A TORTONIAN AGE FOR SEDIMENTARY ROCKS DIRECTLY OVERLYING VOLCANICS IN THE WESTERN PART OF LA SERRATA, NIJAR, PROV. ALMERÍA, SE SPAIN

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ABSTRACT

A well-preserved fauna of planktonic Foraminifera indicates a Tortonian age for a calcilutite directly overlying pyroclastic orthopyroxene-labradorite pheno-andesite. The rock series belongs to the autochthonous of the Betic Cordilleras.

INTRODUCTION

The Serrata is a shallow, SW-NE running mountain ridge, about 12 km in length and 1 km wide, situated approx. 30 km east of Almería (see fig. 1). To the north the Serrata is bounded by the plain of the Campo de Nijar, and to the south by the Los Albaricoques – Fernán-Pérez depression. The mountain ridge consists almost entirely of volcanites surrounded by overlying and off-dipping calcareous sedimentary rocks. The rock series, including both the sedimentary and the volcanic rocks, belongs to the autochthonous sequences in the Betic Cordilleras, postdating the supposed mise-en-place of the nappes, and have long been denoted as being of Miocene-Pliocene age[3]).

During a reconnaissance trip in the Serrata in the summer of 1966 one of the authors (Z) collected a few samples of volcanite and directly overlying sedimentary rock. In the laboratory the other author (S) found that one of the samples of sedimentary rock contained a rather extensive and well-preserved fauna of planktonic Foraminifera, providing valuable information regarding the age of the rock. Although the age is essentially the same as that given by other authors, e.g. C e l a (1968, p. 34-35), for the sedimentary rocks regionally overlying the volcanics in the Cabo de Gata region, the present authors thought it worthwhile to publish their data as the knowledge of the region is liable to benefit from another age determination on a rock sample of which the stratigraphic position is exactly known. The authors hope that this note will be of use to their Spanish colleagues who, forming a team headed by Prof.Dr. J.M. Fúster Casas of Madrid University, are currently engaged in an impressive investigation programme in the volcanic region of Cabo de Gata.

FIELD INFORMATION ON THE DESCRIBED SAMPLES

66 Z 27a – *calcilutite, foraminiferal mudstone*
66 Z 27b – *(?) diatomite*
66 Z 26 – *pyroclastic orthopyroxene-labradorite pheno-andesite*[4])

The samples were taken on the western side of the San José-Nijar road at km 14.950 (see fig. 1). At this

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[3]) Amid the volcanics of the Serrata, a few small, hitherto unrecorded, exposures of red-brown quartzite, gray phyllite and bluish-gray marble were encountered. (Lambert coordinates of a few exposures: 741.788-258.125; 741.325-258.175; 738.200-254.775). These metamorphic rocks are quite similar to, and for that reason a correlation is suggested with, "Triassic (and older?)" rocks of the pre-Tertiary basement, exposed north of the Campo de Nijar (cf. Z e c k, 1968, Ch. 2, p. 14). The relation with the surrounding Tertiary rocks could not be assessed exactly, but could very well be chiefly of a tectonic nature.

[4]) Magmatic rock names in this paper are according to S t r e c k e i s e n (1967).

