

STRATIGRAPHIC POSITION OF THE LIMESTONES AND CONGLOMERATES AROUND THE MARIMANA GRANODIORITE, CENTRAL PYRENEES, SPAIN

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ABSTRACT

Limestones bounding the Marimaña granodiorite, in the Central Pyrenees, which have until recently been correlated with the Cambro-Ordovician "Calcaire métallifère" or "Calcaire de Bentaillou", have been proved to be of Devonian age. Conglomerates occurring at some distance below should be correlated with the main conglomerate level of the Cambro-Ordovician of the Pyrenees.

PREVIOUS PUBLICATIONS

The conception of the stratigraphic position of the limestones bounding the Marimaña granodiorite (fig. 1) varies considerably. Early authors such as Bertrand (1907) and Dalloni (1930) considered these limestones to be Devonian. More recently, de Sitter (1954a, 1954b), Snoep (1956), Kleinsmiede (1960) and Zandvliet (1960) correlated these limestones with the Cambro-Ordovician "Calcaire métallifère" or "Calcaire de Bentaillou", a limestone developed in a narrow E-W trending zone occurring in the eastern part of the Garonne dome and the northern flank of the Salat-Pallaresa anticlinorium (Central anticline). Kleinsmiede clearly proved that in the Garonne dome this limestone always occurs below the main conglomerate level. Along the north flank of the Salat-Pallaresa anticlinorium, investigated by Zandvliet, this conglomerate level is only developed very locally, but if present, as in the Ossès valley, the "Calcaire métallifère" also occurs below this conglomerate.

The limestones cropping out around the Marimaña granodiorite clearly occur above a well-developed conglomerate level, but in view of their lithological similarity (fig. 3A) de Sitter, Snoep, Kleinsmiede and Zandvliet nevertheless correlated these limestones with the "Calcaire métallifère". Moreover Snoep stated that the limestones were certainly of Ordovician age as they obviously underlay the black Silurian slates of the Pla de Bérêt. The occurrence of a conglomerate below these limestones was not considered by Zandvliet as counter-evidence, since this author did not regard the conglomerates as generally correlative rock units.

NEW OBSERVATIONS

The very constant occurrence of one level of coarse conglomerate, observed by the author in the Segre and Valira valleys and which is also described in many other areas of the Pyrenees (Cavet, 1957; Clin, 1959; Kleinsmiede, 1960; de Sitter & Zwart, 1962; Mirouse, 1966; Brouwer, 1968; Bloemraad, 1969; Trouw, 1969) is in contradiction with Zandvliet's observation of a second level of coarse conglomerate in the Marimaña area. For this reason the author briefly investigated the stratigraphic relationship of the coarse conglomerates and the limestones in some key areas of this region.

In the area of the Pic de Moredo and the Cuenca roughly the same lithostratigraphic succession was found as shown in Zandvliet's column (fig. 3A), but some important details could be added. The con-

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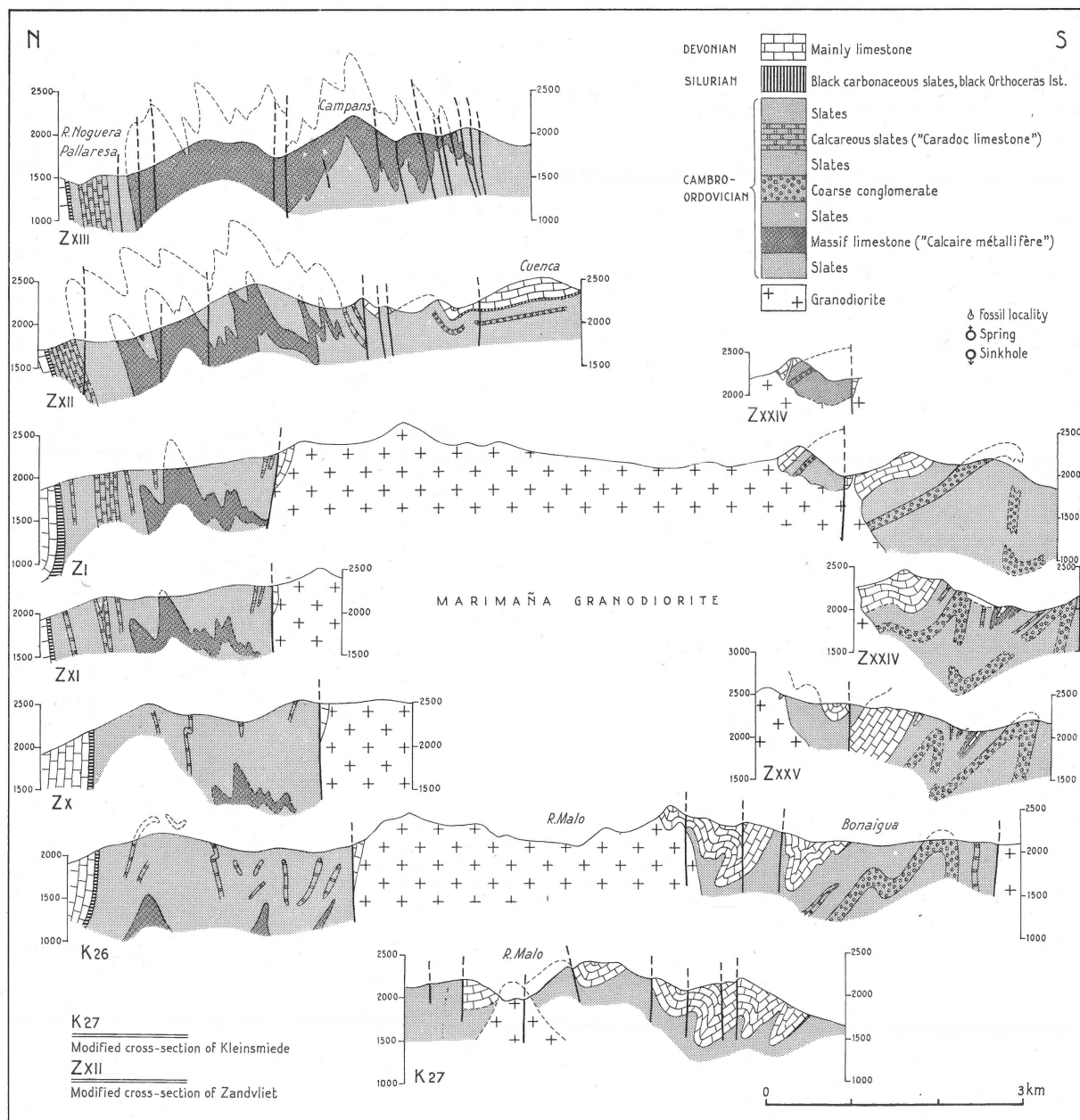


