

Preliminary note on the structural setting of the central-southern Plio-Quaternary Campidano graben (Sardinia)

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RIASSUNTO

Nota preliminare sull'assetto strutturale della parte centro-meridionale del graben del Campidano (Sardegna)

Il graben del Campidano è, in Sardegna, la struttura più importante legata all'evoluzione geologica Plio-Quaternaria dell'Isola. Lo studio di profili sismici, integrato con altri dati geofisici oltre che con la cartografia geologica, permette di definirne meglio l'evoluzione e la geometria. In questa nota viene presentata la mappa dei tempi doppi della superficie di erosione pliocenica e la descrizione delle faglie che la dislocano.

KEY WORDS: *Erosional surface, Plio-Quaternary Campidano graben, Sardinia*

INTRODUCTION

The *Campidano* graben is a regional structure wide about 20 km and extends in direction NW-SE for about 100 km from the *Oristano* gulf to *Cagliari* gulf, delimited to the West by the *Sulcis-Iglesiente-Arburese* block, characterized mainly by Paleozoic basement, and to the East by the *Gerrei-Sarcidano* block, characterized mainly by the Miocene marine succession. It is superimposed on the southern part of the Oligo-Miocene Sardinian rift (CHERCHI & MONTADERT, 1982) and it is filled with Middle-Upper Pliocene continental sediments (*Samassi* formation, PECORINI & POMESANO CHERCHI, 1969), followed by Quaternary deposits. Although the *Campidano* graben is the most important geological structure related to Plio-Pleistocene tectonic activity in Sardinia, up to now, no detailed studies on the geometry and kinematic evolution of this tectonic trough have been made.

In this abstract we present the two-way time map (fig. 1) of the Pliocene erosional surface in the central-southern part of the *Campidano* graben and new data on the structures which characterize this area. These are preliminary data of a larger study still in progress about the Plio-Pleistocene evolution of Sardinia and its relationships with the late Cainozoic opening of the South Tyrrhenian basin. The other main feature related

to this tectonics is the occurrence of wide plateau of lava flows of alkali-transitional basalts, emplace from ca. 6 ma ago to ca. to the Lower Pleistocene (ASSORGIA *et alii*, 1983). This lava flows post-date the *Samassi* formation.

METHODS

To map the Pliocene erosional surface we have interpreted the seismic profiles acquired in 1962 by Total Mineraria (12 lines) and in 1992 by Agip (4 lines), which have been made available for this research by the *Regione Autonoma della Sardegna* and the *Progemisa S.p.A.* Seismic profiles were calibrated with the stratigraphic and electric logs of the *Campidano1* well, drilled in 1963 by Agip, of which a detailed stratigraphy was published (PECORINI & POMESANO CHERCHI, 1969). In the seismic profiles has been picked the horizon interpreted as the Pliocene erosional surface, sometimes easily to recognised because the unconformity surface cuts across bedding planes of the sediments below it, and the faults. Then, integrating other geophysical data, mainly gravity survey (BALIA *et alii*, 1984), and surface geologic data, the two-way time map of the Pliocene erosional surface has been made.

STRUCTURAL SETTING

The depth of the Pliocene erosional surface in the *Campidano1* well is 502m, but, on the vertical of *Decimomannu* village, it reaches about 890m depth, depending on the mean seismic velocity (1,98 km/s in this study) assigned to Quaternary cover and the *Samassi* formation.

From the two-way time contour lines map the Pliocene erosional surface show a "gently rolling" landscape typical of erosion and planation surface developed in continental environment, similar to the surface that, in closest area, cut the Miocene succession and is sealed by Pliocene lava flows (FUNEDDA *et alii*, in press).

This variation in depth seem to be due to the normal faults which bound both the eastern and western edges of the central-southern *Campidano* graben.

The fault in the western edge is not visible in seismic profiles, but in lines CA-304-92-V, CA-303-92-V and LINE04 the *Samassi* formation shows a growth wedge-shaped geometry exhibiting an increasing thickness and divergent strata towards