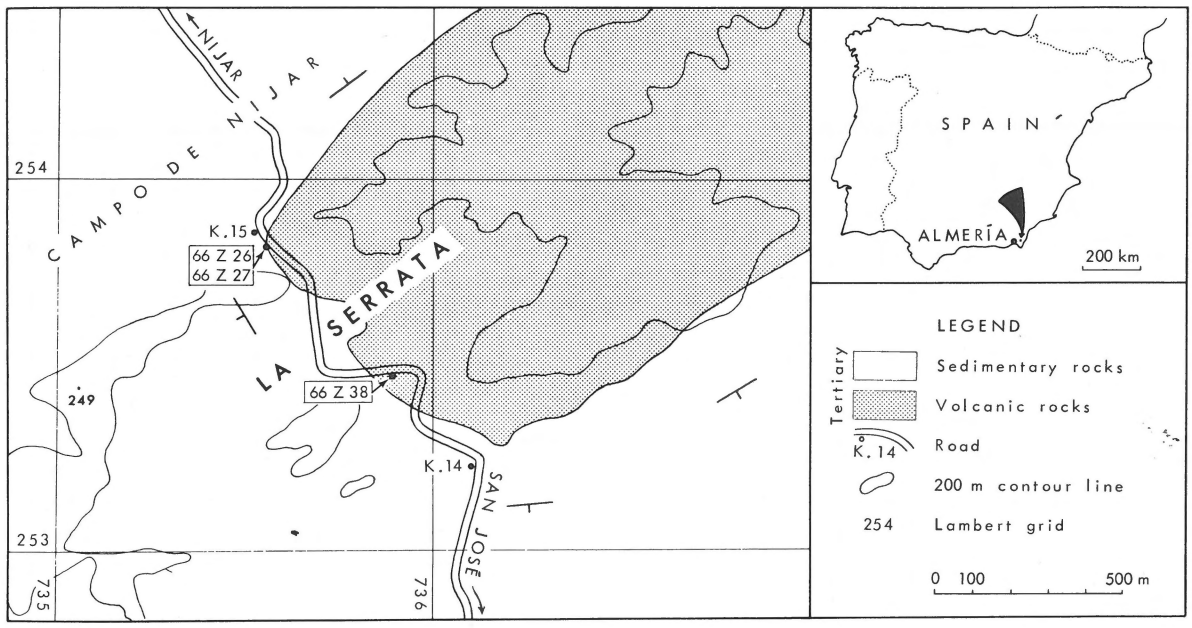

Fig. 1
Location of the described samples indicated on the geological sketch-map of the area, surveyed by H.P. ZECK in 1966. (Realizado de acuerdo con la Comisión Nacional de Geología: C.S.G. no. 845; 5-12-69).

location the sedimentary rock pile overlying the volcanic rock has a thickness of about 25 m. Up to about 1-2 m above the volcanite it consists of very light-coloured, powdery calcilutite (66 Z 27a, the very base of the sequence) in which locally in the basal part a discontinuous layer, about 1 dm thick, was found, consisting of well indured, beige coloured siliceous rock with a typical conchoidal fracture (66 Z 27b). Upwards, the calcilutite grades into a more compact rock, the topmost few metres of the section consisting of a compact limestone that forms small escarpments.

The volcanic rock (66 Z 26) consists of many dark-gray angular fragments (ϕ = 0.1-5 cm) in a greenish light-gray groundmass. The darker fragments are compact, more resistant to weathering and protrude slightly from the rock surface; roughly parallel -elongated vesicular cavities ($\phi \cong$ 1-3 mm) and further some whitish spots ($\phi \cong$ 1-2 mm) may be distinguished in them. Considering also the appearance in thin section, the rock may be classified as a tuff.

66 Z 38 – hornblende-bytownite pheno-andesite

The sample was taken on the western side of the San José-Nijar road (see fig. 1). It represents a compact greenish-gray rock with many black crystals of amphibole ($\phi \cong$ 1-10 mm) and a few quartz crystals ($\phi \cong$ 1-3 mm) dispersed in it. It is covered with a few dm thick conglomerate layer with rounded pebbles of the underlying type of volcanic rock. The volcanic rock just below the contact is fragmented and heavily weathered. The sedimentary rocks overlying the conglomerate are similar to those found above the soft calcilutite at the locality described above. It can be proved in the field that the sedimentary rock piles in both localities belong to the same lithological unit which only at its base may show some apparently varying development. The relation between the two types of volcanites could not be determined.

MICROSCOPICAL INFORMATION

66 Z 27b – (?) diatomite

The bulk of the rock is made up of (?)diatomaceous debris, and further contains a few Radiolaria, sponge spicules and planktonic Foraminifera.

66 Z 27a – foraminiferal mudstone

In thin section the rock appears to be a foraminiferal mudstone. Washed, the rock yielded a well-preserved fauna of planktonic and benthonic Foraminifera, Radiolaria, sponge spicules and echinid spines. The following species of planktonic Foraminifera have been identified:

Globorotalia acostaensis Blow
apertura Pezzani
pseudomiocenica Bolli and Bermúdez
scitula (Brady)
Globigerina bulloides d'Orbigny
decoraperta Takayanagi and Saito
falconensis Blow
globorotaloidea Colom
microstoma Cita, Silva and Rossi
nepenthes Todd
"woodi" Jenkins
Globigerinoides obliquus Bolli
trilobus (Reuss)
Orbulina suturalis Brönnimann
universa d'Orbigny
Globigerinita glutinata (Egger)

Age indicated by the fauna

The co-occurrence of *G. acostaensis, G. pseudomiocenica* and *G. nepenthes* in the sample indicates a Tortonian or younger age for the investigated fauna (cf. B a n n e r and B l o w, 1967; C i t a et al., 1965; B o l l i, 1966; B o l l i and B e r m ú d e z, 1965).

