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Article · September 2012

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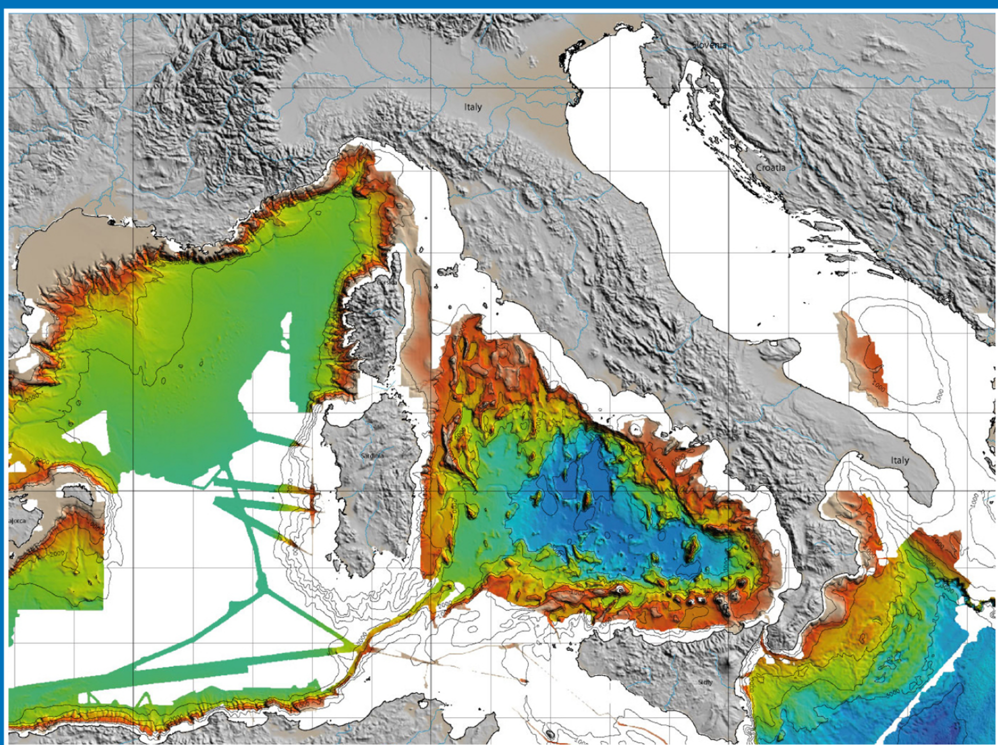
ISSN 2035-8008

RENDICONTI *Online* della *Società Geologica Italiana*

Volume 21 (parte prima)

86° Congresso Nazionale della Società Geologica Italiana

Arcavacata di Rende 18-20 Settembre 2012



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www.socgeol.it

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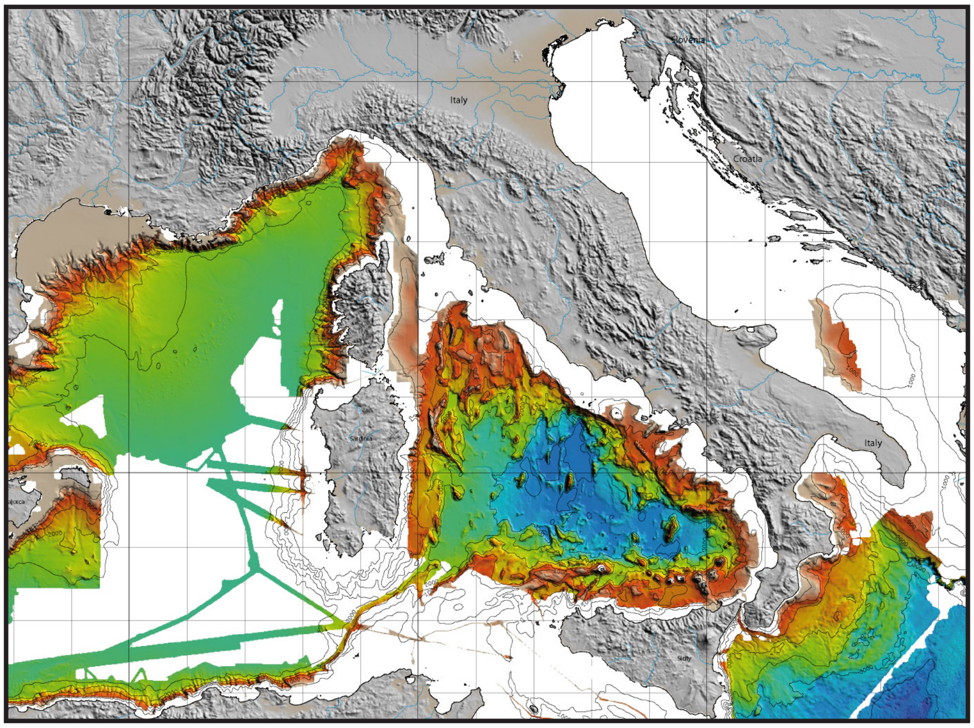

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Rend. Online Soc. Geol. It., Vol. 21 (2012), pp. 646-648, 3 figs.

