in my youth.

Some years ago, I again studied geological history based upon stratigraphy.

PRINCIPLES OF STRATIGRAPHY

A stratum is defined as a lithological unit between limit surfaces in sedimentary rocks. It often provides evidence of sorting of the particles of which it is composed, with their size decreasing from bottom to top of the stratum. The limit surfaces are:-

(1) separations between the fine particles at the top of one stratum and the large ones at the bottom of the stratum which covers it;
(2) bedding planes which can separate two strata; and
(3) those corresponding to a mechanical removal of sediments due to erosion.

The thickness of strata varies from less than a millimetre to more than a metre. A series of superposed strata having the same lithological content, for example, sand, clay or limestone, constitutes a facies.

For two centuries, since stratigraphy was founded, and without formal proof, superposed strata, and on a larger scale facies, have been identified as successive sedimentary layers. As a result, superposed strata were used to define relative chronology. The principles of stratigraphy arose from the belief that strata and facies are successive layers.

The first principle, that of superposition, is defined in France (which with England was the cradle of stratigraphy) as:

> Layers (strata) having been deposited horizontally, one upon the other, each layer is older than the one which covers it.[1]

The first part of the principle, layers (strata) having been deposited horizontally, assumes a horizontal area of deposition, and the average velocity of sedimentation having to be uniform across the deposit area, for each stratum to be horizontal. This latter condition is not met in contemporary sedimentation, where the velocity of sedimentation is variable as a function of the place and the depth of water.

Secondly, the principle of continuity:-

Each layer (stratum) has the same age at any point.

This principle excludes the existence of ocean currents which cause the particles composing the layer to deposit successively in the direction of the current. Consequently, the layer is not the same age at all points. Oceans today are traversed by currents.

These two principles provided the base upon which geologists, at the end of the eighteenth century and beginning of the nineteenth, established age correlations between sedimentary rock sites separated by distances exhibiting the same series of superposed fades. Later, the age correlations were established from fossils, which gave rise to the third principle, that of palaeontological identity:-

Two layers with the same palaeontological content are the same age.

This is another expression of the principle of continuity, and similarly excludes the effect of ocean currents, which as with particles, cause organisms to be swept along and deposited successively in the sediments forming the layer in which they become fossils. In consequence they, too, would not necessarily have the same age.

Constituted in this way, time in the geological time-scale was only relative. The fourth principle of uniformitarianism had to be added. This claimed that the rate of sedimentation in the past was the same as today, so that by calculating the time necessary for the sedimentary formations to form, an absolute scale of time could be obtained. The first illustration of such a scale was given by Charles Lyell.[2]

Now in the twentieth century, the absolute ages of sedimentary rocks are evaluated by measuring the radioactive elements in intrusions and in eruptive material. The ages so obtained have been used to show concordance with those from the geological time-scale. However, John Woodmorappe has listed more than 300 absolute radiometric dates that are totally discordant with the geological time-scale.[3]

WALTHER'S AND MCKEE'S OBSERVATIONS

In 1970 my interest in sedimentology was aroused by reading the reports of the Geological Society of America on the underwater drilling campaigns of the American ship Glomar Challenger. It was from these reports that I learned about the works of the German geologist Johannes Walther,[4] who should be considered as one of the principal founders of sedimentology. At the end of the last century, in the Gulf of Naples, he studied the formation of contemporaneous sedimentary deposits which prograded, or developed, from the coast towards the open sea. By drilling into the sediments, he observed the same succession of facies, from the surface downwards, as from the coast towards the sea, The existence of facies, juxtaposed and superposed at the same time in a deposit area, could also be seen during coastal marine floods.

Sedimentary rocks also display superposed and juxtaposed facies. The objective of sequence stratigraphy, originating from Walther's observations, is to determine whether a given sequence corresponds to a marine progradation, transgression or regression. The principal proponents of sequence stratigraphy, widely used today, are the Americans, Vail, Van Wagoner and Posamentier.[5] It should be noted that facies **in** sequences, superposed and juxtaposed at the same time, do not follow the principles of superposition and continuity.

In 1970, I also received a report from the American geologist Edwin McKee of his 1965 observations of sediments deposited following a river in Colorado overflowing its banks at Bijou Creek due to 48 hours of torrential rain upriver.[6] The stratified deposits, reaching a thickness of 12 feet, exhibited particle sorting and bedding joints. Such bedding planes are generally interpreted by classical stratigraphy as the result of interruptions in sedimentation followed by hardening of the sedimentary surface of the lower surface of the plane.