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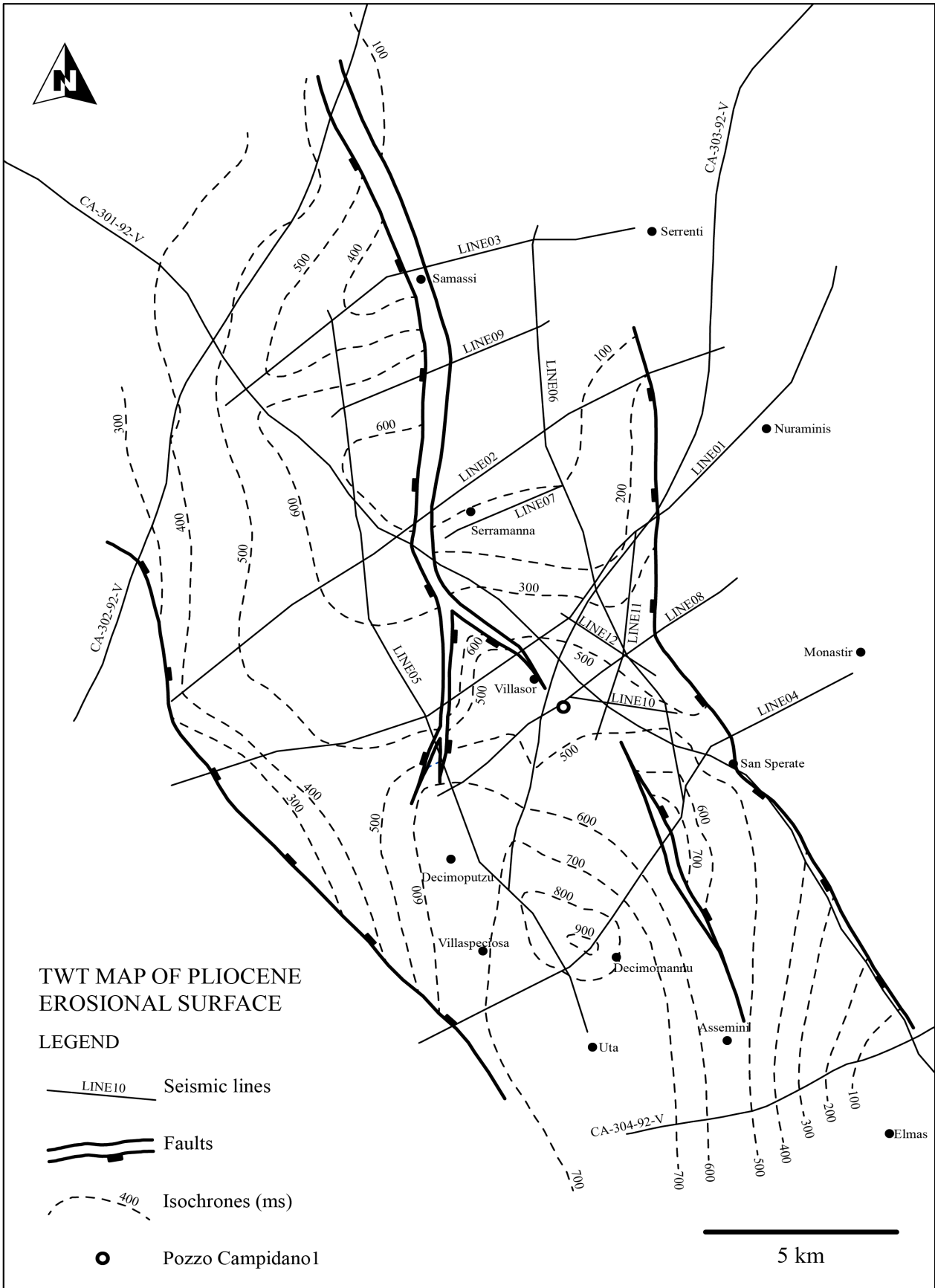


Fig. 1 – Two Way Time map of Pliocene erosional surface in the central-southern part of the Campidano graben

the W, suggesting the occurrence of a syn-depositional fault E-NE dipping. In addition to this, the Bouguer anomaly map (BALIA *et alii*, 1984) shows that on the western border the contour lines are oriented parallel to the graben axis. This fault does not clearly crop out in the field but its occurrence is inferred by the NW-SE alignment of the Paleozoic basement and Oligo-Miocene volcanic outcrops. The total throw of this fault is almost 600 m.

The fault along the eastern edge strikes NW-SE from *Elmas* to *Villasor* and N-S from *Villasor* to *Samassi*, it is clearly visible in lines 02, 01, CA-303-92-V, 08 and 04. In these lines the occurrence of a rollover anticline, which affects both the *Samassi* formation and the pre-Pliocene succession, is shown. The fold axis dips to the SE. Instead, the line CA-301-92-V is parallel to the strike direction of the fault, therefore is not easy to recognize the rollover anticline and the fault, which is suggested by the NW-SE alignment of the Miocene marine outcrops along the eastern edge of the trough. The total throw of this fault is almost 500 m.

A third fault, clearly visible in seismic lines CA-302-92-V, 03, 09 and 02, occurs in the central part of the trough, approximately from north of *Samassi* to north of *Villasor*. This fault is oriented N-S and dips to the W. North of *Villasor* the fault bifurcates into two faults: the first strikes N-S and dips to the E and the second strikes NW-SE and dips to the SW. Between these two faults occurs a rollover anticline. The fold axis dips to the NW. The total throw of this fault reaches 680 m. The footwall block of this fault is equivalent to a N-S elongate positive gravity anomaly, from *Villasor* to *Samassi* (BALIA *et alii*, 1984).

Another fault has been detected approximately on the vertical of *San Sperate* village, strikes NW-SE and dips to the E, with total throw of 300 m.

Where the Pliocene erosional surface is not affected by normal faults, the two-way times contour lines of the surface show the "gently rolling" landscape typical of erosion and planation surface.

CONCLUSION

The structural setting of the central southern part of the Plio-Quaternary Campidano graben has been studied by seismic profiles integrated with other geophysical and surface geological data.

The studied area is characterized by N-S and NW-SE normal faults which affect both the *Samassi* formation and the pre-Pliocene succession. The fault in the western edge of the trough is syn-depositional with the *Samassi* formation, the other faults are post-depositional.

In the two-way time map, the Pliocene erosional surface shows a "gently rolling landscape" morphology. This morphology is the same which in surface is sealed by Upper-Middle Pliocene basaltic flow (FUNEDDA *et alii*, in press).

Probably the *Campidano* graben is originated by extensional tectonics which affected the western Mediterranean during Plio-Quaternary and the formation of the eastern passive margin of the Island, which is the most important geodynamic event which affects Sardinia from Upper-Miocene to Quaternary (KASTENS *et alii*, 1988). The dynamic of this events are still under investigation.

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