The upper age limit of the fauna is more difficult to fix. The fact, however, that species such as *Globorotalia inflata* (d'Orbigny) and *G. hirsuta* (d'Orbigny) which are quite common in Mio-Pliocene strata from SE Spain are lacking, is taken to indicate that the fauna is not younger than B a n n e r and B l o w's (1965) zone N 16. This would imply that the age of the fauna can be fixed within narrow limits, viz. as Tortonian.

66 Z 26 – pyroclastic orthopyroxene-labradorite pheno-andesite

The fresh dark fragments seen in the hand-specimen consist of a groundmass (80) with phenocrysts of plagioclase (15) and orthopyroxene (≤ 5). Estimated vol %% are given in brackets. The *groundmass* consists of glass with microlites ($\phi \cong$ 1-60μ) of plagioclase and rarely of orthopyroxene. It shows a conspicuous flow structure indicated by contrasting brownish and colourless bands and schlieren, of which the former have smaller (and fewer?) microlites. Preferentially in the brown parts perlitic cracks are beautifully developed (see fig. 2). Some fine-grained opaque alteration products mark the perlitic cracks in some fragments. The *plagioclase* phenocrysts ($\phi \cong$ 0.25-2 mm) are euhedral and show a complex, largely euhedral, zoning. Composition is in the range An_{75-50} [5], the outer zones having An_{60-50} Small aggregates consisting of a few plagioclase crystals and a very occasional crystal of orthopyroxene were observed. The *orthopyroxene* phenocrysts are euhedral and range in length from about 0.5 to 1.5 mm. Usually they are partly replaced by carbonate. For the rest the fragments appear virtually unaltered.

The "softer material" between the angular fragments just described has a mineralogical composition similar to these fragments, except for the absence of orthopyroxene and the abundance of fine-grained alteration products, among others, white mica(-like) and chlorite(-like) minerals. However, there is an apparent contrast in structure: in the "softer material", flow structure is absent, perlitic cracks are absent, and the plagioclase is only present in highly angular grains. It is concluded that the "softer material" arises from the material of which the angular fragments are composed, by fragmentation and pulverization in connection with the eruption, thus witnessing the pyroclastic nature of the rock.

66 Z 38 – hornblende-bytownite pheno-andesite

The rock is strongly altered. Before the alteration took place the rock presumably consisted of a groundmass (60) with phenocrysts of biotite (< 5), hornblende (15), plagioclase (20) and quartz (< 5). Estimated vol %% are given in brackets. The *groundmass* of the rock is very fine-grained ($\phi \cong$ 1-30 μ), but holocrystalline, chiefly consisting of colourless minerals presumably mainly quartz and feldspar; probably it has mainly been formed by devitrification of a

[5]) Anorthic contents of plagioclase given in this paper have been determined with the universal stage, using the HT curver of B o r d e t (1963).

