

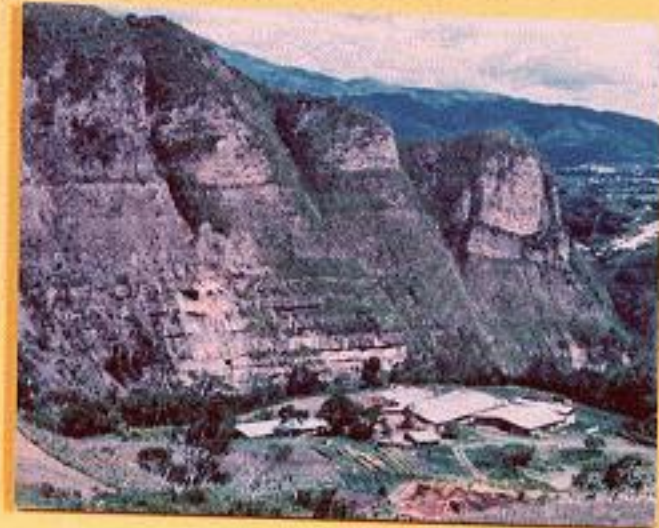
ABSTRACT

The late Cretaceous La Luna Fm in Western Venezuela is believed to be the major source rock in the Maracaibo basin. In order to obtain an approximation of the total amount of hydrocarbons that could have possibly been generated in this basin, the vertical and areal distribution of total organic carbon (TOC) was studied. Since important phosphate deposits were found in the uppermost portion of the La Luna Fm, their distribution was also determined on a regional scale.

A total of 263 samples corresponding to 19 surface sections and 9 wells were collected and analyzed with geochemical methods including LECO carbon analyzer, Rockeval and X-Ray fluorescence. The vertical distribution was represented for all sections and wells. For mapping purposes of TOC and P₂O₅ only the upper part of the formation was considered.

It was determined in general, that TOC increases towards the top of the formation; geographically the highest concentrations were found in the central and western part of the Maracaibo basin, close to the Alturitas-Catatumbo area. Higher TOC concentrations correspond to finely laminated limestones and calcareous shales, where bioclasts are more frequent.

Phosphates are found only in the uppermost 8 - 20 m of the stratigraphic section; geographically it is concentrated in northern Táchira and in the central Maracaibo basin. Phosphate is mostly of primary origin, concentrated in massive limestones, glauconitic sandstones and argillaceous rocks. Phosphate mineralogy includes colophonane, wavellite and apatite oolites, diagenetic fossil replacements and autigenic precipitates.



QROA, ZORICA, EDO. TACHIRA, LA LUNA Fm (TOP) AND MASSIVE CAPACHO LIMESTONES (BASE).

