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Provenance studies applied to building stones of a Bronze age tholos tomb (Messina, Italy)

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***Abstract* – During the Bronze Age, essential advances occurred in the field of architecture. Roundhouses and tombs with circular stone walls appeared. The present research aims to geolocate the sources of raw building materials used by workmen during the Bronze age to construct a Mycenean-type tholos tomb discovered in the alluvial plain of the Messina Ionian slope (Fiumara Gazzi). The used method has foreseen the geological, sedimentological, structural, mineralogical, and petrographic mesoscopic analyses of the tomb's building stones to compare them with the rock features of the surrounding geological outcrops of the Peloritani Mountains. The studied building stones consist of metamorphic, magmatic, and sedimentary rocks. Crystalline building stones are mostly well-rounded alluvial pebbles and boulders; most sedimentary stones are characterized by hand-made well-squared shapes with a minor amount of alluvial pebbles. Studies on the provenance of the alluvial pebbles and boulders of crystalline and sedimentary rocks indicated that they derived, respectively, from the highest and intermediate zones of the northern end of the Peloritani Mountains, where the crystalline rocks (Aspromonte and the Mela Units) and the Tertiary to Quaternary sedimentary covers are respectively in tectonic contact because of a normal fault of the Messina Straits tectonic system. The sedimentary hand-made building stones are derived from local quarries in the surrounding areas, near San Filippo, where the well-bedded bioclastic calcareous rudstones and grainstones are well exposed and visible at a distance.**

I. INTRODUCTION

A multi- and interdisciplinary approach was applied to integrate archaeological, stratigraphic, and palaeo-environmental data for reconstructing the geological framework of the Messina coastal plain during the Bronze age [1-3].

In this area, it is noteworthy that several archaeological soils intercalated within the Holocene alluvial, deltaic, and marsh environments, hosting Neolithic, Bronze, Greek Archaic, Hellenistic, Roman, and Byzantine evidence [1-6].

An excavation, realized for construction purposes in 2012, unearthed a Mycenaean tholos tomb dating back to the Bronze age.

Research on this tomb determined the sedimentary siliciclastic deposits' age and sedimentary environment hosting this important archaeological finding [1-3].

The provenance studies on the sources of raw building materials employed in archaeological sites are commonly carried out by geologists involved in archaeological researches [7].

The present paper aims to itemize further the sedimentological and petrographic features of the tomb building stones and the related provenance and connections with the surrounding areas.

II. MATERIALS AND METHODS

The characteristics of over six hundred building stones were compared with those of the rocks exposed in the surrounding geological outcrops to establish the provenance of the building stones.

When dealing with archaeological and cultural heritage remains, analyses have to be conservative, and often they have to be carried out on-site and in reduced time. The research method foresaw mesoscale observation of the tholos building stones' composition, structure, and textures through the naked eye and portable field stereomicroscope. The main results were indicated in the sketch of figure 1, representing the distribution of the different building stone types in the tholos tomb.

The same rock features were searched and investigated on comparative samples collected in the surrounding areas through sedimentary petrography analyses and stereoscopic observation of the sample surfaces in the laboratory.

III. RESULTS

The crystalline building stones were formed of high-grade metamorphic and plutonic rocks (melanocratic and mafic rocks, gneisses and schists, garnet meta-hornblendite leucocratic rocks, and quartzites, pegmatites, aplites, fels, granitoid, and mylonites, figure 1).

