

STRATIGRAPHY OF THE NEOGENE-QUATERNARY PULPI BASIN, PROVINCES MURCIA AND ALMERIA (SE SPAIN)¹

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ABSTRACT

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Within the mainly clastic sediments of the Neogene-Quaternary Pulpi Basin several transgressions are recognized: a Late Burdigalian, a Langhian, a Late Langhian-Serravalian, a Tortonian, an Early Messinian, and an Early Pliocene transgression. Each of these transgressions is preceded by either a phase of structural deformation, erosion, a hiatus and/or by deposition of red-bed sediments. No evaporitic Messinian sediments are exposed; at the southwestern border of the Pulpi Basin, however, an erosional and slightly angular unconformity is present between marine Late Messinian marls and fine-grained marine Early Pliocene deposits.

Evidence is provided for considerable horizontal displacements along the sinistral 'Aguilon' wrench-fault which disrupts the Sierra Cabrera and the Sierras de Almagrera-Almenara, during Serravalian, Tortonian, and Messinian times. In and since the Pliocene only minor faulting occurred. During the Pliocene-Pleistocene regression a conglomeratic massflow dominated shallow-marine fan-delta prograded from the north to the south in the Pulpi Basin. In the adjacent Vera Basin this delta system it was subsequently diverted in a westerly direction.

INTRODUCTION

This paper summarizes a Masters thesis (VEEKEN, 1979) presented to the University of Amsterdam. It forms part of the Neogene Basin Project, which focuses on Miocene-Pliocene sedimentation in the western Mediterranean region and which is carried out by the Department of Stratigraphy and Paleontology of the Geological Institute, University of Amsterdam.

The main objectives of the present study were:

- to map and describe the Tertiary-Quaternary fill of the Pulpi Basin
- to establish relations with sedimentation patterns in the adjacent Albox and Vera Basins
- to reconstruct the paleogeography of the area.

STRUCTURAL FRAMEWORK

Setting (Fig. 1)

The Pulpi Basin is part of a system of interconnected intermontane Neogene basins situated in the internal zone of the Betic Cordilleras (SE Spain). The structural framework of the basin is formed by Alpine nappes, consisting of three allochthonous pre-Neogene rock units: the meso-metamorphic Nevado-Filabride Complex, the epi-metamorphic Alpujaride Complex and the non-metamorphic Malaguide Complex. These basement rocks crop out to the north in the Sierra de Enmedio, to the southwest in the Sierra de Almagro and to the east in the Sierras de Almenara-Almagrera.

In the south the Pulpi Basin is connected to the Neogene Vera Basin, which has been described by VÖLK & RONDEEL (1964), VÖLK (1967), and MONTENAT ET AL. (1976). The sedimentation pattern of the Vera Basin extends logically into the southern part of the Pulpi Basin. On the northwestern side and in the centre of the basin, however, there is a change in sedimentation pattern and there it is similar to that of the adjacent Albox Basin, described by DUBELAAR & VISSERS (in prep.).

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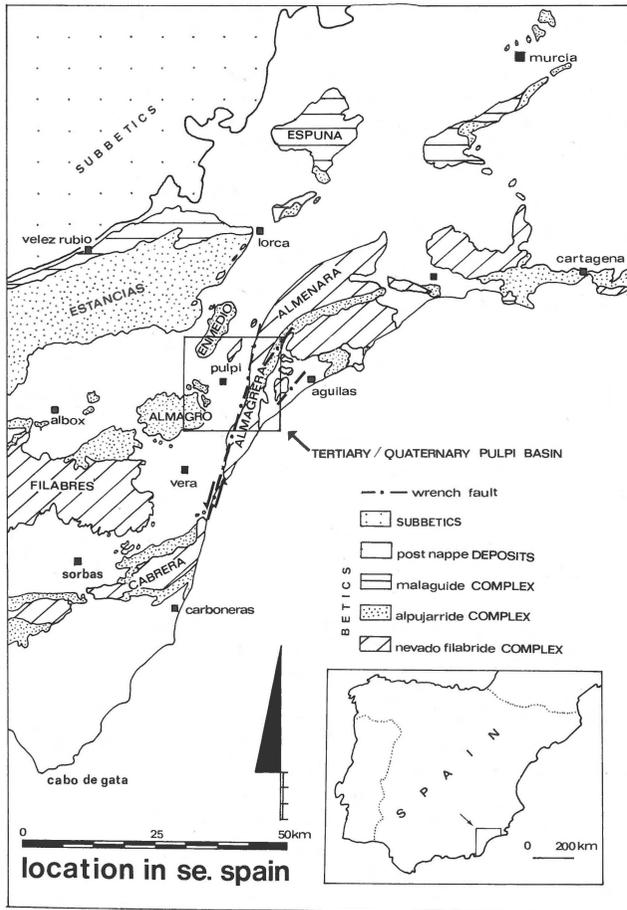


Fig. 1
Location map of the Neogene-Quaternary Pulpi Basin.

General evolution of the basin (Figs. 1 and 2)

After the emplacement of nappes ceased in the Aquitanian-Burdigalian, wrench faulting and vertical tectonic movements were largely responsible for the formation of the intermontane Neogene basins in southeastern Spain (HERMES, 1978; vÖLK, 1967). Only a few isolated remnants of the Early Neogene basinfill (Burdigalian-Serravalian) crop out along the uplifted southern border of the recent Pulpi depression.

A Tertiary N-NNE trending, sinistral wrench fault between the Sierra Cabrera in the south and the Sierras de Almenara-Almejrera in the north with an offset of some 20 km (vÖLK, 1967; BOUSQUET ET AL., 1975), is responsible for a major change in tectonic trend of the pre-Neogene metamorphic rocks of the Betic Cordilleras in the eastern part of the studied area. For this wrench fault the name Aguilon-wrench fault is here proposed. Wrench faulting probably started in the Early to Middle Miocene, since in the adjacent Aguilas Basin Langhian and Serravalian sediments are intensely imbricated with metamorphic basement rocks. A phase of strong tectonic activity between the Serravalian and Tortonian has been reported from all over the Betic Cordilleras (e.g. MONTENAT, 1977).