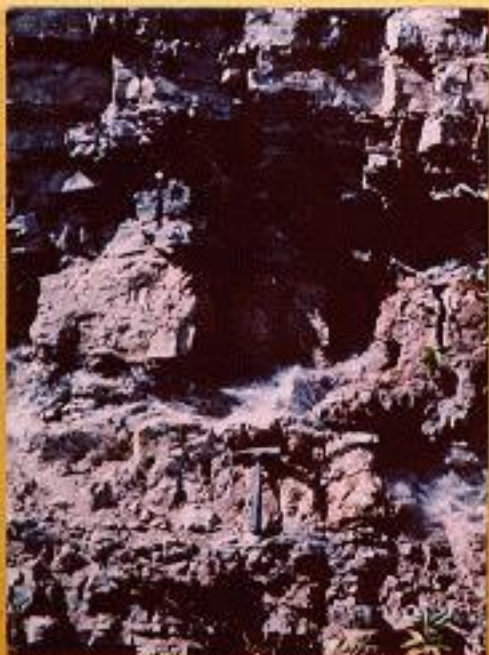
SAN PEDRO DEL RIO PHOSPHATE MINE



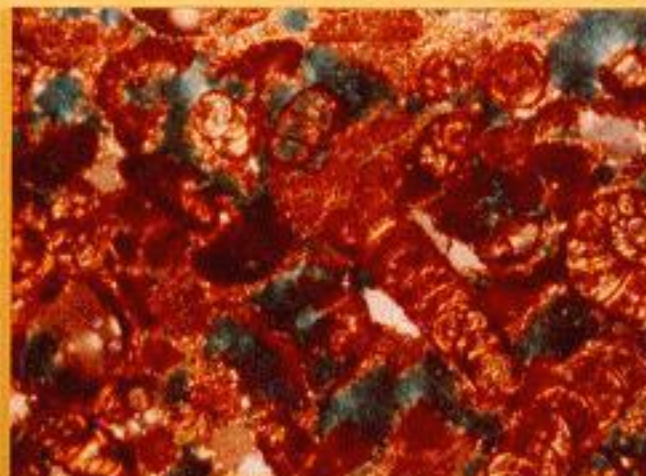
TYPICAL PHOSPHATE ROCK, 25% P₂O₅



LA LUNA Fm TYPICAL THIN-BEDDED ORGANIC-RICH LIMESTONE



SAN PEDRO DEL RIO SECTION. TOP OF LA LUNA Fm WITH CHERT NODULES AND PHOSPHATE-RICH LIMESTONES.



PHOTOMICROGRAPH OF PHOSPHATIZED FORAMINIFERA AND MATRIX, BLUE IS POROSITY.

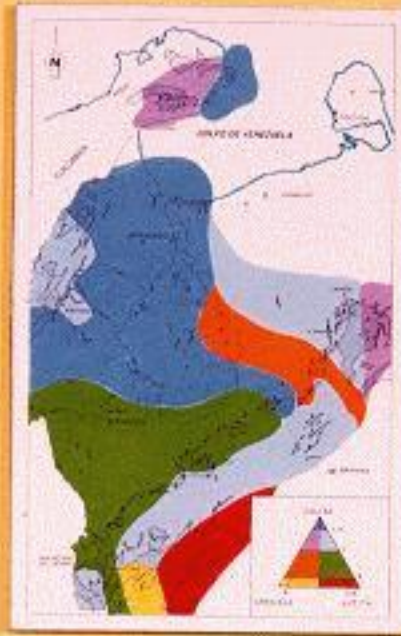


SAN PEDRO DEL RIO PHOSPHATE MINE. DARK GRAY AND BROWN PHOSPHATE ORE ALONG THE EXPLOITATION BANK.

LA LUNA Fm - FACIES



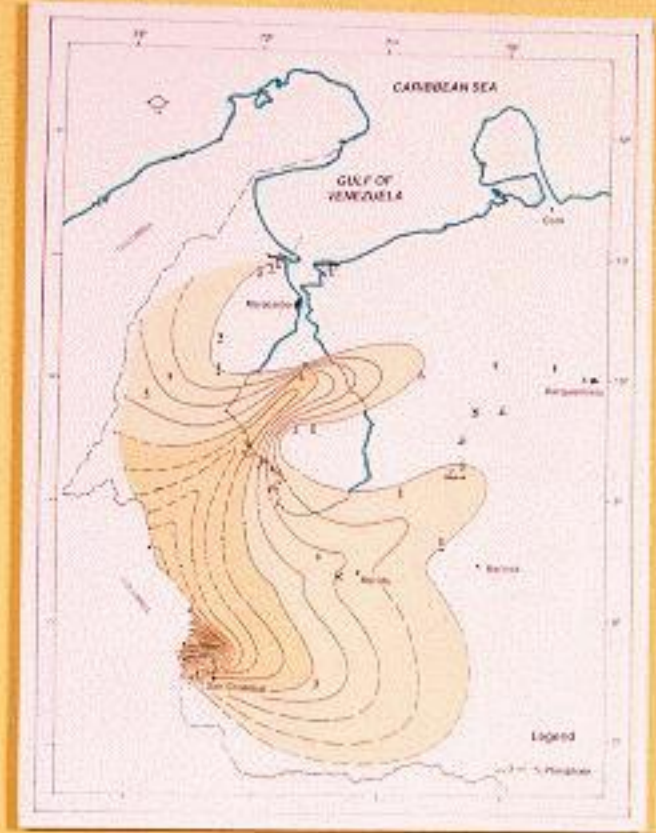
PHOSPHATIZED LENTICULITES SP.



LA LUNA Fm - ISOPACH



LA LUNA Fm PHOSPHATE



LA LUNA Fm TYPICAL THIN-BEDDED LIMESTONE COMPOSED OF LIGHT BANDS OF FORAMINIFERA ALTERNATING WITH DARK LAMINAE OF ORGANIC MATTER AND BITUMEN.



