

Towards a Refoundation of Historical Geology

The author's experiments on stratification have revealed the mechanical nature of lamination and the roll of turbulent flow as agent of stratification. They put in question the interpretation of Stenon, that superposed strata were former successive sedimentary layers. They show that relative chronology should not be referred to as a «stage», but to a «sequence». The complementary rock formation studies by A. Lalomov show that the time of sedimentation was considerably shorter than indicated by the Geological Time Scale. The latter scale corresponds to large marine transgressions and regressions that can result from phenomena such as the shift of the polar axis consecutive to major Caledonian, Hercynian, Alpine orogenesis.

Key words: stratification, lamination, turbulent flow, time of sedimentation, orogenesis.

Since nearly ten years I've financially supported a team of Russian sedimentologists conducted by Alexander Lalomov. They determine the time of sedimentation of sequences of different regions of Russia.

Why am I at the origin of this work?

A long time ago I started studying a geological history. The founder was Nicolas Stenon who interpreted the superposition of strata as a succession of sedimentary layers. But nobody has been witness of stratification of rocks. So it was possible that this interpretation would not be true.

So I performed experiments of stratification (Berthault, 1986). I began by the most easy – lamination. I took a laminated sample of «sand of Fontainebleau» that consists of a slightly cemented sandstone, which I crushed and reduced in sand: I let fall this sand in a test-tube and saw the instantaneous lamination reconstituted in the deposit. The explanation is that the sand is an assorted powder. Its' mechanics is intermediate between solids and distinct liquids which deposit

according their density (Berthault, 1988).

That experiment was considered as fundamental by Professor Georges Millot – President of the French Society of Geology, member of the Institute which presented it at the Academy of Sciences and published the report in 1986, followed by another one in 1988. A report on stratified deposits of the Bijou Creek Flood convinced me that graded-bedding of stratification was the result of a turbulent flow of variable velocity that determined the successive deposit of particles of different sizes.

In order to verify my hypothesis, I concluded a contract with the hydraulic laboratory of the Colorado State University (USA) in 1990. The experiments were performed by Pierre Juén – professor of hydraulics and sedimentology (Julien et al., 1993). In a recirculating flume a pump drags water loaded with sand towards the flume in which the sand particles deposit according to the velocity of turbulent flow (Fig. 1).

The sediments consist of superposed and juxtaposed strata on the deposit area which progrades laterally in the direction of the flow.

The flow in regime of turbulence creates graded-bedding layers. When the velocity of the flow increases, it becomes erosive and creates erosion surface in the deposit. And when the dessication of sediments occurs, joints appear.

The flow is the essential agent of stratification, but is ignored by stratigraphy. So today speaking about genesis of sedimentary rocks it is necessary to take into account the flow.

For a given depth to each size of particles corresponds a critical velocity of flow under which the particle falls.

Thus according to the sizes of particles of a sedimentary rocks formation it is possible to determine the velocities of the paleoflows of transport.

