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Carmita Formation As An Important Consideration For The New Palinspastic Reconstruction

ABSTRACT

Carmita Formation, has great importance for oil exploration in Cuba, due to that it is associated to several oil fields in the north coast of the western Cuba.

These formations has particular distinctive features, associated to well-bedded carbonates interbedded with silicite and countless beds and lens of sandstones and silstone, with some clastic, mainly quartz, plagioclase and in a lesser degree extrusive, glauconite, and secondary minerals as zircon and tourmaline.

We need to explain the presence of clastic rocks, more abundant to the top of the overthrust sequences and also southward, as quartz, plagioclase - typical of the basement - and extrusive rocks, of the oceanic crust.

We need to consider the possibility of emerged or semi emerged basement blocks to the south of the basin; which contributed with the terrigenous elements. Those facts made possible the palinspastic reconstruction of the basin, which also could explain the presence of metacarbonates and metaterrigenous sequences in the Escambray region, which are high pressure and low temperature metamorphic rocks.

Rocks were studied from the geophysical, petrographic and Stratigraphic points of view. In which is found that carbonates are associated to lower radiolarites and clastic fraction, in some of them are described calcarenites, typical of slope environment, while in others, rock of different composition have been observed, deposited in shallow water and characteristic fossils which let us say that these rocks were deposited in different environments.

We can not overlook that tectonic movements were the cause of the out of sequence emplacement of the rock from the studied formation over those of the Veloz Group of Necomian age and these generate oils with characteristics slightly different.

INTRODUCTION

Very Important papers have been published concerning several areas in Central and Western Cuba and many others not published yet, are kept in Cuban institutions. All these information are related to oil exploration projects considering lithologies and in general stratigraphy of oil wells in order to obtain a logical interpretation of origin of crude oils; their source rocks and organic matter.

During the investigation we paid attention to the carbonatic Carmita fm.(Truitt.P/1953) which is chert rich as noduls and lens while in several location interfingers with clayish siliceus rocks with a general composition containing quartz, plagioclase rich in zircon, tourmaline and others and extrusive volcanics.

How to explain quartz and the other elements as well as detritic fragments?. Many times we have been calling these lithologies as part of another formation named Santa Teresa (Wassall H./1952); but as surface it outcrops as radiolaric cherts of black and brown color from finely to medium strata and very fine layers of tuff clay.

This study after detailed observations of well cores, cutting, geology, geophysics, stratigraphy, more of geologic cross section, stimulated the employment of other points of view to carry out the reconstruction of the basin of the continental margin, introducing modifications to the existent ones.

We seek to get the attention on the composition of the rocks of Carmita fm., being part of sequences deposited in several environments, from the deepest, where the carbonates and the radiolaric chert are deposited, until the shallow ones, with the oolites presence and detritics fragments that demonstrate their proximity to means of very low depth.

DEVELOPMENT

We also took in consideration Stratigraphy, lithology and well loggings the oil fields Varadero-Cantel, Boca de Jaruco at the northern Cuban coast and shallow offshore as well onshore Central Cuba fields and placed the information by means of geologic sections.

The first section (Fig. 1), shows the structural frame the area showing the overthrusts and formations emplacements along the northern margin but taking the Carmita fm. as a key one which is very well exposed at the Varadero Sur and Cantel oil fields (1, 2, 3).

A detailed study of the well Varadero Sur – 5, cores number 7 – 8, done by CEINPET'S stratigrapher and petrographers, show oolitic limestone, pseudo oolitic and fragmental with strong filled fossils and clastic materials in the layers composed of quartz grains filling in the fauna. The sequence is characterized for: *Pithonella ovalis*, *Stomiosphaera sphaerica*, radiolarian and *Milliolidae*, which were living in strong energetic shallow water. Cores No. 9,10,11 show microfragmented banded micrites, and the stratification surfaces show quartz crystals, volcanic rocks and other siliceous; fauna is similar.

The lower part of this well, present organic limestone intercalations, mudstone, and other, as well as clayish material, all very stratified comprising the clastic fraction similar to the one described before, showing fauna of *Nannoconus* sl; Radiolarian cast, *Globotruncana*; *Rotalipora* and Others. These fossils indicate deeper water deposition still carrying detritus of granitic rocks.

Practically identical results were obtained from the study of the same formation in the well Cantel 1, where the cores 2 and 3 exhibit mudstone - wackestone, stratified and intercalations of siliceous – clayish rocks, while the cores 4 - 10 show fine and thick calcarenites, carbonates breccia showing lots of siliceous siltstone, which associated to slope deposition.

Usually the siliceous clayish rocks Santa Teresa fm. are easily picked by their low resistivities logs, but the quartz contents are not part of the radiolarites as well as granitic

and basic altered extrusive, which positively were deposited in very deep water between the K₁ Veloz group (Hatten C./1958, in Meyerhoff and Hatten 1974, redescrite Veloz Group, Sánchez A/1993) and Carmita fm.

The study was extended to the south, through the well Martí – 5, showing at the upper part a calcareous fine grained sandstone which content quartz, orthoclase, glauconite and fine grained recrystallized micrites (cores 1, 2, 3) belonging to the Vía Blanca fm (Bronnimann P./ 1963) of K₂^{cp-m} age represented for: Stomiosphaera sp.; Phitonella sp (?); Globigerinelloides sp; Heterohelicidos; cast planctonic foraminifers.