New insights on the possible location of the Roman Harbour of *Pompeii*

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Key words: *Geoarchaeology, Pompeii (Italy), sedimentological analysis, well log stratigraphy* .

INTRODUCTION

The effort for a reliable palaeoenvironmental reconstruction of the territory surrounding the Roman city of *Pompeii* at the time of the 79 AD major eruption involved, in the last two decades, many research groups belonging to the international archaeological and geological communities. Recent contributes among others (CINQUE & RUSSO, 1986; PESCATORE *et alii*, 2001; STEFANI & DI MAIO, 2003; CINQUE & IROLLO, 2004) lead to the determination of some geographic elements accepted by most researchers such as, for example, the position of the 79 AD coastline (more internal than the present-day one) and the presence at its back of two dune ridges (Bottaro and Messigno dune belts). There is no agreement, on the contrary, about the definition of other palaeogeographic elements, such as the location of the harbor of *Pompeii*, which, as well-know from ancient sources, had to play an important role in the management of commercial relationships among the Mediterranean coastal settlements. STEFANI & DI MAIO (2003) assume its location in the mouth of Sarno River, in a position north of the present-day one, in contrast to CINQUE & RUSSO (1986), which hypothesized the existence of a sort of bay farther south (i.e. in correspondence of the present-day Sarno River mouth). CURTI (2004) suggested the possibility of a fluvial/lagoon port near the south-west side of the town, in a palaeo-Sarno river bend, based on several documented evidences, such as the presence of a temple dedicated to Venus, a goddess originally linked to the protection of sea ports, the presence of a stores (*horrea*) area near the temple, and the absence of archaeological finds in this area. Further, just in this area, borehole core sampling and geophysical investigations have been recently carried out (BENEDUCE *et alii*, 2008), allowing a larger collection of data that strengthen this thesis.

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The present study describes unpublished results deriving from sedimentological analyses performed on several samples from the cores drilled by BENEDUCE *et alii* (2008), and discusses their implications in the framework of the paleoenvironmental reconstruction and location of the ancient harbor of *Pompeii*.

GEOLOGICAL SETTING AND STRATIGRAPHIC LOGS

The Roman city of *Pompeii* is located between the foothills of the south-western slope of the Somma-Vesuvius volcanic complex and the coastal-alluvial plain of the Sarno River (Fig. 1a). It stands on a hill with a maximum height of 54 m a.s.l., due to the relict structure of an ancient volcano (CINQUE & IROLLO, 2004), partially buried by alluvial and volcaniclastic deposits supplied from the southern slopes of the Somma-Vesuvius edifice. It is a semicircular morpho-structure mainly set in massive and scoriaceous lava flows by Strombolian activity. Its physical continuity near the archaeological area of *Pompeii* is interrupted by the Versilian palaeocliff along the Vesuvian coast (CINQUE & RUSSO, 1986).

The activity of the Somma-Vesuvius complex in the last 17,000 years has been divided into eruptive cycles started with a major explosive Plinian eruptions, that have repeatedly shaped and changed the morphology of the volcanic edifice and ended with a minor intense, often effusive, eruption. Tephra levels covered large areas of the Campanian Plain and surrounding mountains, with a thickness of several meters. The 79 AD eruption, as described by Pliny the Younger, is one of the most important of the Vesuvius, having buried the Roman cities of *Herculaneum*, *Pompeii*, *Oplontis* and *Stabiae*, causing destruction and casualties.

Based on four continuous core drilling carried out as part of a research aimed to reconstruct the area close to the Porta Marina zone in the archaeological site of *Pompeii*, a 25 m-thick stratigraphic succession has been investigated (Fig. 1b). In the sector closest to the archaeological area (S1, S2, and S3 boreholes), the 79 AD products, here consisting of gray pumice fallout and ash surge found in the first 2.00-8.00 m, lay on fine-grained pyroclastics with little brick fragments, without sedimentary structures and likely related to a continental environment. In the S4 borehole (i.e. the most distant from the present-day boundary of the excavated town), the 79 AD products overlie a high-energy fluvial formation.

