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THE STRUCTURE OF THE SW PART OF THE CANTABRIAN MOUNTAINS

(explanation of a provisional geological 1 : 100.000 scale map)

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ABSTRACT

The present map is the continuation of the map published by De Sitter in 1962. The folded Precambrian basement in this area is overlain unconformably by Cambrian up to Carboniferous strata. The Palaeozoic has been uplifted during the Bretonic phase, and folded during the Sudetic, Asturian, and Saalic phases. In the western end of the Leonides the structures known from the eastern part of the Luna unit do not continue but are replaced bij one syncline and a number of thrusts. Major block faulting of the basement determined the curved structure of the "Asturian Knee" and also the diverse contemporaneous directions of thrusting and folding. Thinly developed Devonian of the Caldas Formation demonstrates the presence of a structural ridge early during the sedimentation. Stephanian intramontane basins developed along faults in downwarped areas.

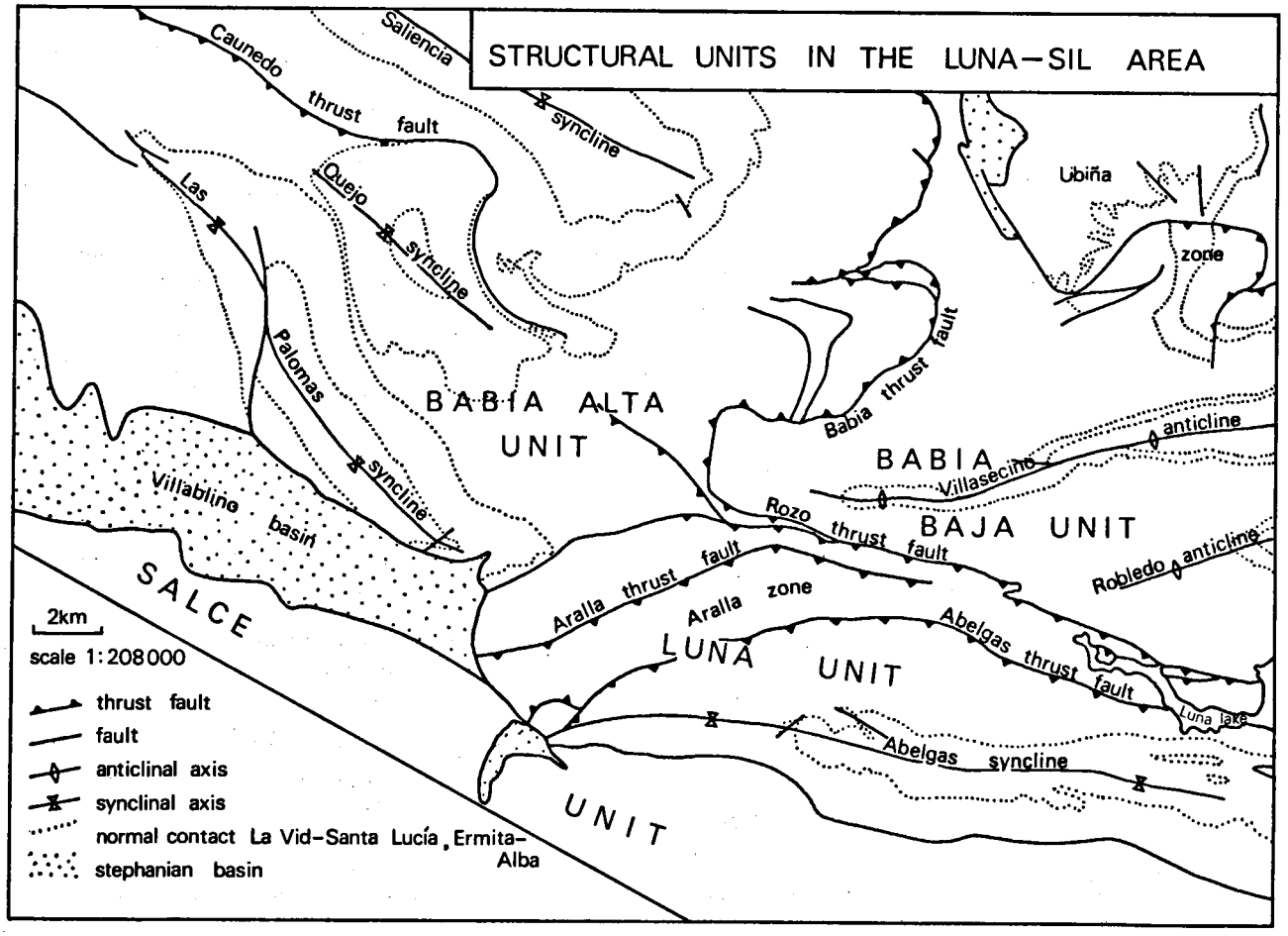

Fig. 1. Structural sketch map.

