

Chemical Entities in the foliated Argillite of coastal sedimentary Pond of Togo

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Abstract

Twenty soundings completely nicked by 20 m of average depth or 400 m drilled were realized on the site of Dagbati-Watchidomé, locality situated in the coastal sedimentary pond in the southeast of Togo in Western Africa. The site was canvassed from June, 2012 till September, 2012 by 4 profiles of soundings each on a 12 km² surface (4x3). A dry flat broke portable swindler of diameter 100 mm (GÖRTZ EMS 23) was used and 360 samples were made. The description of samples shows that argillites leafed down in palygorskites is found in the southern and southeast part of the explored site and bevel northward. Analyses in the X-rays of samples (360) gave rates of +20% of mineral palygorskites in the sample and 5-20% of mineral bentonites in the sample. The levels in palygorskites and in bentonites of the samples indicated a capacity of adsorption to the methylene blue respectively of 85 mg / g and 137 mg / g on the whole canvassed site. The contents of calcite of the tested samples are from 3 to 4 %. All in all, our works show that Togo arranges very important resources of palygorskites and bentonites which are proved to more than 30 million tons in the rough being lying.

Keywords: sedimentary pond, nicked sounding, methylene blue, chemical entity, Togo

Introduction

Argillites leafed down in palygorskites and in bentonites dominating of the coastal sedimentary pond of Togo is natural mineral fibers localized in the levels of the lower Eocene near the fields of phosphates of Hahotoé. They are also under limestones of Avéta and above limestones of Tabligbo and Dagbati-Watchidomé

Indeed, the sterile coat in the sector of Avéta is little thick (20 m), in the sector of Tabligbo in 6 m and in the sector of Hahotoé in 60 m. Argillites in palygorskites and in

bentonites is subaffleurantes in the pressure of Lama.

The site of Dagbati-Watchidomé concerned by our research work is situated in the depression of Lama with a very low covering from 1.50 to 6.00 m. The objective of this study was to realize diffractogrammes in the X-rays and to make industrial tests in the methylene blue on samples made from the nicked soundings.

A campaign of completely nicked soundings was made in the locality of Dagbati-

Watchidomé in the southeast of Togo from June 15th, 2012 till September 15th, 2012. Our article presents the geological data and geology of the site; indicate the used material and specifies the method of laboratory and analysis of samples

The presented and controversial results concern essentially the industrial properties of mineral bioactive substances of therapeutic and industrial interests.

Geologic study of the site of Dagbati-Watchidomé

The Eocene clayey series and paléocène in palygorskites and smectites which is situated between the lutetium and the roof of the limestone Paleocene consists of three coats namely:

- a superficial coat which is situated between 1.50 - 10.00 m constituted by argillites leafed down by beige color appearing in fibrous leaves(pages) with coats(layers) of limestone a less important coat(layer) irregular, plastic and carbonated, inserted by small beds of limestone
- a coat(layer) compacts being situated between 10.00 and 20.00 m which sells(produces) in plaques finely foliated inserted by beds of limestone. The argillites of the studied site consist of smectites, palygorskites, and kaolinites, chlorites associated with the quartz, with the carbonates, with the gypsums and with the apatite.

Genesis and geology of smectites and palygorskites to Dagbati-Watchidomé

According to the stratigraphical subdivisions established by a study of the Bureau des Recherches Géologiques et Minières [1], the palygorskites of this site is of age E1, basis of the Eocene of Paleocene marked by the irregular horizon of glauconie which separates the Eocene of Paleocene.

The observations made from this study show a progressive passage of the beige foliated argillites in plastic clays then in compact clays selling in plaques and remind that palygorskites is formed in condition supergene by change more or less pushed at the expense of smectites. What would

explain the stratigraphical distribution of various levels namely: i) superficial coat 85 % of palygorskites; ii) coat averages 50 % of smectites and 50 % of palygorskites iii) lower coat 85 % of smectites and 15 % of palygorskites.

Methods

The used material included a dry portable swindler of diameter 100 mm (Götz-EBM 23 S) which allowed realizing nicked soundings and plastic bags for the formation of samples. The surface of prospecting covers 12 km² that is 4 km on 3 km. The site was canvassed by 4 profiles of 5 soundings each numbered as follows:

Profile 1

DW 1.1 = 20.00 m
DW 1.2 = 20.20 m
DW 1.3 = 20.40 m
DW 1.4 = 20.10 m
DW 1.5 = 20.00 m

Profile 2

DW 2.1 = 21.00 m
DW 2.2 = 20.00 m
DW 2.3 = 20.00 m
DW 2.4 = 21.00 m
DW 2.5 = 21.00 m

Profile 3

DW 3.1 = 21.00 m
DW 3.2 = 20.60 m
DW 3.3 = 20.00 m
DW 3.4 = 21.20 m
DW 3.5 = 21.50 m

Profile 4

DW 4.1 = 21.00 m
DW 4.2 = 20.60 m
DW 4.3 = 20.00 m
DW 4.4 = 21.20 m
DW 4.5 = 21.50 m

All in all 20 soundings were realized and drilled 408 meters.