In all cores, the oldest unit consists of beach (supratidal) coarse sands and lava pebbles, laying on a pyroclastic cinerite related to the Vesuvius proto-historic activity. The stratigraphic intervals drilled by the S4 borehole form the following sequence (from the top to the bottom): 0.00–4.50 m: anthropic backfill; 4.50–5.90 m: reworked pyroclastics; 5.90–6.20 m: clayey silt with pebble clasts and pumice; 6.20-7.00 m: lithic clasts and pumice in sandy matrix with lava pebbles; 7.00–7.70 m: reworked deposits of 79 AD eruption; 7.70-8.60 m: ash flow deposits of 79 AD eruption; 8.60–11.20 m: white to gray pomiceous lapilli of 79 AD eruption; 11.20–12.20 m: clayey and sandy silt; 12.20–13.60 m: medium to coarse sand with lateritic fragments; 13.60–16.50 m: very poorly sorted lithic clasts and pumice in sandy matrix with lava pebbles; 16.50–20.00 m: blackish sand with gravel; 20.00–23.50 m: ash layers with interbedded palaeosols.

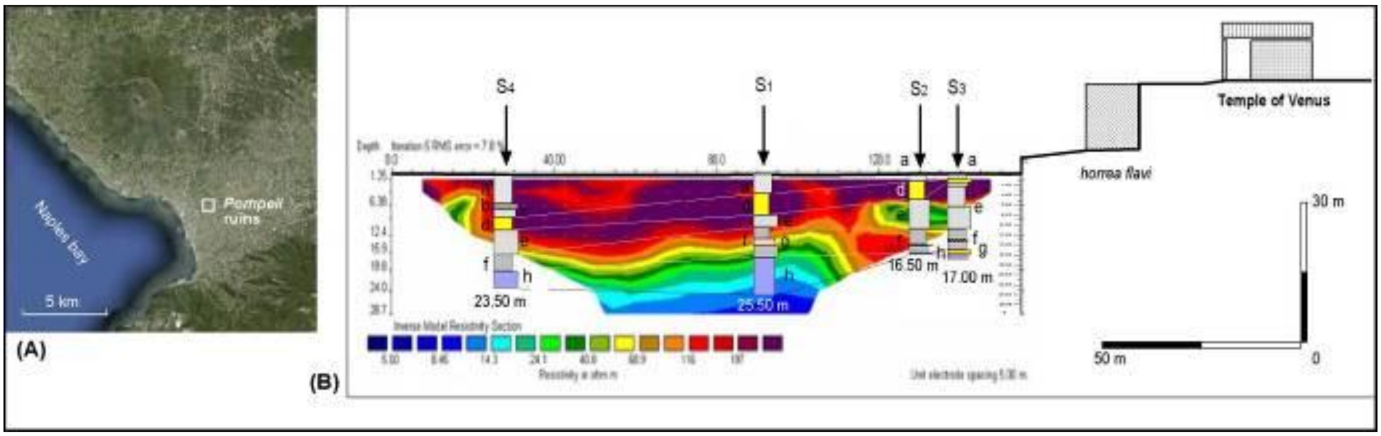

Fig. 1 – (A) Location of the study-area and (B) log-correlation in the frame of the resistivity section (after BENEDUCE *et alii*, 2008). Legend: **a**. anthropic backfill and reworked pyroclastics; **b**. clayey silt with pebble clasts and pumice (low- to mid-energy fluvial environment); **c**. pumice elements in ash matrix (reworked products of 79 AD eruption); **d**. whitish dense-texture pumice with scoriae and lithics and thin ash layers (79 AD eruption); **e**. sand and pebbles with lateritic fragments (high-energy fluvial facies); **f**. black sand with gravels, flat lava pebbles (supralittoral facies); **g**. ash pyroclastics; **h**. proto-historic pyroclastics.

NEW SEDIMENTOLOGICAL DATA

Grain size analyses and morphometric quantitative evaluations have been assessed on 4 gravel-sand, subordinately mud, samples (*S4a-d*) deriving from various stratigraphic core intervals of S4 borehole Sedimentological analyses have been performed on samples from stratigraphic horizons drilled at about 6.00 m, 12.00 m, and deeper than 16.00 m.

Sediments have been properly washed and treated in order to use sieve and densimeter grain size techniques. Roundness has been quantitatively obtained by using the method proposed by WADELL (1932, 1933, 1935).

The results of the Wadell's method applied on 11 pebble-sized samples deriving from the coarsest fraction (Fig. 2) demonstrate as the roundness values oscillates between 0.23 and 0.63 (<1), indicating a very good degree of roundness.

With regard to granulometric analysis, sample *S4b* and *S4d* show the highest mud content, whereas they have a low amount of fine pebbles. On the contrary, sample *S4a* and *S4c* have more pebble-sized elements (Fig. 3), whose diameter ranges between 1 up to 3 cm and whose morphometry lie in the field of the spheroids. All four samples are therefore very poorly sorted.