Towards the end of the Middle Miocene, continental conditions were established in the Pulpi Basin. During the Tortonian a phase of wrench faulting was followed by marine sedimentation. At that time large areas of southeastern Spain were covered by the sea; sea-arms were separated from each other by mountain ridges and islands (cf. MONTENAT ET AL., 1976).

At the end of the Tortonian, local deformation and erosion were followed by an Early Messinian transgression. In the southern and southeastern part of the Pulpi Basin, as in the Vera and adjoining Sorbas basins, this is expressed by an angular unconformity or a non-depositional hiatus. In the northern part of the basin, as in the Albox Basin, there was no such deformation and/or erosion. In the north, the marine Tortonian and Messinian sediments form one lithostratigraphic unit, which shows a large scale thinning and fining upwards tendency, pointing to continuous transgression and/or decrease in sediment supply.

A considerable offset along the Aguilon wrench fault during the Late Miocene is indicated by the distribution of Tortonian and Messinian sediments in a rather narrow, intensely tectonized zone which deeply indents the basement of the Sierra del Aguilon. At the extreme southwestern margin of the Pulpi Basin (Sierra de Almagro) a slight erosional and angular unconformity is exposed between marine Late Messinian and marine Early Pliocene deposits in the 'La Asperilla' section (Fig. 6). The Plio-Pleistocene sediments form a regressive, coarsening upwards sequence in which the upper layers display a continental character similar to the younger Quaternary deposits.

LITHOSTRATIGRAPHY (Figs. 2, 3 and 4)

Introduction

Based on their composition the deposits in the southern part of the Pulpi Basin can be roughly divided in two groups:

- Burdigalian to Serravalian sediments with only epi- and non-metamorphic rock fragments derived from the Alpujarride and Malaguide Complexes
- Tortonian and younger sediments with, in addition to the epi- and non-metamorphic rock fragments, important quantities of meso-metamorphic debris derived from the Nevado-Filabride and/or the base of the Alpujarride Complexes.

These two groups are separated by an unconformity related to a period of strong deformation and erosion in the hinterland. The stratigraphy in this southerly part of the Pulpi Basin is quite similar to that of the Vera Basin, described by vÖLK & RONDEEL (1964), vÖLK (1967) and MONTENAT ET AL. (1976).

The lithostratigraphic succession in the northern part of the basin, however, is different and resembles that of the Albox Basin where the influx of meso-metamorphic detritus is gradual and is not accompanied by a major break in

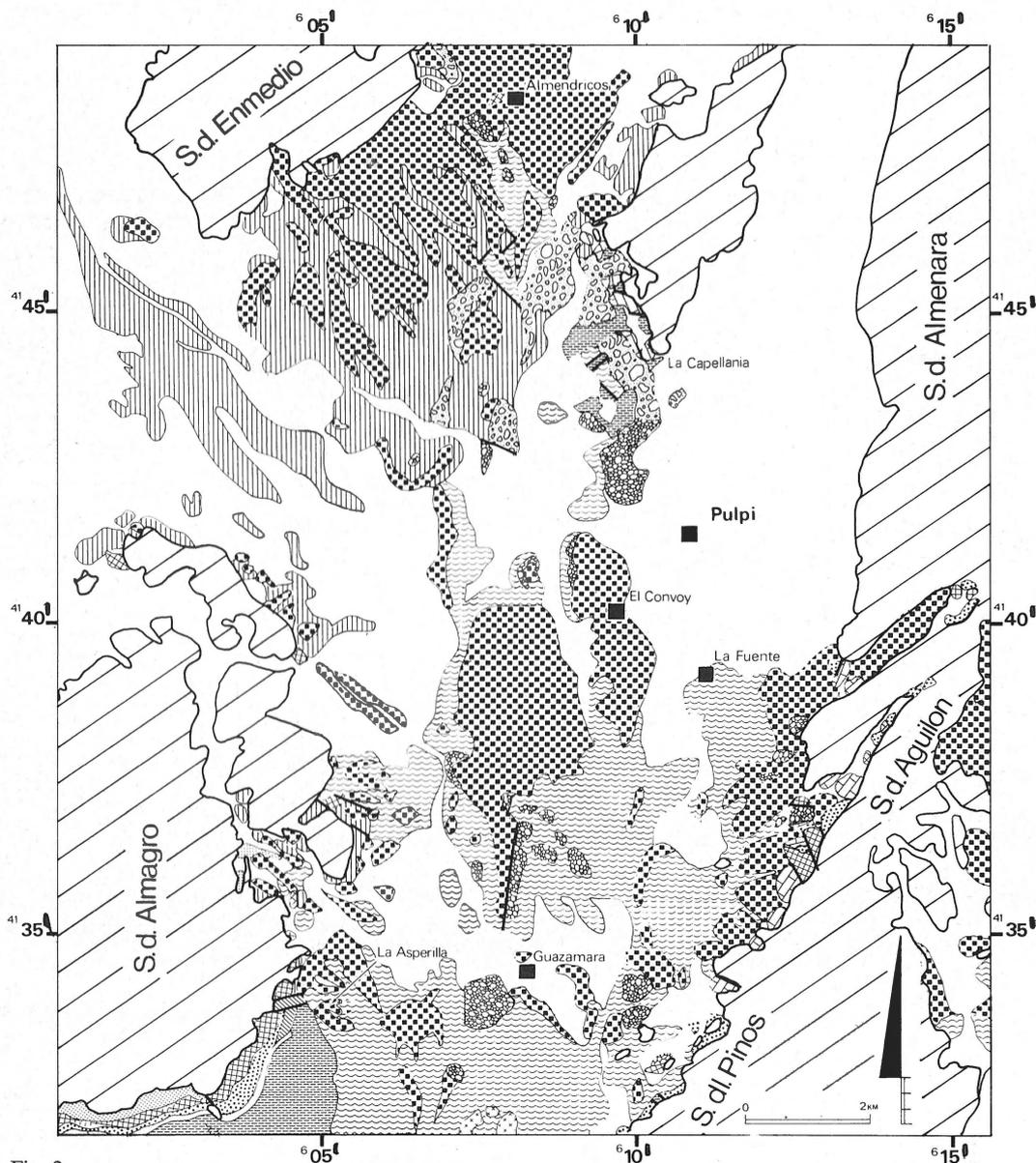


Fig. 2
Lithostratigraphic map of the Neogene/Quaternary Pulpi Basin (provinces Murcia and Almeria, SE Spain).
For map symbols see Fig. 3.

sedimentation; the redcoloured continental sediments (Serravalian-Tortonian) form one lithostratigraphic unit: the Abejuela member of the Taberno formation (DUBELAAR & VISSERS, in prep.).