Fig. 2
Cross-sections of the Marimaña area modified after Kleinsmiede (1960) and Zandvliet (1960).

glomerate is often very well developed and can be very coarse with poorly rounded quartzite pebbles of up to 35 cm. (fig. 4), and could be mapped as lenses occurring exclusively at a level of about 50 m below the limestones. Above the conglomerate sandy slates

occur in which a thin layer of calcareous slates has been observed locally. On top of this succession black carbonaceous slates may be developed locally, above which a continuous narrow band of black limestones, not exceeding a few metres in thickness, was observed

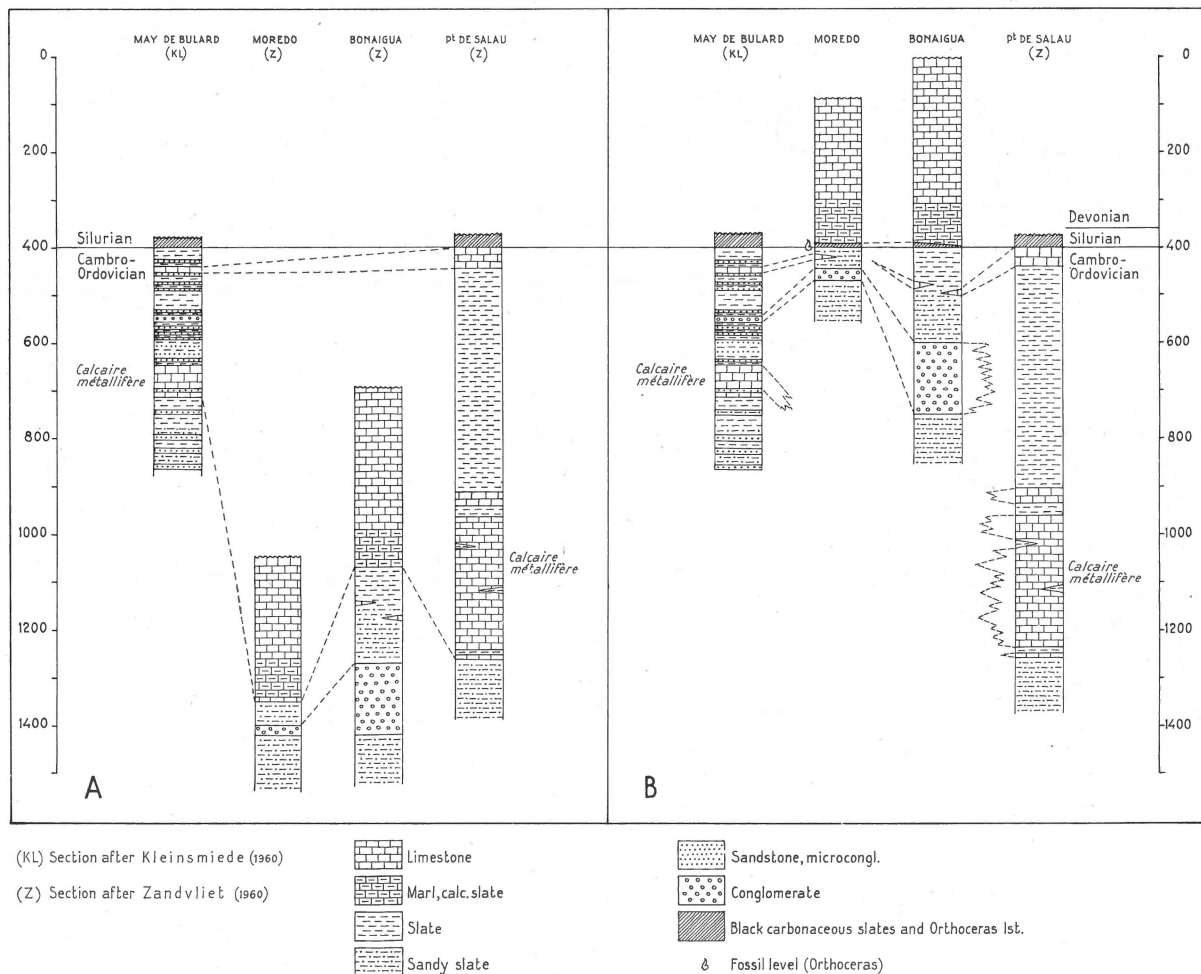


Fig. 3

Correlation of sections according to Kleinsmiede and Zandvliet (A) and the present author (B).



Fig. 4
Coarse conglomerate of the Cambro-Ordovician east of the Cuenca.

containing, at least locally, an abundance of orthoceras (fig. 5). The limestone sequence as described by Zandvliet rests on this black *Orthoceras* limestone.

In the area of the Puerto de la Bonaigua the succession is essentially the same, except for the *Orthoceras* limestone, which was not observed. In the limestones above the slate series, crinoide remains are abundant as was already recorded by Kleinsmiede. Below the limestones black carbonaceous slates can frequently be observed.

Moving west towards the valley of the Rio Garona de Ruda it can be observed that limestones, occurring at both sides of the valley around the Fuentes de Ruda, cannot be distinguished from one other and lie perfectly in each other's extension. Nevertheless, in his map Kleinsmiede indicated the limestones north-east of the valley as the Cambro-Ordovician "Calcaire métallifère" and those to the southwest as Basal limestone of the Devonian. Apparently the similarity of

these limestones was also observed by Kleinsmiede as he stated that the limestone southwest of this valley could conceivably also belong to the "Calcaire Métallifère". At both sides of the valley black carbonaceous slates occur below these limestones.

In the region of the Rio Malo and the Pla de Beret west of the Marimaña granodiorite, the massif limestones only locally dip away to the northwest below the slates in slightly overturned folds. There seems to be no reason for assuming that these limestone structures plunge away to the west below the black slates, as suggested by Snoep (1965). A correlation with similar limestones 500 m to the west overlying these slates and interpreted by Kleinsmiede as the Basal limestone of the Devonian seems more probable. Tracer experiments, carried out by Rijckborst (1967) in the karst systems frequently developed in these limestones, showed that all water of the Rio Malo, disappearing into the sinkhole at the contact



Fig. 5