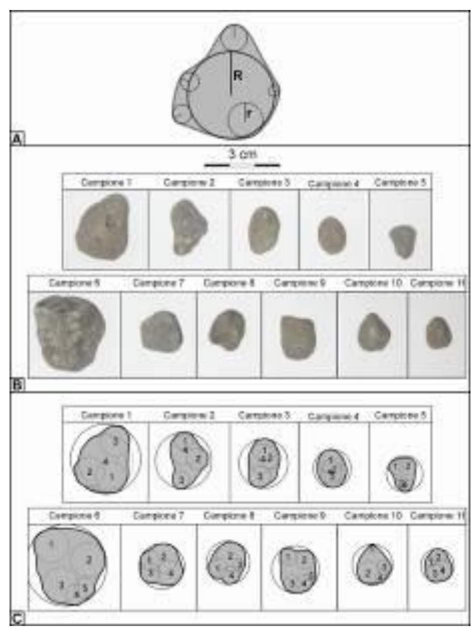

Fig. 2 – Results of the Wadell's method applied on 11 pebble-sized clasts. Legend: (A) Basic method. (B) Samples. (C) Results

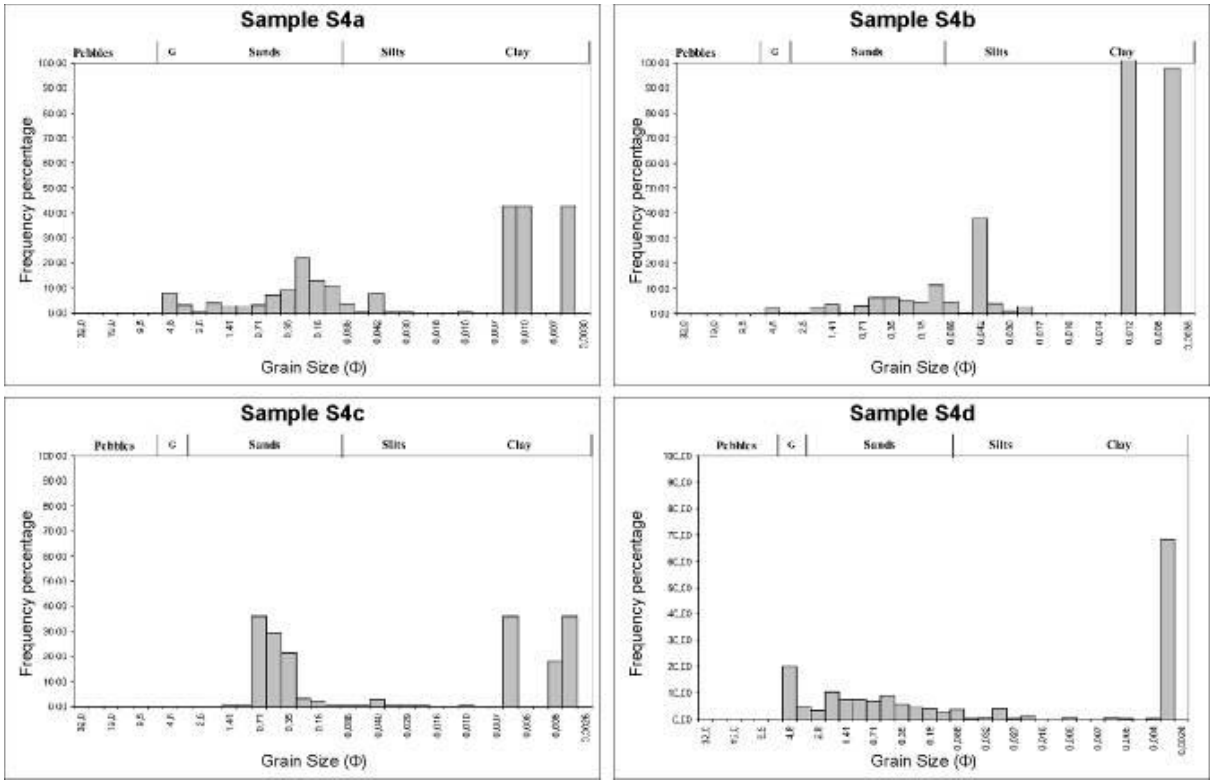

Fig. 3 – Grain size histograms obtained from analyzed samples.

FINAL REMARKS

The sedimentological features of the collected samples analyzed revealed sediments forming very badly sorted assemblages of mud-rich, sand-dominated deposits, containing scattered, very well rounded pebbles up to 3 cm in size. The absence of sorting and the occurrence of scattered pebbles indicate a transport agent represented by currents with changing energy, capable to transport the fine and the coarser fraction during different power stages. Moreover, the roundness and the spherical morphometry of pebble clasts suggest a high amount of sediment transport, which is typical on channel-fill sediments.

Therefore, the key-candidate environment to locate the analyzed deposits is most likely a river channel, where the continuous changes in current competence generated the sedimentary deposits documented in the present study.

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