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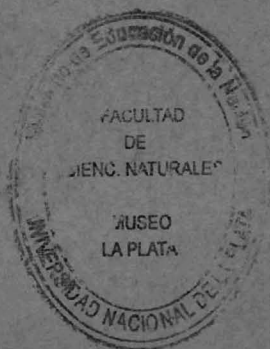
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EXTENT OF THE CARBONIFEROUS MARINE INGRESSION IN THE
PRECORDILLERA OF SAN JUAN - LA RIOJA (ARGENTINA)

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EXTENT OF THE CARBONIFEROUS
MARINE INGRESSION IN THE PRECORDILLERA OF SAN JUAN - LA RIOJA
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Abstract. - The present paper deals with the extent and distribution of a series of Carboniferous sediments occupying a group of separate basins, among which a section made up of marine deposits belonging to one major ingression stands out. Their lithological descriptions are given according to their occurrence and the evolution of the marine environment is outlined.

In the Precordillera of San Juan and La Rioja, Argentina, a group of now isolated basins is found. They lie on both the eastern and the western edges of that range, but are also found in its central portion, with an alignment approximately parallel to the north-south trend of the Precordillera. Such basins, filled mainly by Carboniferous sediments, show certain common characteristics, the most striking being the consolidated sediments of a marine ingression.

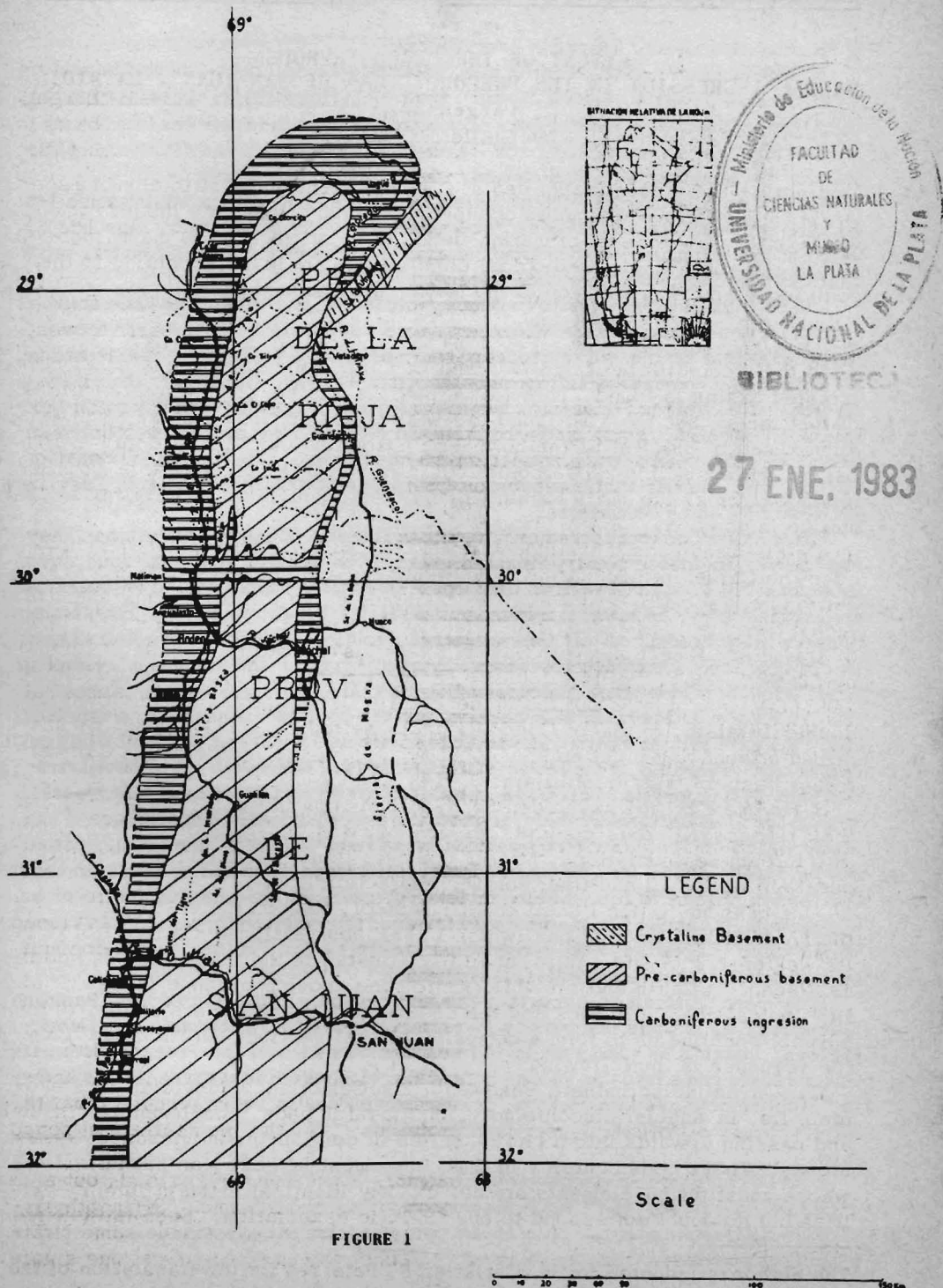
Detailed and excellent accounts by FRENGUELLI first brought to our knowledge the Carboniferous marine deposits of the eastern Precordillera. While carrying out a geological survey in Quebrada de La Herradura, northeast of Jachal (San Juan), he found, 200 meters above the bottom of the section, beds of shales and limestones with abundant remains of a marine fauna later studied by LEANZA. South of this locality, a section in Rio Huaco was studied by BORELLO, who pointed out the presence of a Carboniferous marine level undoubtedly related to that of Quebrada de La Herradura. LEANZA, again, described a fauna from yet another locality, Jague, the northernmost Carboniferous basin of the Precordillera.