The lithostratigraphic correlation diagram (Fig. 3) shows also that in the south an erosive phase at the end of the Tortonian was followed by an Early Messinian transgression. The latter is reflected in the presence of shallow marine Azagador Member deposits at the base of the Turre Formation (cf. VÖLK & RONDEEL, 1964). There is no such unconformity in the northern part of the Pulpi Basin, and the coarser marine Tortonian sediments thus pass gradually into finer grained Messinian deposits to form together the Huercal-Overa formation (cf. DUBELAAR & VISSERS, in prep.).

Burdigalian – Serravalian

The oldest basin deposits of Burdigalian to Serravalian age were not studied in detail because of the poor exposure and the isolated nature of the strongly tectonized outcrops along the southern rim of the Pulpi Basin. For a description of the Alamo, Gomara, Umbria and Mofar formations see VÖLK & RONDEEL (1964) and VÖLK (1967).

Serravalian – Quaternary

Chozas formation (cf. VÖLK & RONDEEL, 1964) The Chozas Formation overlies unconformably older Neogene deposits

South Pulpi-basin
 Vera
 Sorbas

North Pulpi-basin
 North Albox

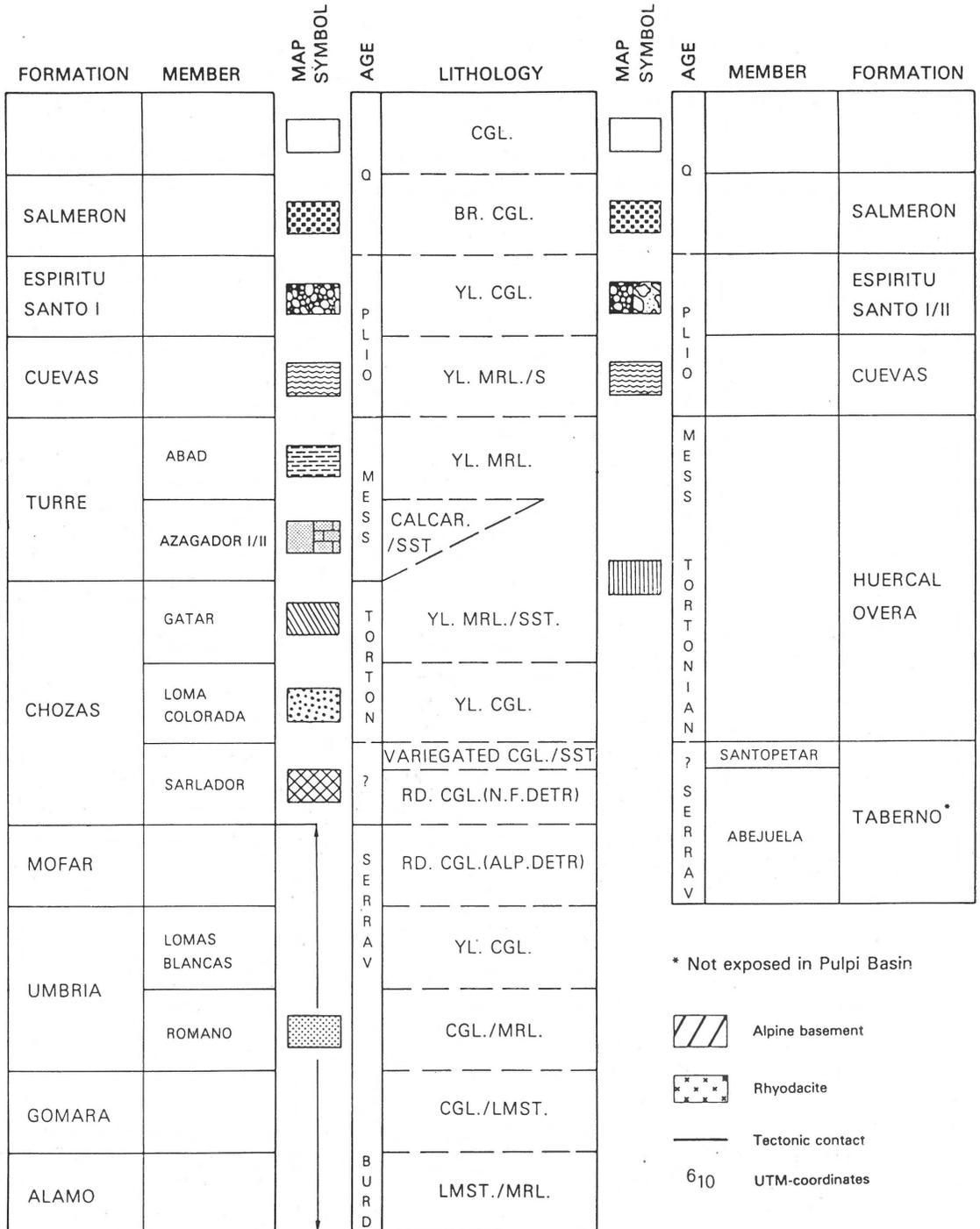


Fig. 3 Lithostratigraphic correlation diagram for the northern and southern parts of the Pulpi Basin, including explanation of map symbols used in Fig. 2.