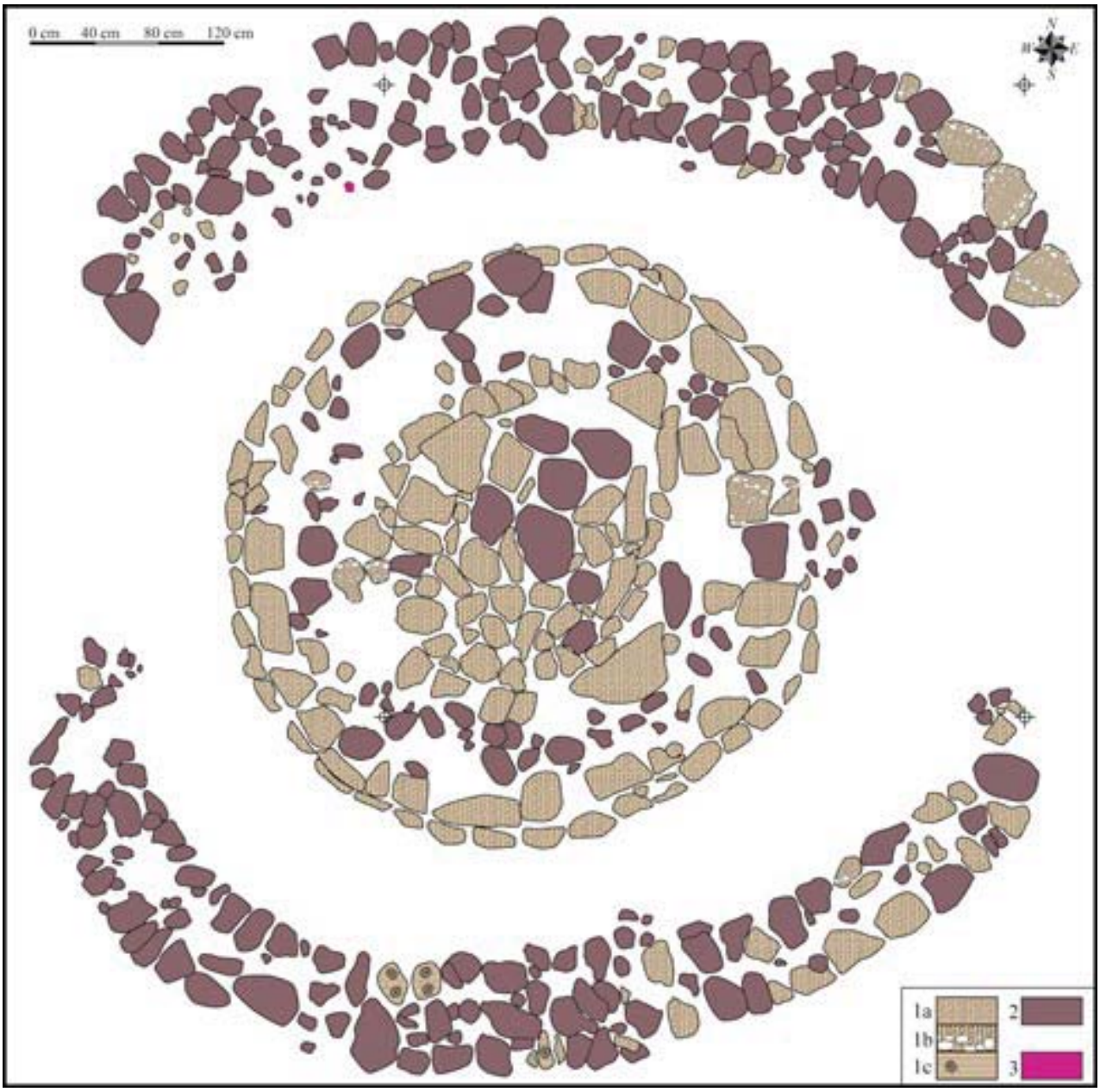

Fig. 1. The tholos tomb with the different building stone types. Legend: 1a: Bioclastic grainstones with corals, ostreids, gastropods, brachiopods, echinids, and bryozoans. 1b: Hybrid arenites with pebbles. 1c: Coral rudstones. 2: Gneiss, migmatitic gneiss, melanocratic and leucocratic rocks, mafic rocks, pegmatites, aplites, granitoids, schists, quartzites, fels, augen gneisses, and mylonites (Aspromonte Unit). 3: Garnet meta-horneblendite (Mela Unit).

These building stones appeared as well-rounded pebbles and boulders (figure 1).

The sedimentary building stones were mainly composed of calcareous bioclastic grainstones and rudstones (figure 1) and hybrid arenites with conglomerate levels.

The paleontological content of the studied grainstones and rudstones was characterized by pectinids, ostreids, brachiopods, bryozoans, and corals with a minor amount of coral rudstones with typical deep-water scleractinians (*Desmophyllum crista Galli, Caryophyllia coronata, Lophelia pertusa, Madrepora oculate*).