INTRODUCTION

This provisional geological map of the Luna-Sil region is the western continuation of the 1 : 100.000 scale map of the southern slope of the Cantabrian Mountains by De Sitter (1962).

García-Fuente (1959) mapped the 1 : 50.000 sheet La Plaza which covers the NE corner of the map, Gómez de Llarena & Rodríguez Arango (1948) presented a 1 : 100.000 scale sketch map of the area in front of the large thrust faults and Martínez Alvarez

(1965) gives general strikes of the structures on his 1 : 500.000 scale map of NW Spain.
The stratigraphic subdivision given by Comte (1959) for the Cambrian-Devonian of the Bernesga area and by the department of geology of Leiden University for the Carboniferous are still valid in this part of the Cantabrian Mountains (fig. 2).
The present map is only a provisional one; a 1 : 50.000 scale map accompanied by a detailed map description, covering most of the present area, will soon be published.

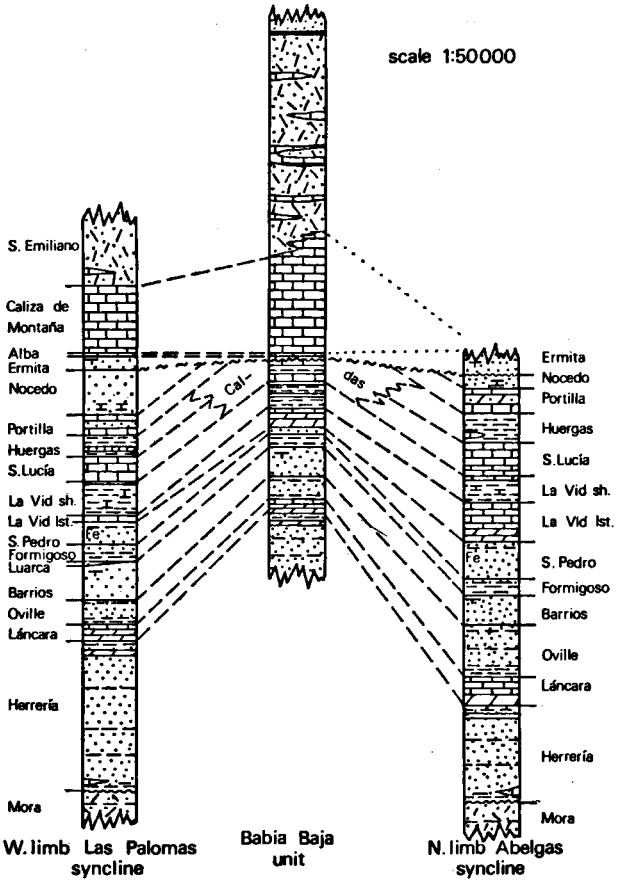

Fig. 2. Stratigraphic relations in the Luna-Sil region.

STRATIGRAPHY

The Palaeozoic starts with the Herrería Formation of Lower Cambrian age which lies with a clearly unconformable contact, accentuated by a weathering zone and a basal conglomerate, on the strongly folded and epimetamorphic Precambrian, Mora Formation. The Herrería Formation consists mainly of coarse quartzitic sandstones and siltstones with dolomite beds near the top. There is a gradual transition from these sandstones into the limestones and dolomites of the Láncara Formation. This Formation has a detritic, striking red nodular limestone at the top; N of Torrestío it loses some of its colour. The following Oville Formation starts with mainly siltstones but becomes sandier and grades upward into the Barrios Quartzite Formation.
Between the Barrios quartzites and the black shales at the base of the Formigoso, glauconite containing mudstones and quartzite beds frequently occur; NW of Lumajo these reach a thickness of more than 40 metres. This sequence can probably be correlated with the Luarca shales (Barrois, 1882), growing thicker towards the north (Poll, 1963). The black shales with graptolites overlay these sediments with a sharp contact. The Silurian Formigoso Formation merges gradually into the red iron-bearing sandstones and green shales of the San Pedro Formation. Towards the .top more and more shales are intercalated and there is a gradual transition into the Lower Devonian La Vid dolomites and limestones.
In the Babia Alta and Luna units (fig. 2) further Devonian deposition was continuous and a limestone-shale sequence comparable to that in the Bernesga area is encountered. One exception is a bank of pure sandstone, 40 metres thick, in the middle part of the Portilla Formation near Quintanilla. In the Babia Baja unit Comte's stratigraphic subdivision for the Middle Devonian can no longer be used. Smits (1965) introduced the name Caldas Formation for the more terrigenous Middle Devonian sediments here; this development commenced during the deposition of the La Vid Formation.
After the Bretonic epirogenetic uplift, being most important in the NE, strong erosion took place. The transgressive Upper Devonian Ermita Formation overlies conformably the Fueyo Member of the Nocedo Formation in the W, while towards the NE it lies with an unconformable contact on Middle Devonian or even Lower Devonian strata, filling up karst cavities in the underlying surface.
In the Villasecino anticline the Ermita quartzitic sandstones are followed, without an apparent hiatus, by red nodular limestones of the Alba Formation (fig. 2). After sedimentation of the 500—700 metres thick limestones of the Caliza de Montaña, more than 1700 metres of flysch sediments of the San Emiliano Formation were deposited: the youngest beds here have an Upper Westphalian A age (Van Ginkel, 1965). These have been folded during the Sudetic phase. Age determinations in the Carboniferous of the Asturian coal basin indicate Westphalian C and D; these sediments were folded during the Asturian orogenetic phase (post-Upper Westphalian D).
After this phase intramontane basins developed along faults, probably as the result of adjustments to isostacy, which were filled with coal-bearing sediments; subsequently they were folded, probably during the Saalic orogenetic phase.