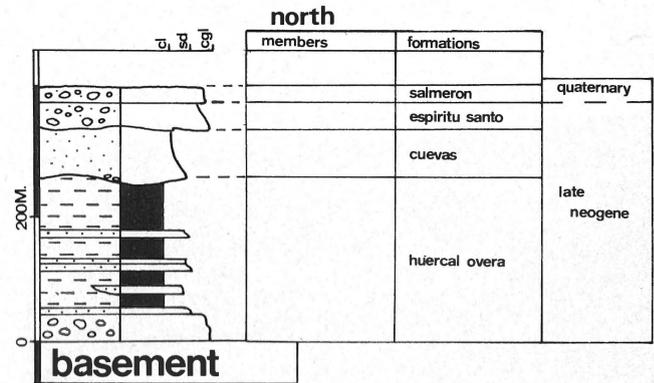
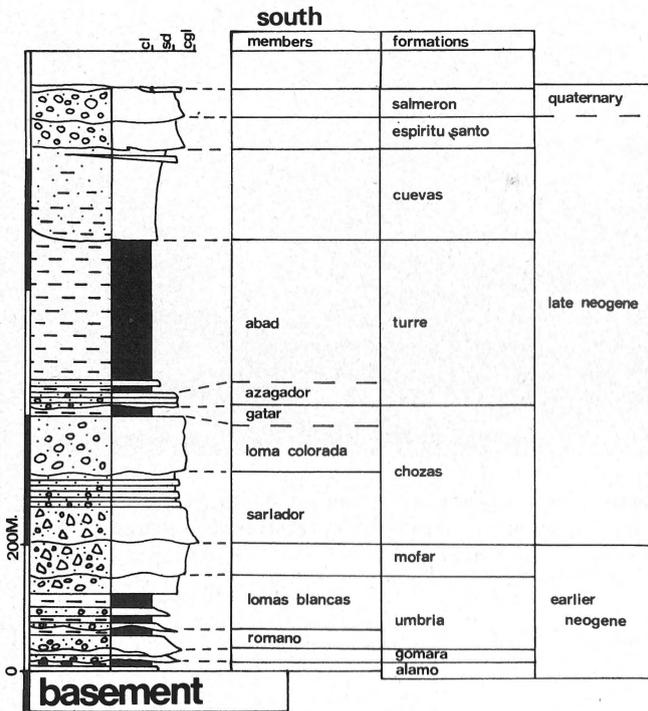


Fig. 4
Lithostratigraphic columns of the Neogene-Quaternary Pulpi Basin (SE Spain).

and metamorphic basement. As in the Vera basin, three members can be distinguished:

(1) Sarlador Member.

The base of this member consists of red sheet-like rhythmically alternating thick-bedded coarse (up to boulder size) conglomerates and pebbly sandstones, both with a high percentage of meso-metamorphic detritus. These poorly rounded and unsorted sediments are interpreted as debris flow deposits laid down in an alluvial fan complex. The sedimentology of these deposits resembles that of the Abejuela member (basal part of the Taberno formation; VISSERS, 1976, internal report, University of Amsterdam) in the adjacent Albox Basin.

The upper part of the Sarlador Member shows rapid litho-facies changes and is composed of gypsum-veined nonfossiliferous conglomerates, sandstones, and siltstones with a characteristic variety in colours. In the Albox Basin, similar sediments are exposed in the Santopetar Member (top of the Taberno formation) where they interfinger with the underlying continental Abejuela member (Fig. 3). The Santopetar member is overlain by the marine Huercal-Overa Formation of which the base is formed by an extensive mudstone with large oysters and ostracods (VAN HARTEN, 1975). This setting indicates for the Santopetar member a transitional depositional environment; a protected lagoon with possibly associated sabkha's (DUBELAAR & VISSERS, 1982, pers. comm.).

(2) Loma-Colorada Member.

The Loma-Colorada Member unconformably overlies the Sarlador Member. The 200 m thick Loma-Colorada sequence

is composed of poorly sorted yellow-brown marine conglomerates, pebbly sandstones, and foraminiferal marls. It displays rapid vertical and lateral lithofacies changes. In the basal part channelling and slumping occur frequently. The following macro-fossils are observed: oysters, balanids, and *Clypeaster*. These shallow marine fossils as well as bored pebbles are now found in slumped conglomerates which have slid down into deeper parts of the Tortonian marine basin. Consequently the poorly sorted sediments are interpreted as proximal submarine fan deposits laid down in the vicinity of the paleo-highs formed by the Sierras de Almagro-Los Filabres and the Almenara-Almagrera mountain range.

(3) Gatar Member.

The Gatar Member is only locally exposed at the extreme southwestern border of the Pulpi Basin. There it is represented by a 10 m thick foraminiferal marly sequence. These deep-marine deposits mark the final stage of the Tortonian transgression.

Turre Formation (cf. VÖLK & RONDEEL, 1964) As in the Vera and adjoining Sorbas basins (VÖLK, 1967; DRONKERT, 1976) the Turre Formation unconformably overlies the Chozas Formation and pre-Neogene basement rocks. In the Pulpi Basin two members (defined by VÖLK & RONDEEL, 1964) are present:

(1) Azagador Member.

The Azagador Member forms the coarser basal part of the Messinian Turre Formation and is represented by two distinct types of transgressive conglomeratic deposits:

– On the southwestern margin of the basin the Azagador sediments are only overlying the Chozas Formation. There they form a 30 m thick alternation of algal carbonates (*Lithothamnium*), silty marls, sandstones, and sandy conglomerates, which show a large scale thinning and fining

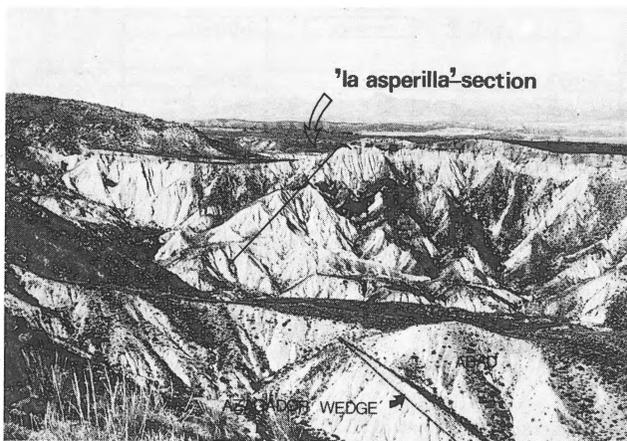


Fig. 5A
Pinch-out of the sandy Azagador Member (Turre Formation) in a northerly direction along the Sierra de Almagro. In the background the position is marked of the marine biostratigraphic 'La Asperilla' section, which covers the Miocene-Pliocene boundary. Height of cliff is approx. 150 m.