Cores 4 - 15, also of Marti 5, the rocks are integrated by dolomitic, organogen limestone, fragmentary, siliceous and others with poor quartz fraction, and fauna represented for: Nannoconus sl.; N. aff. trutti and N. minutus; Colomisphaera heliosphaera; Heterohelisisidae; Hedbergella sp.; radiolarium recrystallized casts. As many petrographic and paleontological information facilitate to associate these, to the Carmita fm. as well as Aptian - Albian (K₁^{ap - al}), also showing deep waters deposition. Also shows, these are overthrusting above the Upper Tithonian - Valanginian (J₃^{t3} - K₁^v), Veloz group, with typical fauna: Nannocunus sl; N. colomii and N. stumianni; Calpionellids ss; radiolariums recrystallized casts

From the lower part below to 3222 m. - other sequence are not identified, due to the absence of samples; and starting from the cores 16, the rocks are more terrigenous, with intercalations of quartz sandstone and calcareous cement, with angular and sub angular grains, and subordinately orthoclase, muscovite and zircon; intercalations of calcareous of reddish brown color. It can be dated from the Upper Tithonian to the Valanginian for their fauna (J₃^{t3} - K₁^v). with Cadosinidae; Colomisphaera; Calpionellids ss recrystallized; Parvicinula sp; Sethocapsa sp; radiolarium recrystallized casts; Nannoconus sl (poor and recrystallized); and others; showing non deep deposition environment.

These sequences do not associate them to none of the established formations, for the different lithologic - facies from the northern coast (1,2), neither those studied in the mapped region (3), although it is not our interest to frame it closely, it is necessary to remark the sources corresponds to the different environment (5).

In a similar way, toward the area of Boca de Jaruco location, several cross section were made that served from base to the investigation toward this area.

The studied rocks of the Carmita fm., in the well VB - 11, (cores 12 - 19); VB -15 (cores 7 - 15); VB -9 (cores 7 - 23) were 15% identified clásticos similar to those described, that as elements of the limestones and as well as stratification layers, can be result of the destruction of granitic basement blocks as an archipelago emerged to the south (8).

From central part of Cuba, similar analogies can be settled down, starting from the mapping of detailed in the Jarahueca and Bonachea Hills (5, 6, 11,12 and 13), Carmita fm. is observed overthrust above the Veloz group and among them, the sinorogenic of the Vega Alta fm. (Kantchev I./1978), of the Paleocene to the Low Eocene (P₁²⁻³ - P₂¹), like the one also observed in wells along the north coast Havana –Matanzas region.

The investigation shows how Via Blanca fm. (K_2^{cp-m}) lays above the rocks of the Carmita fm., toward the west and the granitic debris and blocks has been described in its lower part as portions of the same ones, volcanic debris and others are associated. Similarly, in the central territory of Cuba, calcarenitas of coars grains means as described - generally -, with extrusive fragments, coming from the Islands Arc and of the Oceanic crust, above the Carmita fm., although, apply to another formation, which is a demonstration receiving the contribution of granitic and extrusive rocks.

At the same time, we know from geologic papers that south of the Cuban territory, are found terrigenous and carbonated rocks affected by the metamorphism of high pressure and low temperature, caused by the deep burial to that they were subjected, product of the overthrust oceanic crust and the islands arc above the same ones: remaining exposed outcrops witness of such rocks in the mountainous system of the Escambray (7).

The elements enumerated previously, were the base to attempt the palinspastic reconstruction of the basin (Fig. 2), not with the purpose of making a new model, but to be able to explain the presence as well as detritic fragments, that we have studied during the geologic investigation and also as alternative to argue the deposition of the terrigenous and carbonates rocks in a south depocentre, in which radiolaric chert metamorfized has also been studied (7), and with it not to have necessity to justify its presence starting from secunense deposited in the Pacific Ocean (4, 9, 10).

In the oils studied by the geochemistry - Cantel, Guásimas, Varadero Sur, Martí, Boca de Jaruco -, the different qualities of the petroleum can be explained reasonably, since, the organic matter (OM) that generated those hydrocarbons. In some cases, where the rocks were carbonated of deep waters with poor terrigenos participation and for it the organic matter was essentially marine, and other, they corresponded to less deep means and significant participation of terrigenos, jointly with the OM of that origin also, while in other the mixtures are evidenced.

The above mentioned is exemplified starting from graphic C29/C30 terpan pentacíclic vs. C35/C34 terpan pentacíclic whose relationships > 1 , tipificaly abundant marine carbonatic sediments; being appreciated an increment of the carbonate from the location Cantel toward Guásimas.

In ternary diagrams, the relative abundance of C27, C28, C29 is observed, sterans, representing the petroleum that originate for blended organic matter, in the area of the corresponding graphics.

CONCLUSIONS

1. The investigation show that the rocks of the Carmita fm. was deposited in different enviroments from to the deepest until the shallow ones, and they are formed by rocks of different origen.
2. The presence of the clastic fraction composed by quartz, plagioclas, extrusive, with accessories as zircon, tourmaline, and other, in the intercalations layers and in the own carbonated rocks it is not identified like part of the Santa Teresa fm., compound for,

radiolaric sherts and intercalaciones of volcanic clayish, those that were deposited in the deepest part in the basins.

3. The composition of the clastic fraction, their most abundant presence throout in south, are an important element to argue the existence of emerged basemen blocks to the south, as source to deposition to the northern and southern depocenter. The granitic fragments in the rocks of the Campanian - Maestrichtian and younger, they also confirm it.

4. The variability in the composition of the Carmita fm. and the presence of the clastic fraction, they have allowed to explain the participation cohesively or not of the terrestrial organic matter in the generation of the different tip of oil, studied by the geochemistry.

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