Most of these sedimentary building stones exhibited manufactured well-squared shapes, whereas well-rounded

Fig. 2. Specimen of bioclastic calcareous rudstones and grainstones sampled at San Filippo.

pebbles and boulders represented a little rock number (figure 1).

Studies on the provenance of the studied building stones of the Messina tholos tomb were accomplished in the Messina surroundings.

The main features observed in the crystalline building stones indicated that they were comparable with those of the metamorphic rocks of the Variscan basement of the Aspromonte Unit of the Peloritani Mts. [8-11]. Features of one building stone made up of garnet meta-hornblendite showed petrographic features analogous to those of the meta-hornblendites of the Mela Unit [8].

Analogously, the petrographic characteristics of the building stones made of Miocene to Pleistocene sedimentary rocks were similar to those of outcropping formations along the Messina town hills [8-15] (figure 2).

IV. DISCUSSION AND CONCLUSIONS

The provenance study of the crystalline and sedimentary building stones of the Messina tholos tomb suggested that these were derived from local outcrops in the Messina town.

Studied crystalline building stones mainly consist of rounded pebbles and boulders of alluvial environment. A geological survey accomplished along the primary alluvial deposits of the Ionian slope streams suggested that the studied building stones are likely exposed along the Gazzi stream (a few km from the studied tomb). Upstream, both the Aspromonte Unit and Mela Unit crop out. Along this stream, the first unit is exposed extensively, whereas the second one outcrops in a tectonic window in minimal areas [10].

Pebbles are mainly derived from the erosion, transport, and sedimentation downhill of the above-cited metamorphic rocks exposed in the most elevated zones of the Peloritani chain (figure 2).

Analogously, the minor amount of pebbles, composed of Miocene to Pleistocene sedimentary rocks, derived from the erosion, transport, and sedimentation of the sedimentary belt stretched at a lower altitude along with the Ionian slope and in tectonic contact through the Messina Straits normal fault system with the above-mentioned crystalline basement [8-15] (figure 2).

Textural and structural features of the hand-made blocks of the Miocene to Pleistocene sedimentary rocks, compared with those of the Peloritani Mts., indicated that these blocks may have originated from local quarries localized in the surrounding areas where the well-bedded bioclastic calcareous rudstones and grainstones are well exposed and visible at a distance as in the case of the outcrops near San Filippo village (a few km from the studied tomb) well exposed and visible in the landscape (figures 3 and 4).

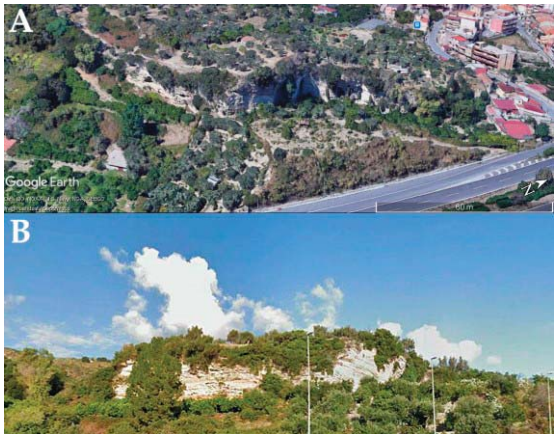

Fig. 3. A) Satellite image of the well-bedded bioclastic calcareous rudstones and grainstones at San Filippo village. B). Well-bedded bioclastic calcareous rudstones and grainstones at San Filippo village.