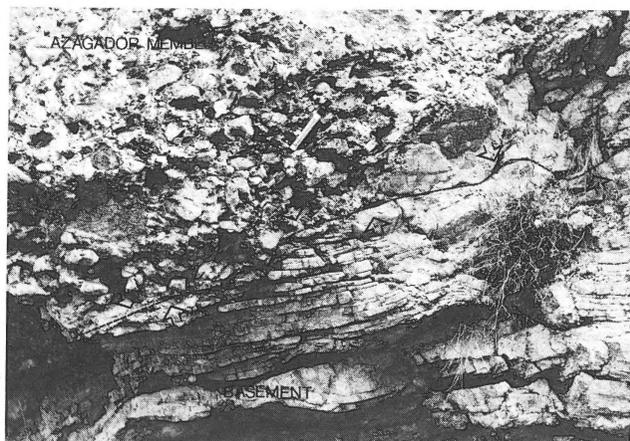


Fig. 5B
Sub- to well rounded basal conglomerate of the Azagador Member which unconformably overlies the pre-Neogene basement (150 m north of La Capellania).

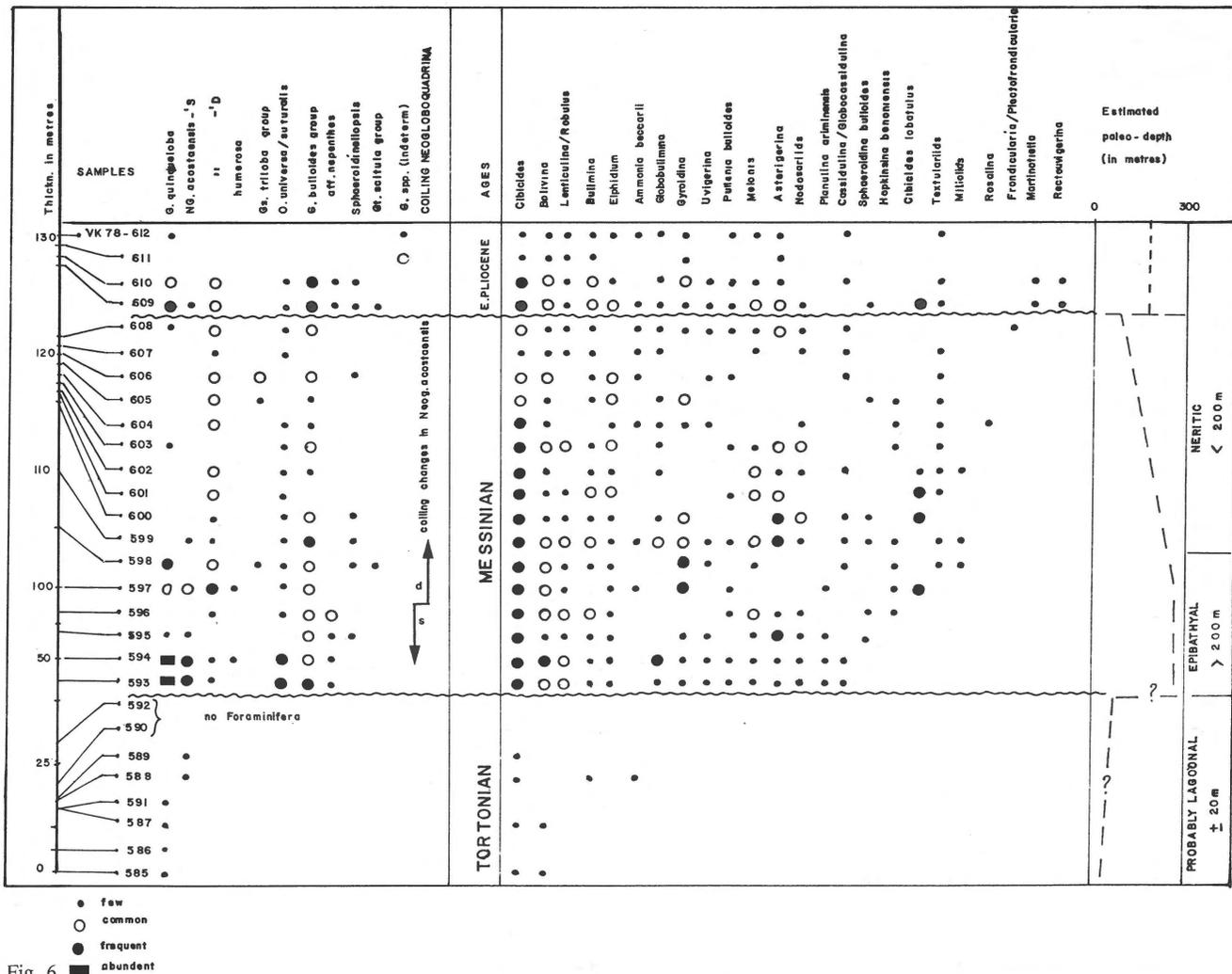


Fig. 6
The marine Mio-Pliocene biostratigraphic 'La Asperilla' section. The faunas were analysed by J. A. Manuputty (University of Amsterdam). For location see Fig. 5A.

upward tendency indicative for a progressive deepening. Towards the north these deposits pinch out and the Tortonian and Messinian marls cannot be separated lithologically; they are therefore taken together and form the top part of the Huercal-Overa Formation (Fig. 5A).

– On the eastern margin of the basin the Azagador Member is composed of extremely fossiliferous calcarenites and conglomerates of shallow-marine origin containing: *Ostrea*, *Chlamys*, *Pecten*, *Clypeaster* bryozoa and *Lithothamnium* (Fig. 5B).