Orthoceras limestone of the Silurian east of the Cuenca.

with the granodiorite, reappears from the springs in the same brook at the limestone slate contact to the west and that no connection exists with the Ruda and Algüaire springs down in the Garona valley as might be expected if these limestones were to plunge steeply to the west.

CONCLUSIONS

1. The black orthoceras limestone is a typically Silurian rock unit always underlying the Devonian of the Pyrenees. The occurrence of this rock unit below the limestones of the Pic de Moredo and Cuenca indicates that these limestones are of Devonian age.
2. The poor development of the black carbonaceous slates typical of the Silurian is a common feature of the Marimaña area as well as of the area west of it, and cannot be used as counter-evidence against a Devonian age for the limestones above.
3. There is no lithological difference between the limestones of the Marimaña area and the Basal limestone of the Devonian to the west.
4. Crinoide remains, found in these limestones, do not occur in the "Calcaire métallifère" of the eastern part of the Garonne dome and the north flank of the Salat-Pallaresa anticlinorium.
5. Limestones east and south of the Marimaña granodiorite structurally constitute a perfect continuation of the established Devonian rocks to the west.
6. The Cambro-Ordovician stratigraphy below the limestones is in complete correlation with the stratigraphy given by Kleinsmiede for the eastern part of the Garonne dome, except for the "Calcaire métallifère" which is not developed in the Marimaña area. There is no more need to assume an exceptional

second coarse conglomerate level, and the stratigraphic succession can also be correlated with most other sections of the Pyrenees. The thin calcareous slates, observed in the slate sequence above the conglomerate in the Moredo-Cuenca area and at the Puerto de la Bonaigua, are probably correlative with the well-known fossiliferous Caradocian limestone frequently observed in the Pyrenees.

7. The "Calcaire Métallifère" is restricted to a level below the coarse conglomerate.

The conclusions above clearly indicate the Devonian age of the limestones of the Marimafia area. The structural consequences of this reinterpretation of the stratigraphy are shown in modified sections of Kleinsmiede and Zandvliet (fig. 2). Corrections in the structures were only necessary in the Bonaigua area (Zandvliet's sections I, XXIV and XXV) where a large syncline developed in which some Silurian slates and Devonian limestones can be observed.

The "Calcaire métallifère" of the Campans north of the Marimafia granodiorite (Zandvliet's sections I and X to XIII) can be seen wedging out towards the south in the modified sections of fig. 2.

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