Cover

Profile 1 = moyenne 3.25 m
Profile 2 = moyenne 6.60 m
Profile 3 = moyenne 3.00 m
Profile 4 = moyenne 3.75 m

Power of the coat of argillite leafed down without the sterile and the limestone

Profile 1 =12.80 m
Profile 2 = 12.50 m
Profile 3 = 16.80 m
Profile 4 =15.50 m

The overall average is thus 14.40 meters on 20.00 meters deep. The whole work was led in the respect for the directives of the Good Laboratory Practices (eGLP) of the European Union.

And the monitoring of the controls of quality conjugated with the statistical analysis was confided to the Laboratory of the Head Office of Mines of the Geology of Togo. Our study in its current phase was analytical to know the quality of samples and choice of the site as the field of exploitation. Because the field work concerned mainly the site of Dagbati-Watchidomé and covered the period from June till September, 2012. The analysis carried on: 20 soundings completely nicked by average depth of 20.00 m and 360 samples were formed.

The protocol of laboratory consisted in preparing samples for essays and the execution of the essays consisted in the definition of the test of the task and the dosage.

Results Properties

The description of the soundings showed that palygorkites and bentonites are found between 1.50 and 6.00 m in the sector of the site.

Palygorkites (Attapulgités)

The palygorkites of the site being lying of Dagbati-Watchidomé is of color grey in beige, of the monoclinical system and orthorhombic, the silky brightness, the hardness 2-2.5 transparent, density 2.21 g / cm³, soft and flexible. The refractive index 1.55, the cleavage completed in a direction. The chemical formula is : (Mg, Al) ₂ Si₄O₁₀ (OH) 4H₂O; silicate of aluminum hydrated close serpentines appearing in fibers crypto crystalline muddled giving birth to light masses and belong to the grey phyllosilicates of color in beige on the zone

of our study. They are short fibers (5 micrometers) or long fibers (> 5 micrometers).

Bentonites (Smectites)

The smectites of the site being lying of Dagbati-Watchidomé is phyllosilicates 2:1 dioctaédric with low connections between leaves. They have a density of 2.3 g / cm³, are for whitish color, of cleavage completed in a direction and belong to the monoclinical system. The bentonites of raw chemical formula: Si₄ (Al (2-x) Rx) (O₁₀, H₂O) with R = Mg, Fe, Mn, Zn, nor and It = That, Na, Mg; silicates of hydrated alumina belonging to the group of smectites are.

Results of analyses in laboratory

X-rays

Palygorskite.....20 % of mineral in the sample

Bentonites.....5-20 % of mineral in the sample

Kaolinite.....5-20 % of mineral in the sample

Calcite.....5 % of mineral in the sample

The obtained diffractomètres showed that the basis of argillite leafed down in the summit, compacts sells towards the base It is about a mixture in proportion variable of palygorskites, bentonites, clay kaolinique, quartz, dolomite and carbonates. The calcic bentonite is montmorillonites associated with the calcite, with the kaolinite, with the quartz and with the apatite. We observed a side variation of the argillites of the South to the north of the site where the dominant palygorskites in the South of the field decreases and give way to bentonites to the north of the site. As for the in-depth variation, she is not net and does not allow a separation in different coats.

Industrial tests

The purpose of these tests was to determine to the methylene blue, the pole dominating foliated argillites of the site being lying of Dagbati-Watchidomé to select samples answering the industrial criteria. We formed 360 samples which were

submitted to the tests of calcimetric, of capacity of adsorption in the blue of methyl alcohol and content in sand. It was possible after drying for 60 ° in the oven.

These tests served as selection of samples following the criteria of the industry of the mineral fibers which specify a content calcite of 10 %: an absorption capacity in the methylene blue for bentonites between 100 and 280 mg / g; palygorskites between 70 and 100 mg / g and the sand is of content lower than 30 %. The capacity of adsorption in the methylene blue expresses itself in milligram of blue absorbed by a gram of clay. Indeed, this test constitutes a good indicator of the industrial value of the tested product. We present below the weighted averages of the rates of calcimetric and the capacity of adsorption to the methylene blue obtained.

Series of the palygorskites

Essays in the methylene blue ...90.60 mg / g
Calcimetric....2.9 CaCO₃
Moisture content.....18.95 % % in Sand > 63μ

All in all, for the levels in palygorskites, samples presented a capacity of adsorption to the methylene blue of 85 mg / g on the whole site. The content it calcite of our samples is from 3 to 4 %.