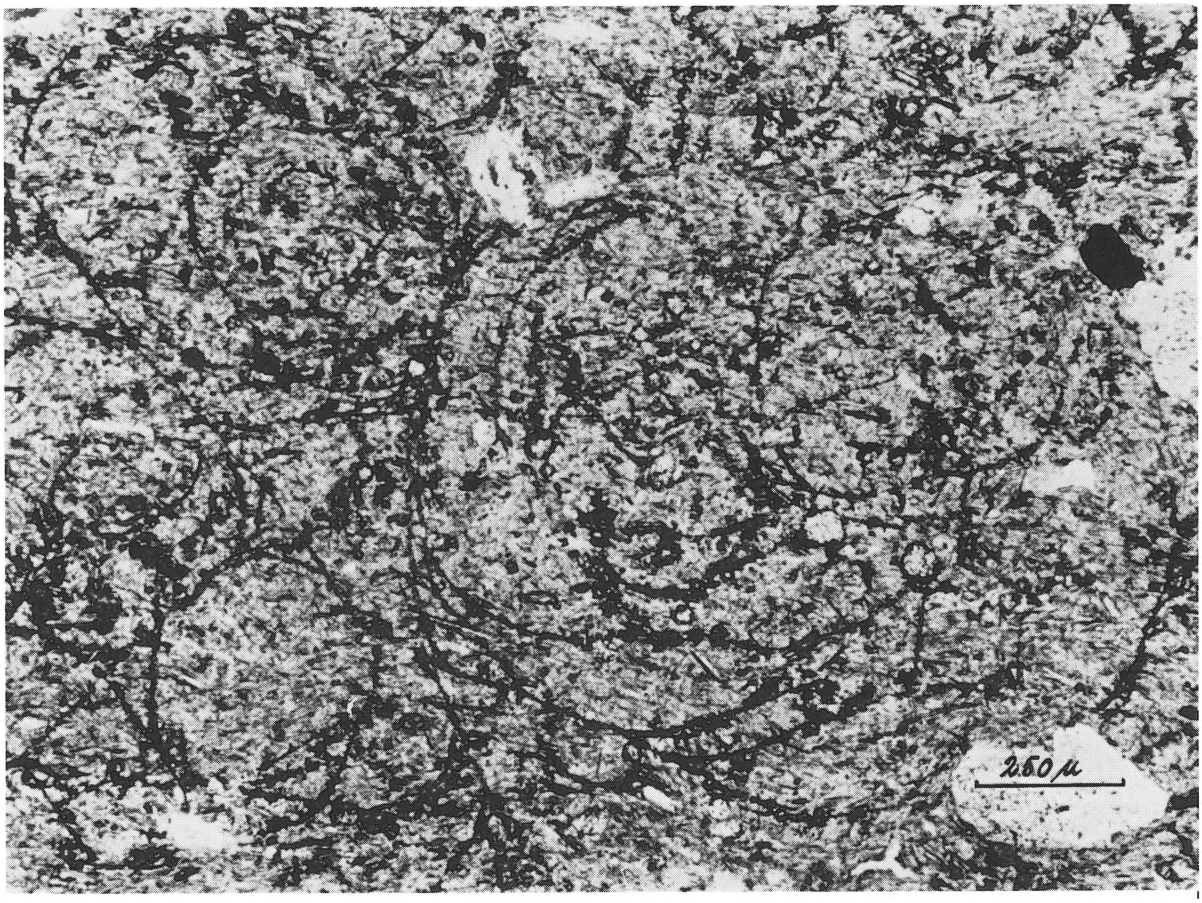

Fig. 2
Perlitic cracks (marked by some fine-grained opaque alteration products) in a compact fragment from the pyroclastic orthopyroxene-labradorite pheno-andesite. Plane polarized light.

glass-rich groundmass. Further minerals observed in the groundmass: apatite, brown-green micaceous material with moderate birefringence (and often forming rosettes), carbonate, opaque material, red-brown iron compounds, and zircon. Some of these minerals are alteration products. The plagioclase phenocrysts ($\phi \cong 0.2$-7 mm) are euhedral, show oscillatory zonal structure and have a rather calcic composition, An_{87-77}, for the bulk of the crystals. A very thin mantle with normal zoning ($\cong An_{70-50}$) completes the crystals. Many crystals are largely replaced, mainly by calcite, the brown-green micaceous mineral mentioned above, and very fine-grained brown material. In many crystals decomposition is most manifest at the crystal margins or in the core or certain compositional zones. The *hornblende* crystals, varying in length from about 0.5 mm to 10 mm, are pleochroic in brown to green colours. Many crystals are partly replaced, mainly by biotite or a biotite-like mineral. Brown to yellowish pleochroic *biotite* is (further present) in euhedral flakes ($\phi \cong 0.5$-2 mm), which have suffered little or no alteration. Except in the groundmass, *quartz* occurs in phenocrysts ($\phi \cong 0.5$-3 mm), the outlines of which may be very irregular.

CONCLUSIONS

Considering its pyroclastic nature, and the Tortonian age of the directly overlying sedimentary rocks, it is concluded that the orthopyroxene -labradorite pheno-andesite in the western part of the

Serrata has a Tortonian or older age. With some restriction the same is true for the hornblende -bytownite pheno-andesite, adjacently exposed.

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