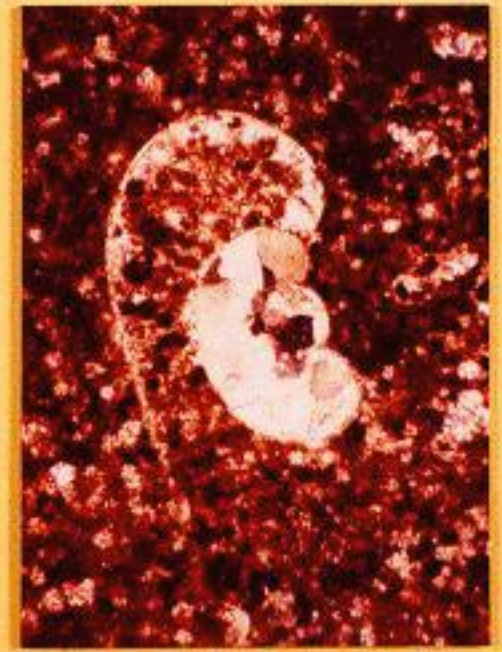
LA LUNA Fm TYPE SECTION OF THE LA AGUADA MEMBER NEAR BARBACOAS.



LA VUELTOOSA, EDO. BARINAS. LA LUNA Fm NEAR TRANSITION TO THE ESCANDALOSA Fm.



LOBATERA MINE, DETAIL OF PHOSPHATE ORE WITH FORAMINIFERA AND FISH REMAINS.

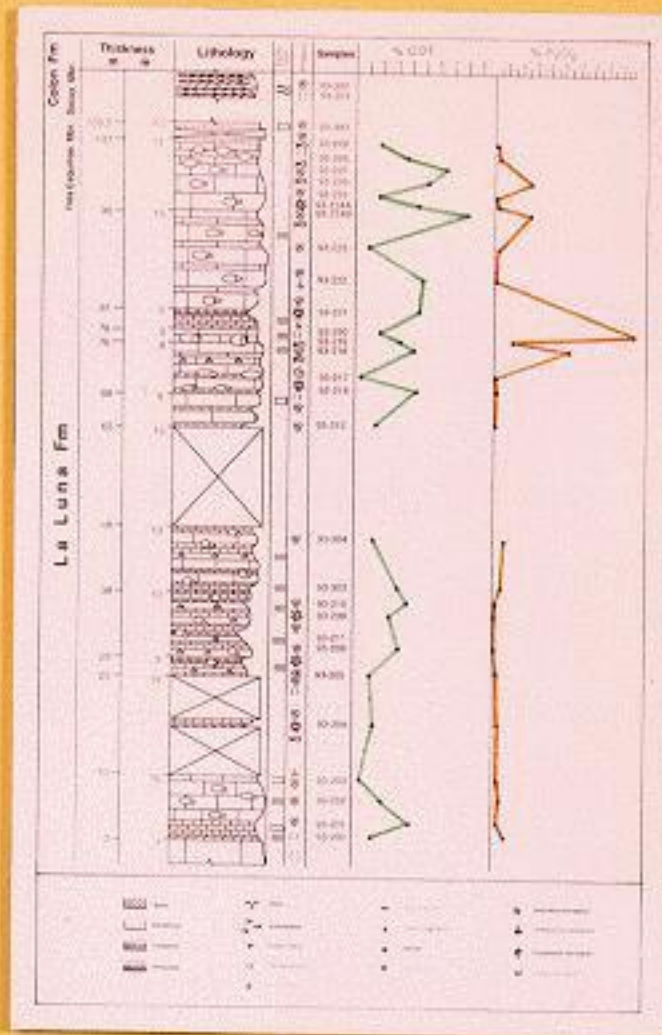


LA LUNA Fm CHAMBER OF JUVENILE AMMONITE.