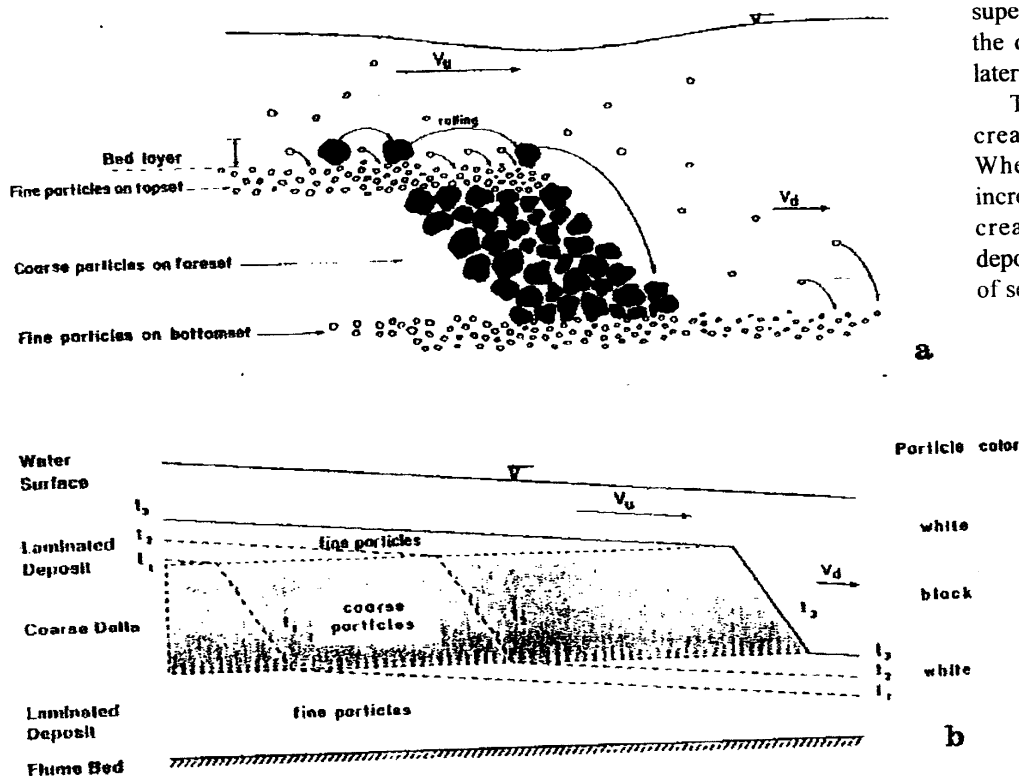


Fig. 1. a – Schematic formation of graded-beds. b – Time sequence of deposit formation for $t_1 < t_2 < t_3$ (Julien et al., 1993)

These ones integrated into the formula of sedimentary mechanics give the sedimentary transport capacity by units of time and volume. Dividing the volume of the studied formation by this capacity we obtain the time of sedimentation of the formation (Einstein, 1950).

Alexander Lalomov's team realizes it with success (Lalomov, 2006; 2007; Lalomov, Tugarova, 2008).

The last publication (Berthault, Lalomov et al., 2011) in «Lithology and Mineral Resources» indicates that time of Cambrian-Ordovician sandstones sedimentation represents only 0,05 % of the stratigraphic time.

At the whole, stratigraphy has overlooked the current as a factor of stratification. According to the initial interpretation of Stenon, superposed strata correspond to successive layers of sediment, must be replaced by a succession of series. Each of them is composed of a sequence of transgression and a sequence of regression, each sequence composed of fades which are superposed and juxtaposed.

These series are mainly the consequences of orogenesis such as catedoman, bercyuan, alpine ones. Christian Marchal has demonstrated that such orogenesis provoked a shift of the axis of rotation of the Earth. It resulted into marine transgressions. That demonstration has been published in the Bulletin of the Museum of Natural Sciences in Paris in 1996 (Marchal, 1996).

Professor G. Gohau in his book «A history of Geology» (1990) said: «What is measuring time, is the duration of sedimentation and not those of orogenesis». This idea put into question the succession of fossils as a base of geologic time.

The measurement of time of sandstones sedimentation of in the region of Saint-Petersburg by Alexander Lalomov, who gives 0,05 % of stratigraphic time, proves that it is necessary to measure the time as the time of sedimentation instead of stratigraphic time (Berthault, 2010; Berthault et al., 2011).

The radioactive dating of rocks formation is based on the phenomenon of spontaneous decay of a radioactive element from a «parent» element into its «daughter» element. Examples are Potassium (the parent element) which decays into Argon (the daughter element) or Uranium (the parent element) which decays into Lead (the daughter element). The rate of radioactive decay is constant and depends on time. The age of a lava rock should be able to be determined by measuring the quantity of parent element and comparing it with the daughter element.

But radioactive decay exists in the liquid magma where gravity exerts a differential separation between «parents» and «daughters» according to their density. When the magma erupts on to the Earth's surface, solidifies into rock. A sample taken from this rock would therefore include unrelated «parents» and «daughters». Moreover, the respective quantity of «daughter» elements produced in the magma cannot or distinguished from those produced in the rock. As a result the age of the rock cannot be determined.

At last, I can say that the contemporaneous observation of subecological marine fauna presents a diversification in depth, latitude and longitude. It could partly explain the superposition of buried fossils in sediment instead of evolution of fossils.

So it is necessary to replace stratigraphy issued of Stenon's interpretation and to take into account the current

of sequence as agent of stratification and substitute the sequence instead of the stage as the basic division of time and the time of sedimentation to the stratigraphic one.

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Guy Berthault

graduated from the French Polytechnic School. Member of the French Society of Geology. His research interests are represented by experiments on stratification realized in France, USA and Russia. They put into question the concept of Nicolas Stenon according which superposed strata are successive layers. The references point out his publications.

French Polytechnic School engineer, France
berthault.guy@orange.fr