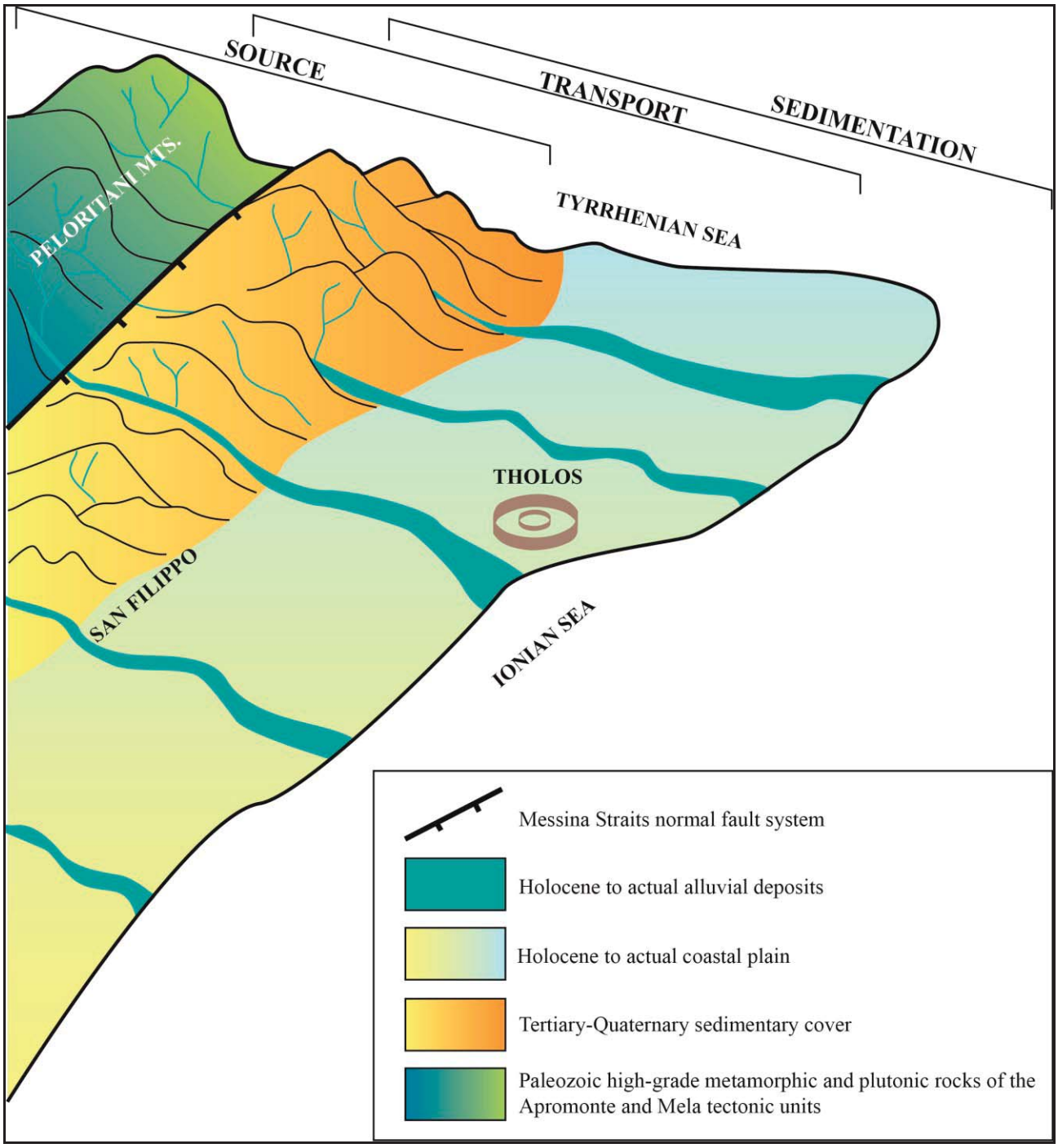

Fig. 4. Simplified sketch map of the Ionian slope during the Bronze age with the localization of the tholos tomb.

It is likely that considering the crucial advances that occurred in the field of architecture in the Bronze age, the skilled workmen noted the outcrops of this type of rock in the landscape and, evaluating the related potential, learned to exalt the original bedding plans by working these easily workable soft rocks producing stone slabs with well-squared shapes.

REFERENCES

[1] R.Somma, L.Bonfiglio, S.Lanza, G.Mangano, R.Miccichè, G.Pavia, G.Randazzo, L.Sineo, G.Tigano, G.Zaffino, "The new finding of a Mycenaean tholos in the alluvial deposits of the Messina coastal plain (north-eastern Sicily): stratigraphic and palaeoenvironmental consequences", 86° Congresso Nazionale Società Geologica Italiana (SGI), Arcavacata di Rende (Cosenza), 18-20 Settembre 2012. Rendiconti Online Società Geologica Italiana, 21, 674. ISSN 2035-8008.