(2) Abad Member

The Abad Member interfingers with the coarser Azagador Member and represents its deeper marine equivalent. It is a succession, more than 200 m thick, of pale greenish-yellow foraminiferal marls which alternate with siltstones and calcareous turbidite sandstones of distal origin (often with *Palaeodictyon*). The marls are in general homogenized due to intense bioturbation. The upper part of the Abad sequence consists of monotonous marls and lime mud laminites pointing to a further decrease in clastic sediment supply and lack of biologic activity on the basin floor.

The foraminifera in the 'La Asperilla Section', studied by Mr. Manuputty (University of Amsterdam), indicate a Late Tortonian to Early Pliocene age (Fig. 6). The Early Messinian marls in the basal part of the section were deposited in an epi-bathyal environment. During the Messinian sea level dropped considerably (cf. VAIL ET AL., 1977) while infilling of the basin continued. As a result the base of the Late Messinian represents an outer neritic, the upper part an inner neritic environment (MANUPUTTY, 1978). Probably tectonic movements contributed also to this shallowing at the end of the Messinian.

Huercal-Overa Formation (cf. DUBELAAR & VISSERS, in prep.) The Huercal-Overa Formation consists of marine deposits with a Tortonian to Messinian age. They are yellow-brown poorly-sorted conglomerates, pebbly sandstones, and foraminiferal marls which show strong lateral and vertical lithologic changes. The type locality of the formation is situated in the Albox Basin (VISSERS, 1976), where the sediments are interpreted as submarine fan deposits. These submarine fan deposits extend into the northwestern part of the Pulpi Basin where they display a more distal character.

The Huercal-Overa Formation overlies a relief formed by tectonized Tertiary sediments and metamorphic basement. Locally, small-scale, probably synsedimentary, tensional faults affected the substratum of the Sierra de Enmedio and created a basin floor topography which was infilled with marls and monomict breccias (Fig. 7). In the south, patches of monomict angular to subrounded basal conglomerates are observed directly overlying the basement of the Sierra de Almagro and giant low-angle foreset-beds are found on the metamorphic rocks northwest of Los Guiraos (marine onlap). The foraminiferal content of the basal part of the Huercal-Overa Formation indicates a Middle Tortonian age and an



Fig. 7

The marly and brecciated clastic infill of Tortonian age, which is here preserved in the broken-up substratum (Sierra de Enmedio), illustrates the sedimentary contact of relatively deep-marine deposits, onlapping on the Alpine basement.

original waterdepth greater than 200 m (MANUPUTTY, 1978).

Towards the top of the formation, the lithology becomes more and more dominated by turbiditic calcareous sandstones alternating with thicker pelitic intervals. This large scale fining-and-thinning-upwards tendency finally resulted in the deposition of monotonous marls of Messinian age. The latter are lithologically inseparable from the Messinian Abad Member marls in the southern part of the Pulpi Basin.

In general the bulk source area of the submarine fan deposits must be located in the adjacent Albox Basin, although there was also minor local sediment input from the margins of the Tortonian Pulpi Basin. A detailed description of the sedimentology of the Huercal-Overa Formation will be given by DUBELAAR & VISSERS (in prep.).

Cuevas Formation (cf. VÖLK & RONDEEL, 1964) Near the margin of the Pulpi Basin the Messinian marls are unconformably overlain by the marine Early Pliocene Cuevas Formation. This unconformity is exposed in the 'La Asperilla section' (Fig. 6), where an erosive sandy layer marks the start of the Early Pliocene marine sedimentation, for which the microfauna reveals an outer neritic environment (MANUPUTTY, 1978). This points to a rapid deepening of the southern part of the basin before or during the initial Early Pliocene marine transgression.

The Cuevas Formation is mainly built by an alternation of yellowbrown and greyish coloured sand-, siltstones, and clayey marls. Occasionally poorly sorted conglomeratic beds are intercalated, which often display slump features. The sediments are rich in micro- and macro-fossils with frequent occurrence of: *Ammussium*, *Chlamys*, *Ostrea*, *Pecten*, gastropoda *Serpula*, balanids, ostracods and foraminifera. The sedimentary structures are usually heavily disturbed by intense bioturbation. Towards the top of the Formation the sediments show a coarsening upward trend: conglomeratic

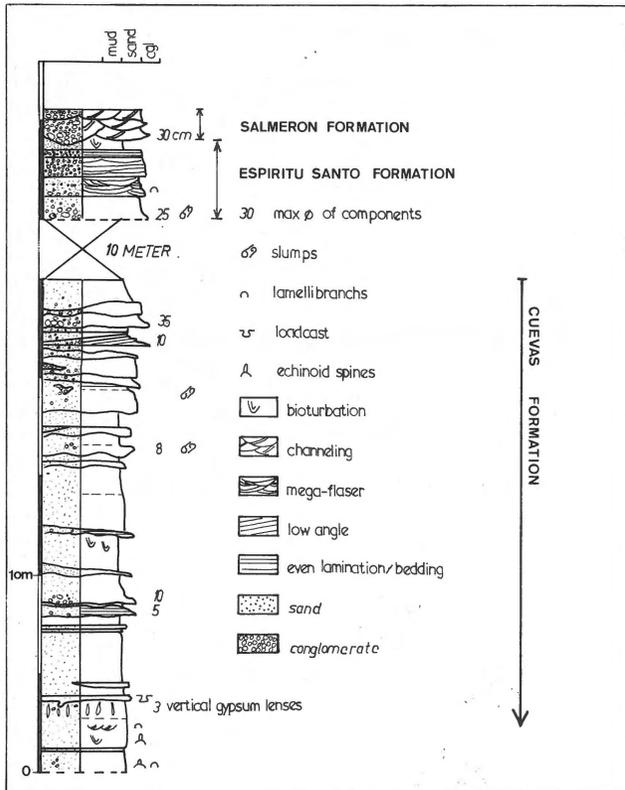


Fig. 8 Plio-Pleistocene lithologic section showing a regressive shallowing-upward sequence. Location: approx. 1 km west of Pulpi along the road to Huercal-Overa.

layers become thicker and more prominent, thus underlining the start of the Pliocene regression.