A few more basins have been found apart from those just mentioned and their rich fossiliferous contents are at present under study. Before going into further considerations, I shall describe those basins briefly, pointing out their individual and their common characteristics.

One of them, which I shall call Guandacol, lies on the eastern border of the Precordillera; another one (which I shall name Maliman-Carrizalito) is in its western border and a third, centrally situated in the range, will be known as Volcan. A fourth and smaller one is the above mentioned Jague. Their lithological characteristics and the sedimentary sequence are similar to the point of enabling us to form a composite general section. In its broad lines, the sequence is the following:

1) On an indiscriminate Basement (Pre-Cambrian, Ordovician or Devonian) lie, in angular unconformity, continental beds, conglomeratic below and passing upwards into a thick series of greyish-green micaceous sandstones. These beds contain, in their uppermost levels, an abundant flora whose constituting elements are not exactly identical in the different localities but no doubt correspond to one floristic association. Such is the case

¹The author is indebted to Dr. Christian S. Petersen for the translation of the manuscript from Spanish to English.



of Huaco, Herradura, Trapiche and Volcan.

2) A few meters above the former, all these localities show a marine level bearing fossils, among which forms of Syringothyris, Streptorhynchus and Chonetes abound; this fauna is practically uniform in the eastern basins. With slight faunal variations, the same level appears in the basins of Rio Blanco, no doubt existing as to their identity with the former.

3) Overlaying the last group there is a remarkably constant series of arkoses and whitish sandstones, with interbedded reddish beds, the latter being more abundant in the upper levels; it is frankly continental, with characteristic argillaceous coal seams.

I have labelled the first two groups mentioned as Volcan and the third as Panacan Formations. Their thickness varies appreciably from east to west, especially that of the marine deposits, being in the eastern basins around 50 meters and exceeding in the western ones 120 m. Moreover, the lower portion of the Volcan Formation, which in Huaco, Herradura and Trapiche exceeds 400 meters, is not present in the Rio Blanco area through tectonic suppression, and, hence, no correlations may be drawn. The Panacan Formation, in turn, has similar thicknesses on both sides of the Precordillera, varying between 500 and 700 meters.