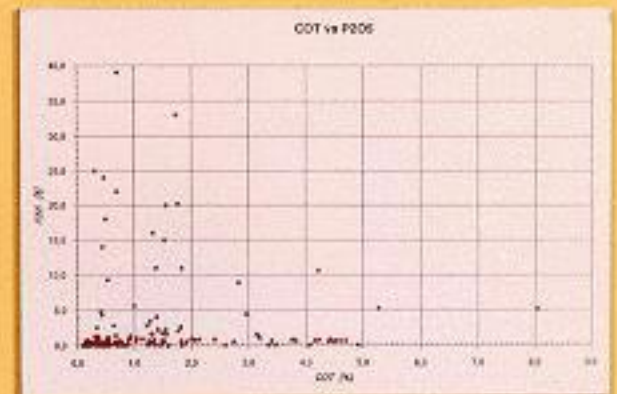
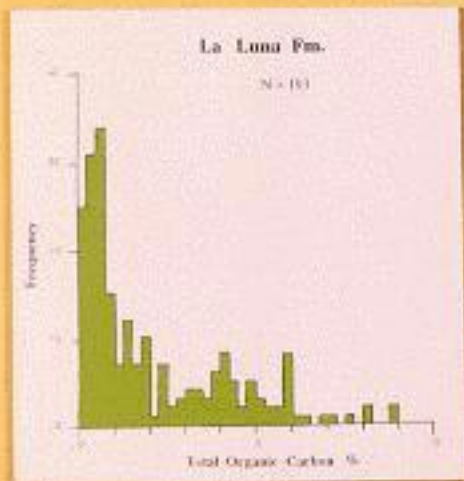
LA LUNA Fm - TOC



LA LUNA Fm - QUEBRADA MARACA SECTION



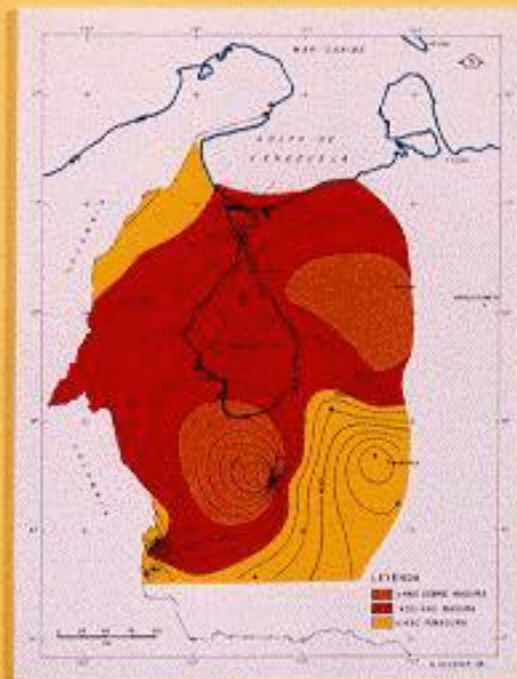
LA LUNA Fm IN QUEBRADA MARACA. TYPICAL CONCRETIONS AND PHOSPHATIC LIMESTONES IN THE UPPER PART OF THE FORMATION.



LEAN TOC LIMESTONE

RICH TOC LIMESTONE

LA LUNA Fm - Tmax



LA LUNA Fm TYPE SECTION. THIN-BEDDED, ORGANIC-RICH LIMESTONE ALTERNATING WITH MASSIVE, LIGHT GRAY, FOSSILIFEROUS LIMESTONE.

CONCLUSIONS

Organic carbon and phosphate are concentrated in the upper part of the La Luna Fm.

Phosphate is concentrated in the central and southwestern portions, whereas organic carbon is concentrated in the western part of the basin.

Organic carbon is found in two distinct populations: thin-bedded, TOC-rich (4-7%), dark gray to black limestones, and gray to dark gray, massive limestones with 0.5 - 2% TOC.

Phosphate concentrations vary between <0.5% to 39% P₂O₅, the largest concentrations are found in the Táchira state Lobatera and San Pedro del Rio mines, and the Los Monos prospect.

Wavellite and collophane is found in oolites, fish remains and calcite matrix replacement.

Abundant planctonic foraminifera and patterns of phosphate concentration indicate upwelling from the west in the central and southwestern Maracaibo basin during upper La Luna time. The age of this period was determined by *Dicarinella primitiva* and *Whiteinella archaeocretacea* as 86 to 84 MM years.

In general, the La Luna water column was stratified: oxygenated oceanic conditions with abundant planctonic foraminifera and fishes prevailed on the surface, while anoxic bottom conditions favored the accumulation and preservation of organic matter.

The typical black chert of the La Luna Fm shows evidences of diagenetic origin. There is field evidence of progressive replacement of limestone and concretions by silica.