The Cuevas Formation passes gradually into the regressive shallow-marine deposits of the Espiritu-Santo Formation (Fig. 8).



Fig. 9A Giant-foresetted (maximum height elsewhere in the basin 15 m) conglomerates of the Espiritu-Santo Formation, deposited in a mass-flow dominated fan-delta, exposed along the Huercal-Overa/Puerto Lumbreras railroad track (1 km west of Almendricos). Note hammer for scale.

Espiritu-Santo Formation (cf. VÖLK & RONDEEL, 1964) The Espiritu-Santo Formation interfingers with the underlying Pliocene Cuevas Formation. Locally there is an unconformable contact. The Espiritu-Santo Formation is composed of yellow-grey conglomerates with a minor quantity of intercalated sand- and siltstones. The deposits generally show large-scale sedimentary structures. The presence of thick-shelled *Ostrea*, *Pecten* fragments, balanids, *Serpula*, and also the stratigraphic setting of the Formation, capped by the continental Salmeron Formation, indicates a transitional depositional environment. The sediments are interpreted as fluvio-marine and beach deposits.

The Formation exists of the following two lateral-equivalent units:

(1) Espiritu-Santo I

In the Espiritu-Santo I yellowish-grey, wellrounded conglomerates, locally very rich in quartz-pebbles, are associated with some sandstone layers and siltstones that contain plantremains. These deposits show the following sedimentary structures: giant S-SW dipping foreset beds, formed in a Gilbert-type fan-delta dominated by mass-transport (cf. POSTMA, 1980; Fig. 9A); slumps; mega-flasers and even-laminations representing shallow-marine near-shore and beach deposits (cf. wave-built structures in a Messinian coastal sequence from the Sorbas Basin, ROEP ET AL, 1978).

(2) Espiritu-Santo II.

In this unit poorly sorted coarse (up to boulder size) and also fine yellow-grey conglomerates are laterally associated with channelized sandy conglomerates and sandstones. In the top of the sequence channelling occurs frequently. Based on detritus (local source-area) two types of deposits can be recognized and a lobe in which grey phyllite fragments are dominant; a lobe with an important amount of green diabase components, derived from the Sierra Enmedio in the north. Both sequences are interpreted to have been deposited in a prograding fluvio-marine fan-delta.

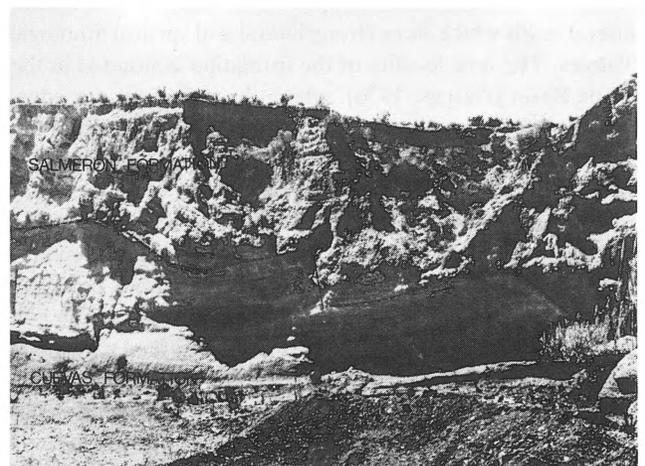


Fig. 9B Folded Pliocene marls truncated by slightly tilted fluvial channel deposits of Quaternary age in an exposure 2 km south of El Convoy.

Salmeron Formation (cf. VÖLK & RONDEEL, 1964) The regressive phase, which already started during the Pliocene, finally resulted in the deposition of continental Plio-Pleistocene conglomerates which built the Salmeron Formation. Before the Salmeron-floodplain was formed the basin-deposits were tilted and eroded; in the Rambla de las Canalejas slightly tilted Salmeron conglomerates overlie gently folded Cuevas-marls (Fig. 9B). The Salmeron Formation is composed of red and grey, tightly packed, poorly rounded and poorly sorted conglomerates which alternate with some sand- and siltstones. Caliche-deposits are sometimes intercalated. Channeling and pebble-imbrication frequently occurs. The general transport-direction is towards the southeast.

The Salmeron-conglomerates are interpreted as braided stream, alluvial fan, and caliche deposits; they are quite comparable to recent so-called 'barranco' deposits (braided stream). The Salmeron conglomerates are distinct from the latter in that they are still regionally tilted, affected by faulting, and usually by a more intense red colouring.

RELATIONSHIP WITH ADJACENT NEOGENE BASINS

In the Aguilas Basin (Fig. 1) marine Langhian and Serravalian sediments are directly and unconformably overlain by fossiliferous Early Pliocene deposits (cf. MONTENAT ET AL., 1978). These Langhian and Serravalian sediments are intensely affected by fractures and are exposed in the so-called 'mixture'-zones, which were earlier described as 'Olistolithes' by MONTENAT ET AL. (1978).

In these mixture-zones, Neogene deposits are imbricated with metamorphic basement rocks. In the southern part of the Aguilas Basin (Terreros area: Isla Negra and Cala Reona) andesitic volcanic rocks are exposed that are comparable with those found much further south in the Cabo de Gata and Carboneras area which are dated by BELLON ET AL. (1976) between 15.5 and 12.3 Ma. It is assumed that the origin of these mixture-zones is related to the strong post-Serravalian tectonic deformation phase (cf. MONTENAT ET AL., 1976), that was responsible for an important horizontal displacement along the Aguilon wrench fault structure and the extinction of volcanic activity in the Aguilas Basin.

This major strike-slip tectonic line has separated the Aguilas and Pulpi basins from Late Miocene times onward, as indicated by the following characteristics of the Aguilas Basin:

- lack of Miocene red-bed sediments;
- no marine Tortonian and Messinian deposits;
- a degenerated shallow-marine Pliocene fauna.