There is no general agreement regarding the age of these formations, having been considered totally Permian, partly or wholly Carboniferous, even including the lower levels of the upper-Devonian. The data now available are furnished by the marine faunas and floristic associations. The former deserve more credit, as all the vegetable remains from these regions known so far call for a complete revision. Syringothyris is the principal element; together with a few other species of brachiopods, it is present in almost all the known localities. LEANZA ascertained its position remarking on the fact that Syringothyris is found in the Carboniferous of Europe and the United States and regarding it as lower-Carboniferous. However, it is now stressed that Syringothyris has not an absolute determinative value by itself within the Carboniferous; this fact attaches considerable importance to the study which on the brachiopods of this fauna which is now being carried out by AMOS, who, in a recent letter, forwarded to me his impression that the faunas belong to the middle or lower-Visean. In the present state of our knowledge, therefore, it seems safe to regard the marine Ingression as Visean *sensu lato*. Likewise, the continental facies of the Volcan Formation must be restricted to the Lower-Mississippian.

It is more difficult to ascertain the chronological position of the Panacan Formation, as it does not contain reliable fossils to determine it. Nevertheless, bearing in mind that in the eastern basins of the Precordillera its lower levels pass into the Volcan Formation without evident break, thus showing a continuous sedimentation, it may be taken as very probable that the latter covers all of the upper-Carboniferous, i.e. the Pennsylvanian sensu lato.

Evolution of the marine environment. - A marine level stands out as a dominant feature in the basins described; it has been named "Syringothyris-sea" in different papers. It is found persistently, always in the same stratigraphical position, thus enabling us to accept the presence of one single

marine transgression which came about during the higher terms of lower-Carboniferous times. The sea started its advance from the south, along the longitudinal valley of the Rio Blanco, until it overflowed the main range of the Precordillera where the Leoncito salt-lakes are now situated and reaching the latitude of Jague. There the northernmost outcrops of the marine Carboniferous known so far are found (its shallow-sea character being made evident by the halobios and limnobios faunal sequence) and allow us to assume that the transgression did not far exceed the latitude of Jague.

The connection of this marine level with those of Quebrada de la Herradura, Trapiche and Huaco does not come about through a southern extension of the sea from Jague, as a few kilometers south of this locality two transverse structural units formed thresholds of pre-Cambrian Basement constituting an unsurmountable barrier to the penetration of the sea; they now make up the Cerro Cacho and Sierra de Umango ranges. The depression that facilitated the marine invasion as far as the Guandacol basin must, therefore, be sought elsewhere. In this respect it is of particular interest to note the presence of the marine levels in Quebrada Volcan and other undescribed deposits of Quebrada Talcanco, situated in areas morphologically looked upon as central tracts of the Precordillera. The deposits outcropping in Quebrada Talcanco present marked similarities to those of Quebrada Volcan; though no fossils have been found in them, their lithological identity is, to the present author, beyond question.

Wishing to avoid lengthy considerations on these two localities, I shall state just the following:

During the ingression of the Carboniferous sea along the longitudinal valley of Rio Blanco - a structural unit already present in the vicinity of Quebrada Talcanco and Cerro Guachi - a transversal depression existed deep enough to enable the sea to advance to the point of occupying the Guandacol basin; here the marine conditions were short lived, as revealed by the scant thickness of the sediments as compared to those of the Rio Blanco area. A general raising of the region pushed the marine ingression westward towards Malinan and farther south. Slight coastal oscillations allowed later for minor marine ingressions; these were restricted to the valley of the Rio Blanco, as the transverse depression of Quebrada Volcan-Cerro Guachi was already at a higher topographical level. With the gradual southward retreat of the sea the lower-Carboniferous events came to an end and a continental environment was initiated which has prevailed to the present day.

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