[2] G.Tigano, "L'attività della Soprintendenza di Messina nel settore dei beni archeologici tra la fine del 2010 e il primo semestre del 2012", Società messinese di storia patria. 2012, Archivio Storico Messinese, 93: 335–370.

[3] R.Somma, L.Bonfiglio, G.Mangano, R.Miccichè, G.Pavia, L.Sineo, G.Tigano, "The discovery of a Mycenaean-type tholos tomb in the Bronze Age necropolis of the Gazzi buried floodplain (Messina, Southern Italy): new geological and anthropological data", Stratigraphy, 2019, 16 (4), 249-263. DOI: 10.29041/strat.16.4.249-263.

[4] G.M.Bacci Spigo, Coop. Antropos, G.Mangano, M.C.Martinelli, "Messina: scavo del sito do via La Farina isolato 158", In: D.Cocchi Genick, Ed., 1996, L'antica età del Bronzo in Italia, 596–597, Firenze: Octavo.

[5] G.M.Bacci Spigo, M.C.Martinelli, "L'insediamento dell'età del Bronzo in Via La Farina isolato 158 A Messina. Lo scavo 1992" In: Bonsignori, Ed., 1998-2000, Origini, Preistoria e protostoria delle civiltà antiche, XXII, 195–250.

[6] C.Lega, D.Fulgione, A.Genovese, L.Rook, M.Masseti, M.Meiri, A.C.Marra, F.Carotenuto, P.Raia, "Like a pig out of water: seaborne spread of domestic pigs in Southern Italy and Sardinia during the Bronze and Iron Ages", Heredity, 118, 154-159.

[7] P.Kastenmeier, G.Di Maio, G.Balassone, M.Boni, M.M.Joachimski, N.Mondillo, "The source of stone building materials from the Pompeii archaeological area and its surroundings", Periodico di Mineralogia, 2010, 79, 39-58, 10.2451/2010PM0020.

[8] A.Messina, R.Somma, E.Macaione, G.Carbone, G.Careri, "Peloritani continental crust composition (southern Italy): geological and petrochemical evidences", Bollettino Società Geologica Italiana, 2004, 123, 3, 405-441.

[9] S.Carbone, A.Messina, F.Lentini, M.S.Barbano, D.Grasso, A.Di Stefano, V.Ferrara, R.Somma, "Nota illustrativa del Foglio 601 Messina-Reggio di Calabria", 2008, Servizio Geologico Nazionale APAT – Roma.

[10] S.Carbone, A.Caliri, C.Gargano, P.Guarnieri, F.Lentini, R.Somma, "Carta Geologica d'Italia alla scala 1:50.000 del Foglio 601 "Messina-Reggio di Calabria", Servizio Geologico Nazionale APAT – Roma.

[11] R.Somma, I.Martin-Rojas, V.Perrone, "The stratigraphic record of the Alì-Montagnareale Unit (Peloritani Mountains, NE Sicily, Italy)". Rendiconti Online Società Geologica Italiana, 2013, 25, 106-115. ISSN 2035-8008. DOI: 10.3301/ROL.2013.10.

[12] P.Navas-Parejo, R.Somma, R.Rodríguez-Cañero, A.Martín-Algarra, V.Perrone, "Conodont-based stratigraphy in the Devonian of the Serre Massif (southern Italy)". Stratigraphy, 2015, 12, 1-21, ISSN 1547139X.

[13] A.C.Marra, "Pleistocene mammal faunas from Calabria (Southern Italy): biochronology and palaeobiogeography". Bollettino della Società Paleontologica Italiana, 2009, 48 (2), 113-122.

[14] A.C.Marra, "Evolution of endemic species, ecological interactions and geographical changes in insular environment: a case study of Quaternary mammals of Sicily (Italy, EU)". Geosciences, 2013, 3, 114-139; doi:10.3390/geosciences3010114

[15] R.Somma, "The Inventory and Quantitative Assessment of Geodiversity as Strategic Tools for Promoting Sustainable Geoconservation and Geo-Education in the Peloritani Mountains (Italy)" Educ. Sci., 2022, 12, 580. https://doi.org/10.3390/educsci12090580.