In the Vera Basin, as in the Pulpi Basin, there are indications for important tectonic wrench fault movements at the end of the Messinian (VÖLK, 1967). Southwest of Garucha, Azagador Member sediments are steeply dipping (85°) and here also the SW-NE strike, displayed by the southern rim of

the Vera Basin is suddenly changed in a N-NE direction. The older Neogene deposits are even more severely affected by this tectonic feature which is interpreted as tear along the sinistral wrench fault running between the Sierra Cabrera and the Sierras de Almenara-Almagrera. Along the 'Palomares-fault' (BOUSQUET ET AL., 1975), most probably a conjugate of the Aguilon wrench fault, no important sinistral horizontal component is observed in the Pulpi Basin.

In the Albox and Vera basins, as in the Pulpi Basin thick rhythmical evaporitic sediments of Messinian age are also absent. In the Vera Basin (Cuevas del Almanzora section) the presence of the fossils *Chara* and *Cyprideis* in the top of the Messinian marls indicates a short interval of non-marine deposition before the Early Pliocene marine sedimentation sets in (GEERLINGS ET AL., 1980). For the same sediments MONTENAT ET AL. (1976) describe a sudden change in the composition of the clay-minerals, which coincided with the Mio-Pliocene boundary and which was caused by a higher rate of erosion in the hinterland. This period of non-marine deposition might be correlative with the evaporite and 'Lago-Mare' sedimentation (HSÜ ET AL., 1977) reported elsewhere in the Mediterranean, which is generally related to the Messinian salinity-crisis associated with a lowered sea level (GEERLINGS ET AL., 1980). The gradual transition of marine Miocene marls into non-marine 'Lago-Mare' marls and then into marine Pliocene marls could also point to a mere change in water composition in a basin of unknown extent (ROEP & VAN HARTEN, 1979).

The Pliocene regression in the Pulpi Basin is represented by shallow-marine and fluvio-marine deposits of the Espiritu-Santo Formation. The transport direction, indicated by giant foresets (metre scale; 40 m at the most) in the fluvio-marine conglomerates, is south-southwest (Fig. 10). In the Vera Basin, however, these deposits show a main westerly transport direction. VÖLK (1966c, 1967) therefore assumed the existence of a large source-area east of the present Mediterranean rim of the Vera Basin. As figure 10 suggests, it seems, however, more likely that the sediments of the Espiritu-Santo Formation in the Vera Basin are also derived from the north, passing through the Pulpi Basin, to curve around the Sierra de Almagro in a westerly direction. The southerly transport direction in the Pulpi Basin also is clear proof that the mountain range, formed by the Sierras de Almenara, -del Aguilon, -de los Pinos and -de Almagrera, already existed at that time and that it separated the Aguilas from the Pulpi basins. The draping of shallow marine Messinian deposits along the western side of this mountain range indicates that it even formed a high in Messinian times.

CONCLUSIONS

- The Tertiary basin fill is mainly composed of clastics.
- In the southern part of the Pulpi Basin, as in the Vera Basin, the sea transgressed in the Late Burdigalian, Langhian, Late

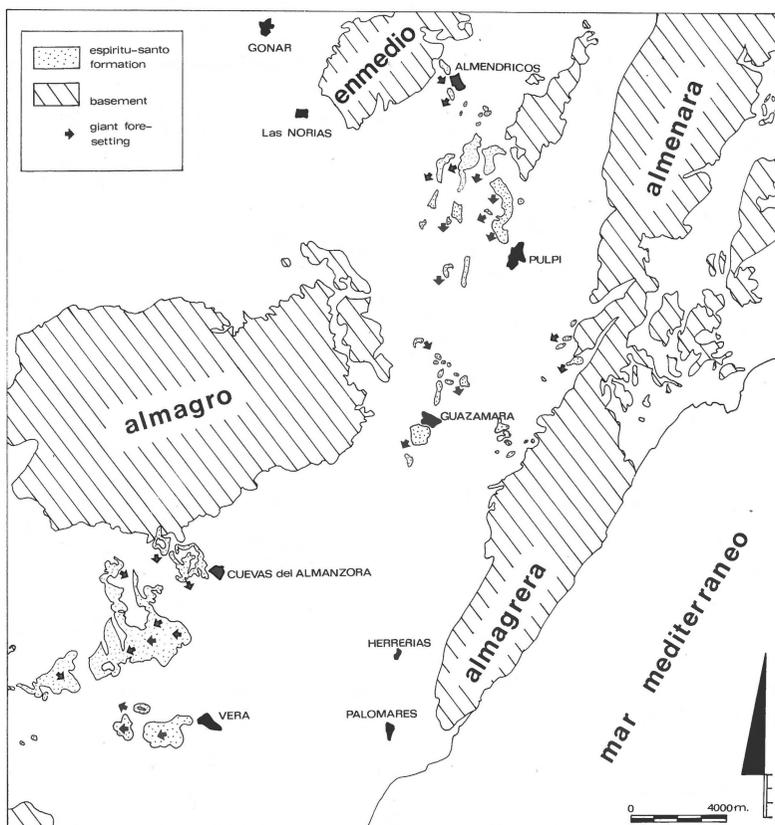


Fig. 10

The southerly oriented transport-directions of the Espiritu-Santo Formation in the Pulpi Basin and the westerly orientated directions, measured by völk (1966, 1967) in the adjacent Vera Basin, can be linked – this contrary to the opinion of Völk – by assuming a curving of the main sediment-supply around the Sierra de Almagro.

Langhian-Serravalian, Tortonian, Early Messinian and Early Pliocene.

– In the northern part of the basin, as in the Albox Basin, transgressions occurred in Tortonian-Messinian and Pliocene times.

– There were strong episodic movements along the sinistral Aguilon wrench fault, which offsets the Sierra Cabrera some 20 km from the Sierras de Almenara-Almagrera, at the end of the Serravalian, the Tortonian, and during the Messinian. During and since the Pliocene only vertical dislocation took place. This main tectonic alignment was responsible for the individualisation of Neogene Aguilas Basin from Tortonian times onward.

– At the extreme southern margin of the basin marine Messinian deposits are unconformably overlain by coarser marine Early Pliocene sediments; no evaporitic Messinian sediments are exposed.

– The provenance of the fluvio-marine Pliocene deposits from the Vera Basin must be located in the north; most material is brought in from the Pulpi Basin.

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