FLUME EXPERIMENTS

The rains having lasted 48 hours, and the supply of sediment being continuous throughout the period, it was impossible to identify the strata in the deposit as successive layers of sediment, with interruptions in sedimentation producing partings. This led me to do some experiments on stratification. The first were in France with limited material, the subsequent ones in the USA at the well-equipped Colorado State University with hydraulically-controlled flowing water transporting sand through flumes.

The flume experiments demonstrated the mechanical nature of stratification, whereby:

(1) Segregation of particles according to their size, when exposed to a current of variable velocity, gave rise to sorting.
(2) Desiccation of deposits caused bedding planes or partings.
(3) Under both dry and water conditions, stratification of the deposit formed parallel to the slope of the initial area of deposit which could exceed 30°. This fact invalidates the first part of the principle of superposition as defined.
(4) The strata resulting from particle segregation were distinct from sedimentary layers deposited between two consecutive times. **The discovery of this fundamentally important distinction provided an entirely new conception of strata formation.**
(5) Due to the presence of a current, strata were formed vertically and laterally at the same time in the direction of the current (see Figure 1).

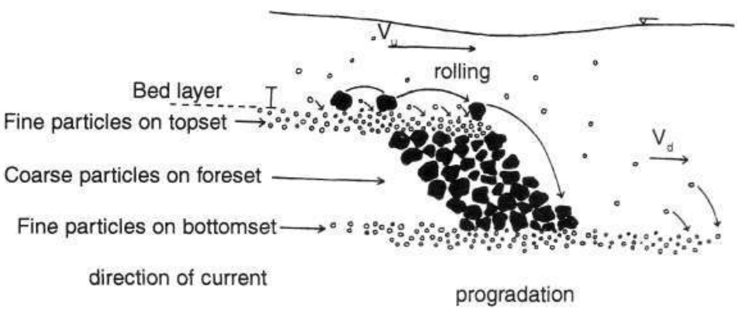

Figure 1. Schematic formation of graded-beds.

The stratified deposits formed in the flume experiments showed that where there was a current, the principles of superposition and continuity did not apply to their formation. Reports of the experiments in France were published by the French Academy of Sciences[7] in 1986 and 1988 respectively, and those in the USA in the **Journal of the Geological Society of France**[8] in 1993. The reports were translated and published in **Ex Nihilo Technical Journal.**[911]

The flume experiments were repeated in 1993 in a larger flume and filmed for the production of a video entitled **Fundamental Experiments in Stratification,** which was integrated into the video **Drama in the Rocks.**[12] This latter video now forms an integral part of the updated version of **Evolution, Fact or Belief?**[13]

DEPOSITION OF GRAND CANYON SEDIMENTARY ROCKS

In 1994 the Institute for Creation Research produced a book on the Grand Canyon,[14] which included items by geologists Kurt Wise and Steve Austin. The latter contributed an item entitled 'A creationist view of Grand Canyon strata' which made reference to two papers, one by Rubin on the relation between hydraulic conditions and stratified structures in the Bay of San Francisco,[15] and the other by Southard which summarised 39 series of flume experiments on the same relations.[16] Rubin summarised these relations by means of a three-dimensional diagram (see Figure 2). The co-ordinates it features, producing the different depositional structures, are the velocity of current, depth of water and size of sedimentary particles.

Having recognised the same structures in the Grand Canyon sedimentary rocks, Steve Austin applied them to the Tonto Group. This formation extends for 800 km from east to west, and corresponds to a transgressive sequence of three facies, superposed and juxtaposed. He determined the hydraulic conditions that existed when the sediments were deposited which gave rise to the rock facies of the Tonto Group. These were principally the velocities of currents of the ocean transgression, which rose to more than 2,000 m above today's ocean level.

The maximum velocity was that which corresponded to the initial erosion of the subjacent rocks by the invading marine waters. It was greater than 2 m/s, and might well have reached 22 m/s. With such current velocities, the 800 km margin of the continent could have been submerged by invading ocean water within several days. The velocities decreased as the transgression reached its peak and before the waters started to subside.

It should be noted that the velocities are of the same magnitude as those in our flume experiments. Logically, therefore, the strata in the Tonto Group facies probably formed similarly, that is, vertically and laterally in the direction of the current. As the velocity of the current decreased the particles deposited were finer and finer, giving rise to the three superposed and juxtaposed facies of the Tonto Group: sandstone, clay and limestone.