STRUCTURE

From a structural point of view this map area can be subdivided in four main structural units, the Babia Alta-, Babia Baja-, Luna- and Salce units (fig. 1).
The Babia Alta unit is characterized by NW striking

synclinal fold structures, the Las Palomas-, Quejo- and Saliencia synclines. Further eastwards these units have been upthrusted along the Babia thrust fault over the Babia Baja unit.

The Luna unit is the direct continuation of the Bernesga unit of the Leonides with roughly E-W striking upthrusts (Abelgas-, Aralla-, and Rozo thrusts), together representing the Aralla thrust zone. A complicated synclinal structure south of these, the Abelgas syncline, forms the continuation of the Alba syncline, the Mirantes anticline and the Pedroso syncline of the Bernesga unit.

The boundary zone between the Babia Alta unit and the Luna unit is formed by several faults, among which the Aralla thrust fault, running in a WSW direction, and is the continuation of the structures in the Babia Baja unit. This structure can probably be regarded as a splay of the León line, another splay perhaps passing roughly north of the Babia Alta unit.

The Babia Baja unit is characterized by WSW trending folds and forms the NW continuation of the Bodón unit; its NE part is called the Ubiña zone.

The Salce unit is a block faulted area, bounded in the NE by a principal fault cutting off the Luna unit. The intramontane Stephanian basins developed along normal faults; later these faults controlled the folding of these basins. The southern part of the Luna unit, the Abelgas syncline, has an intensively deformed core; its axial plane is dipping towards the north, just as the strata on its northern limb. This overturned limb is thrusted upon the Aralla zone with at its base the Láncara limestones acting as a basal shearing plane. In the western part of the Aralla zone intense deformation resulted in an imbricate structure. The thrusts are generally directed towards the north but, south of the above named imbricate structure, small upthrusts occur in a direction opposite to the main thrust direction. In this complicated zone the Herrería is also involved in the thrusting. More to the east the front of the Luna unit near Rabanal has been refolded during the Asturian phase with WSW trending folds, while the thrusting is of Sudetic age.

The front of the Babia Alta unit is a curved thrust plane at the base of the Láncara Formation where the western block has been thrusted eastwards. This movement is apparently of the same age as the thrusting in the Luna unit. The original curved structure of the "Asturian Knee" and major faults cutting the rigid basement into blocks, determined the structural directions in the overlying sedimentary cover. A later refolding of the region is possibly of Asturian age.

In the Babia Alta unit the strata overlying the very incompetent shale member of the La Vid Formation have not been deformed very intensively. An important fault is the wrench fault which cuts the Las Palomas syncline and which runs probably down into the basement. Most of the axial planes are dipping towards the NE. The Caunedo thrust fault brings Láncara on Huergas shales; towards the SE the amount of thrusting diminishes in the overlying younger strata.

The most important feature of the Babia Baja unit is the Villasecino anticline which is cut by a WSW trending fault; the interference of this fault with a W-E striking fault, NE of Villafeliz, resulted in a very complicated structure. The southern part of the Ubiña zone has moved towards the NE along a thrust fault which merges into a left-lateral wrench fault. Due to this fault, folding in the northern part of the Ubiña structure is more intense than in the south.

The intramontane basin of Villablino has been folded after the main deformation phases, probably during the Saalic phase. The deformation is controlled by the faults bordering the basin.

A post-Miocene peneplain with young incisions, on the Precambrian in the southern part of the region, indicates late-Tertiary uplifts; thanks to these uplifts the Río Sil could cut down very rapidly and capture the meandering Río Luna (Vidal Box, 1943).

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