Series of the bentonites

Essays in the methylene
blue.....130.0 mg / g
Calcimetric.....1.8 CaCO₃
Moisture content.....16.8 %
Content in Sand.....63 μ

All in all, the levels in bentonites of the tested samples presented a capacity of adsorption to the methylene blue of 137 mg / g on the whole site. The content it calcite of the samples is from 3 to 4 %.

Discussions

The analysis of the results and the tests in the methylene blue allowed us to clear the mining characteristics and to check the criteria of exploitability and industrial

specifications of the foliated argillites of the site of Dagbati-Watchidomé.

Criteria bound to the raw material

On the site of Dagbati-Watchidomé, the content of the foliated argillites there palygorskites or bentonites is superior to 75 %. This content meets the criteria of mineralogical composition demanded on the international market, worth knowing: the content it smectite [2] is from 70 to 80 % minimum of the whole coming for bentonites, from 30% to 40 % for the production of the absorbent granules and 70 % of the whole coming for the uses in loads. On this market the content it palygorskite (attapulgitite) is very variable [3].

All in all, the site concerned by our work of present research a field of palygorskites and bentonites in strong absorption capacities with an absorption capacity for the palygorskite of 85 mg / g and an absorption capacity for the bentonite of 137mg / g which represents a good indication of industrial quality. However, the low contents in carbonates (2 % of CaCO) and in sand do not constitute crippling factors for the exploitation of the field.

Criteria of exploitability of the field of Dagbati-Watchidomé

The analysis of the results allowed concluding that the site of Dagbati-Watchidomé is a field containing palygorskites and bentonites of very good quality. This field meets the criteria of exploitability of palygorskites and bentonites which are 3 m. The average power of the palygorskites of the studied site is 8 m which gives an economically profitable coat to the exploitation. All in all the exploitation of the field of Dagbati Watchidomé is going to concern as well the palygorskites as the bentonites. It will thus be about a global exploitation especially as palygorskites (attapulgitites) and bentonites (smectites) substitute themselves in certain domains of use.

Therapeutic and nutritional interest of palygorskites and bentonites

Palygorskites and bentonites are used on human medicine and on biological animal production especially from a therapeutic point of view by taking advantage of their adsorbing and haemostatic power. It was demonstrated that the bentonite is very effective against the diarrhea at the calves [4]. And certain pharmaceutical products to look after the diarrhea at the human being contain it.

Authors [5] showed that bentonites are probably the sociable agents most used in the manufacturing of food in tablets. The bentonite is added in this case to a rate of 1.5 % of the ration. Dembinski and coll. [4], realized a study on herds of cows during which a difference in the composition of the milk was observed for cows receiving 2 % of dry materials of bentonite in their ration of the end of the gestation until 4 in 6 weeks after the birth. Besides, Krchnavi and Leech [6] claimed in their patent which the addition of 2 % of a montmorillonite (palygorskite) in a well-balanced normal ration allows to improve the scent and the taste of eggs, to reduce the mortality of the chicks and to increase them.

It has also been shown that the addition of 5 % of palygorskite in the ration of poultry allows to reduce the humidity of the fertilizer and to improve the indication of consumption, and it is true better than the bentonite or the kaolinite [7].

Industrial interest of palygorskites and bentonites

Palygorskites finds applications in the industrial domain, in particular to absorb oil and, also serve as supports in the phytosanitary products [8]. The same authors also indicate that bentonites are used for the bouletage of iron ore, in the drillings,

in the public works, for the environmental protection by the realization of tight barriers for the burying of garbage.

Conclusion

Within the limits of the depth of 20 m and the surface of 12 km²: the mineralogical results and those of the industrial tests allowed to discover a field of 2 substances good quality biocatives and of economic interest to Dagbati-Watchidomé.

All in all, the studied site presents all the characteristics of a good exploitable field, worth knowing:

- 1 °- a very low discovery of 4 m on average
- 2 °- an exploitable thickness of 15 m at least or global (palygorskites and bentonites)

Our results show that the surface of palygorskites is average in 12 km² with possibilities of extension southward - is of the site being lying. While bentonites constitutes very important reserves. All in all, our works show that Togo arranges very important resources of palygorskites and bentonites which are proved to more than 30 million tons in the rough being lying. They are probably more important. And it is in view of the therapeutic and nutritional aspects which are definitively advantageous as much for the human beings as for the animals of breeding that following additional works are essential and necessary for a feasibility study with the aim of the exploitation of this deposit. It is a question of realizing:

- 1 ° - a campaign of nicked soundings and in stitch squeezed in the south and southeast sectors of the field
- 2 ° - qualitative and quantitative studies by a thermal analysis and cristallographique
- 3 ° - a physical and rheologic study
- 4 ° - a toxicologique and bacteriological study

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