The sedimentation was therefore rapid, not only during the marine invasion, but all the time that the ocean stayed at its highest level when there was little or no current. In the absence of a current, the finest particles would have been deposited at a speed of 2 cm/day. As soon as the waters started to subside, the renewed current interrupted the sedimentation of the finer particles. During the marine regression, the inversed currents would have reached

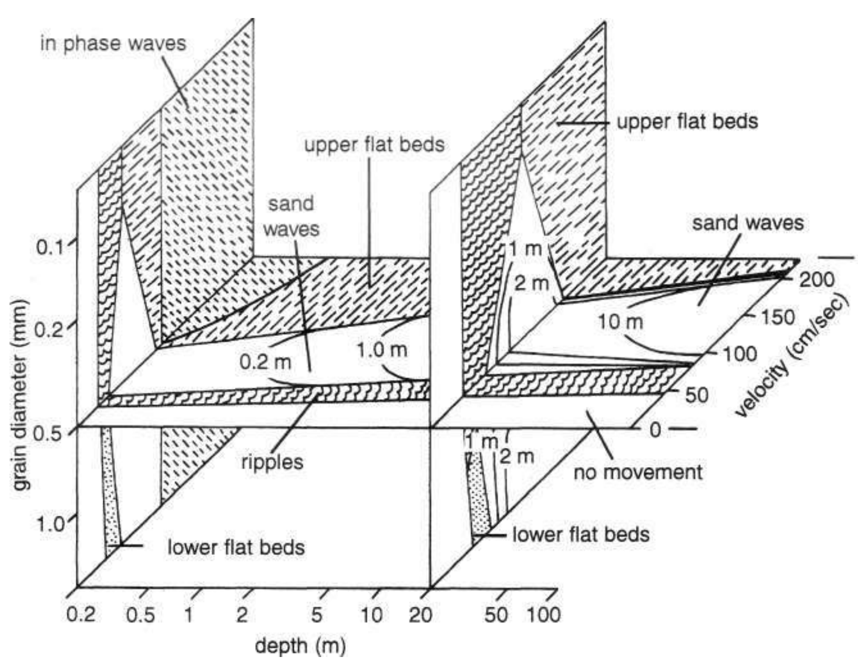

Figure 2. Three-dimensional plot of bed phase and sand-wave height as a function of velocity, sediment size, and depth, generalised from bay data and flume data cited in text.

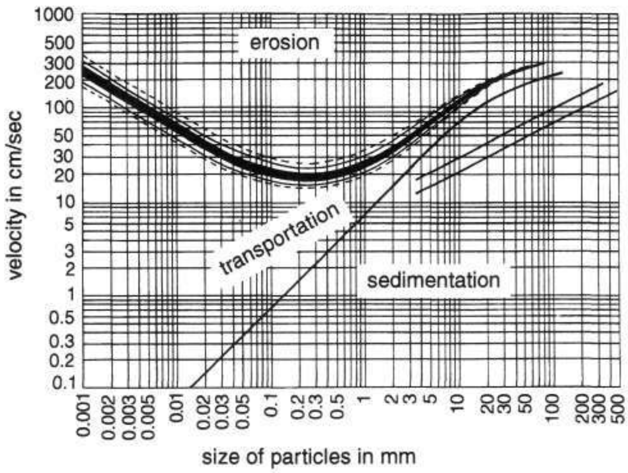

Figure 3. *The curves for erosion and deposition of a uniform material.*

velocities sufficient to have eroded deep valleys in the non-consolidated sediments deposited during the transgression.

The Tonto Group is attributed to the Cambrian period which, according to the geological time-scale, lasted 70 million years. It can be seen, therefore, to what extent Steve Austin's model, which is founded not upon the Biblical Flood, but on the previously mentioned experimental data,[15,16] at least condenses the time required for a major part of the geological time-scale.

FURTHER EXPERIMENTS

Determination of initial hydraulic conditions from sedimentary rock structures, resulting from sedimentological data is, therefore, a research priority.

In this connection, my colleague Pièrre Julien presented a paper in May 1997 to the Third Powders and Grains Conference at Durham, North Carolina, a re-published copy of which follows this paper. The conclusions from our current programme, which is admittedly ambitious, will unfortunately not be available until next year. The experimental work described below is, however, completed.

In the report of our stratification experiments, published in the **Journal of the French Geological** Society,[8] reference was made to Filip Hjulstrom.[17] From his observations of the morphological activity of rivers, he produced the diagram (see Figure 3) where, with regard to the average velocities of currents given in ordinates, and the size of particles in abscissas, the zones of erosion, transport and sedimentation of sedimentary particles are represented. From the size of a sedimentary particle, therefore, the velocities of currents which eroded, transported and deposited sediments can be evaluated. Although the erosion and transport have been carefully measured, the velocities of sedimentation have been estimated empirically by Hjulstrom as two-thirds of the erosion velocities.

