Translation No. 6

STUDY OF A LANDSLIDE DUE TO THE PRESENCE OF GLAUCONITE
(A translation)

Proix-Noe, Mrs. Marthe, Etude d'un glissement de terrain dû à la présence de glauconie; Comptes rendus hebdomadaires des séances de l'Académie des Sciences, tome 222, No. 7, pp. 403-405, Paris, Feb. 1946.

Translated by Mrs. Severine Britt, U. S. Geological Survey, 1947.

In the region of "Mustapha Superieur" the molassic (Miocene and Pliocene) cliffs which crown the amphitheater of Algiers Bay periodically break off at the end of the rainy season. Parts of the cliff face collapse as blocks, and the marls on the slopes slide. These accidents had already been observed by the "Societe Geologique de France" at the time of its special meeting in Algiers on October 7, 1896. Since 1896, the amplitude of these accidents keeps increasing due to the deforestation of the slopes that result from building development.

The geologic section of the terrain in question is as follows: the molasse of Mustapha forms cliffs which may have a thickness of 80 m., 35 to 40 m. of which are visible; it is a sandy or gritty yellowish-white limestone containing Pecten scabrellus, in direct contact with gray, blue or yellowish sandy marls, or with fossiliferous sandy beds of various thickness, containing Ostrea cochlear and Turritella angulata, which are related to the Plaisancian (middle Pliocene) and overlie blue marls, also of variable thickness, belonging to the lower Miocene, and in direct contact with compact sandstones of the lower Miocene.

In January 1943, there was a landslide of the cliff which occurred as a collapse of molassic blocks in the marly stratum. The physico-chemical causes of the phenomenon were studied. During rains, the quantity of flowing water is abundant, due to runoff as well as to infiltration; yet because of the localization of the collapse area it is only necessary to consider the infiltration water derived from rain or from subsurface water. The underground running water comes from the plain of Chateauneuf, which moreover receives the runoff from the mountainous mass of Bouzareah.

The visit on the terrain after the collapse and between two heavy showers allowed the investigators to determine that no seepage occurred in the molasse. On the other hand, the whole argillaceous layer is saturated with water up to the sandy layer but a water sample could be collected only from the yellow marl under the molasse.

It may be concluded that water running through all the marl finds an easier passage through the yellow marl. The pH as determined in the field is strongly alkaline (pH9). The following chemical analysis of water shows that, in addition to the usual contents in electrolytes for Algeria, the water contains a strong proportion of silica and alkaline ions.

Chemical composition of water running through marl

(1 litre of water contains: dry residue at 180°: 0.914 g.)

Cation:	Potassium	K^{+}	0.051 g.
	Sodium	Na^{+}	0.183
	Calcium	Ca^{++},	0.160
	Magnesium	Mg^{++}	0.024
	Iron and aluminum	Fe^{+++} and Al^{+++}.	0.010
Anion:	Sulfuric	SO_4^{--}	0.104
	Chlorine	Cl^{-}	0.189
	Carbonic	HCO_3^{-}	0.140

Undissociated acid, silica SiO_2 0.147

A sample from an experimental boring made under the El Biar gardens which were directly threatened was studied in the laboratory. The result gave:

1) Glauconite, which appears as typical dark green grains, is present at every level, and in increasing quantity up to the level -3m (see fig.1) where it decreases abruptly; the grains are altered and in the molasse they clog up into the mass.

2) At every level, glauconite is associated with the same complex of micro-fossils, the abundance of which is proportional to the glauconite grains.

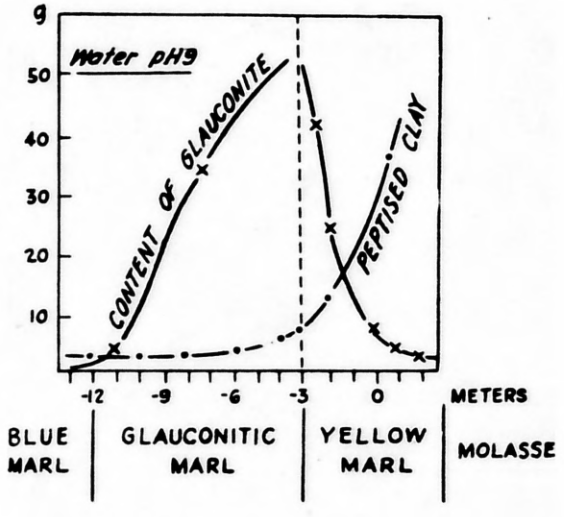
3) At every level, the same types of angular quartz grains are found in constant proportions.

4) The composition of the whole marl formation, which may be expressed by the ratio $CaCO_3$/clay is slightly increasing up to the level -3m., where it suddenly increases up to the molasse (see fig. 1).

The yellow marl appears as the spot of intense physico-chemical reactions between the levels -3m and 0m.

The geochemical action of water is determined by the presence of glauconite. Glauconite is essentially a hydrated alumino-silicate with heavy potassium contents, the structure of which is suited to base-exchange.

When crossing the molasse or calcareous formations, the water becomes charged with electrolytes, particularly calcium salts. In contact with glauconite, the fixation of Ca^{++} ion and the liberation of alkaline ions occur, which fix the water at pH9. The alkalinized water acts as a peptising agent on the colloidal micelles and hydrolyses the alumino-silicates, so that the permeability increases by putting back in suspension particles which are carried along by the water, and by the solubilization of the silicic ion. The marl bed gradually loses its rigidity and then slides. The undercutting at the base of the cliff provokes its periodic collapse.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Water pH9
50
40
30
20
10
CONTENT OF GLAUCONITE
PEPTISED CLAY
-12
-9
-6
-3
0
METERS
BLUE MARL
GLAUCONITIC MARL
YELLOW MARL
MOLASSE

FIGURE 1