The object of our new experimental programme is to determine these velocities. Two complementary series of experiments have been carried out in a flume using small glass and steel balls of different sizes. In the first series, a smooth-bottomed flume was traversed by a water current carrying the balls along with it. The velocity of current, corresponding to the deposit of a ball according to its size and density, was noted. In the second series, the movement of a ball in the same flume was studied up to when it stopped. This time the flume was dry and sloped. Its bottom was roughened by particles of calibrated sand, the size of which was changed for each experiment. From the 10,000 pieces of data obtained, a synthesis is being made of the two series of experiments studying the complete movement of a ball (its fall, and its roll on the rough surface of particles previously deposited, up to when it stops).

This synthesis, to be completed next year, should enable the formulation of an experimental relationship between velocity of current and size of particle, which will allow for greater precision in determining the hydraulic conditions pertaining when the sediments giving rise to sedimentary rocks were deposited.

CONCLUDING COMMENTS

In conclusion, regarding the principles of superposition and continuity, it has been shown that:

(1) Facies in sequences do not follow each other but are deposited simultaneously, according to sequential stratigraphy initiated by Walther;
(2) They do not apply to the resultant stratified deposits formed in the flume experiments when there was a current; and
(3) Hjulstrom's observations on fluviatile sedimentation, and submarine observations, such as Rubin's, and Southard's flume experiments, establish the relation between hydraulic conditions (depth, current velocity) and structures (grain diameters) of the deposits.

These deposit structures are found in sedimentary rocks. From them, the original hydraulic conditions, and particularly the velocity of the current, can be determined, as Steve Austin did in the Tonto Group. In the absence of a current, the conditions defined by the principles of stratigraphy apply. When there is a transgression, regression or progradation, there is automatically a current and the principles no longer apply. If a principle, having world-wide application, and used as a basis for scientific reasoning, is shown by one experiment not to apply, the principle must be abandoned. This is particularly the case for the principles of stratigraphy upon which the geological time-scale was founded, since they did not take hydraulic conditions into account. The abandonment of principles upon which the geological time-scale is founded, and the recognition of initial hydraulic conditions, are likely to involve important changes in the conception of the scale.

An illustration is the correlation used in the Grand Canyon to correspond the Flood of 370 days with the 460 million years formation of the Cambrian to the Jurassic according to the geological time-scale. This was made possible because the initial diluvial conditions had not been taken into account by the time-scale.

The question remains whether with the failure of stratigraphic dating, radiometric dating is a viable method. The **CEN Technical Journal** recently published a report on the radiometric dating by the potassium/argon method of a dacite sample formed in 1986 when Mt St Helens last erupted.[18] The age obtained was 350,000 years. Part of the sample was subjected to a magnetic separation of the dacite into its constituent parts. The ages obtained were respectively :-

340,000 years for feldspar
900,000 years for amphibole
2,800,000 years for pyroxene

The report pointed out that the cause of the dating error was the assumption that the argon measured came from the rock after its crystallisation, whereas the lava, before crystallisation, generally contained excess argon generated by radioactive potassium. This assumption led to the attribution of a very old age to a young rock.

The same situation applies to other elements whose radioactivity existed in lavas and magmas from which crystallised rocks came. The fact that radiometric dating methods require stable daughter isotopes does not resolve the problem, because these isotopes often also exist in the lavas and magmas. The liquid lavas being constantly mixed, the parent/daughter relationships in a given volume are not constant. As a result, two samples from the same rock unit can have quite different radioactive ages. This phenomenon challenges the validity of radioactive dating of rocks.

Finally, what natural phenomenon could have caused the flood conditions? In January 1996, the **Journal of** the **Natural History Museum** in Paris published a study by Christian Marchal,[19] Research Director at ONERA (Office National d'Etudes et de Recherches Aerospatiales). The conclusion of a calculation in mechanics showed that the uplift of the Himalayas brought about a temporary geographical displacement of the axis of the Earth's rotation, the amplitude of which could have reached 30°. Christian Marchal, in fact, evaluated the displacement at between 60° and 90°. The Earth being an ellipsoid, a tilt in such conditions would inevitably have provoked one or more displacements of the oceans which covered the continents.

The summary of the data leads to a geological chronology significantly shorter than that proposed by the geological time-scale, and to a different history to the one taught in our schools. In consequence, the feeling of contradiction experienced in my youth no longer exists. The Flood conditions, which undoubtedly existed, buried many species that had been displaced on account of their palaeontological distribution into superposed biozones. The position of the latter in the fossil record led to the disputable belief of a chronological succession of species and, in consequence, the various theories of evolution.

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