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Preliminary note on the Upper Miocene Radiolarian assemblage of Cappella Monte (Alessandria)⁽¹⁾

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KEY WORDS – Radiolarians, Paleoecology, Upper Miocene, Piedmont Basin, N Italy.

ABSTRACT – We carried out a preliminary quantitative and qualitative study on the radiolarian fauna of the spongolitic levels of Cappella Monte. The radiolarian assemblage, formed by 60 taxa, proves, in our opinion, that these levels settled in a neritic environment.

RIASSUNTO – [Nota preliminare sull'associazione a radiolari di Cappella Monte (Alessandria)] – È stato condotto uno studio preliminare, quantitativo e qualitativo, sulle faune a radiolari dei livelli spongolitici di Cappella Monte (Serravalle Scrivia, Alessandria). L'associazione a radiolari, costituita da 60 taxa, fa ritenere che questi livelli si siano depositati in un ambiente marino neritico.

INTRODUCTION

The spongolitic levels of the sedimentary sequence of the Upper Miocene, concerning the S. Agata Fossil Formation, outcropping in Cappella Monte (near Serravalle Scrivia; Bonci, 1995; fig. 1) have been studied in the last years both from a lithobiostatigraphic point of view and from a paleoecological one (Bonci *et al.*, 1991; 1997 and Bonci, 1995).

It is common knowledge that the above-mentioned siliceous levels are biogenic in origin and mainly consist of sponge spicules, diatoms and subordinately with radiolarians, silicoflagellates, Dinophyceae, Ebridaceae and Archaeomonadaceae. The calcareous biogenic component is subordinate to the siliceous one and is formed by foraminifers, both planktonic and benthonic, and nannofossils.

This work is the first contribution to the study of the radiolarian fauna in the spongolitic levels.

MATERIALS AND METHODS

The eleven samples (19-29) studied in this preliminary paper were provided by Dr.ssa Bonci of the Dipartimento per lo Studio del Territorio e delle Sue Risorse, University of Genova.

The samples were prepared according to the following procedure:

1. The sediment was dried in an oven for 5 hr at 100°C.
2. 5 gr. of dried sediment were placed in a beaker and boiled for 12 hr in diluted (5 parts water to 1 part peroxide) hydrogen peroxide.
3. Diluted (15%) hydrochloric acid (HCl) was added to the sample after it had cooled to room temperature.
4. The residue was sieved (45 µm mesh size).
5. The remaining residue was mixed in a beaker with 60 ml of distilled water and put into suspension. A fixed split (5 ml) of this suspension was taken by a pipette and strewn on a 27 mm x 46 mm coverslip.
6. The coverslip was dried on a hot plate at moderate temperature (30°-40° C) and then fixed to a slide with glycerine.

The Radiolarians were assembled into 60 counting groups (taxa); most of them are species and a few are genera, families and orders. In some cases, according to Riedel *et al.* (1985) related species were combined into a counting group (e.g. *Anthocyrtidium* group).

A Reichert-Jung Polyvar light microscope was used for all observations (25x objective, 1,25x optovar and 10x ocular).

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Relative abundance of taxa, recorded on Tab. 1, was determined by examining an intere 27 x 46 mm slide and is indicated by the following scale: R = rare (1-2); F = few (3-6); C = common (7-17); A = abundant (>18 specimens).

RESULTS AND CONCLUSIONS

The samples generally contain abundant and moderately preserved radiolarians, except for samples 19 and 29, which contain few to common and poorly preserved radiolarians. Spumellaria constitute 61.7% of the total fauna and Nassellaria 38.3% (spyrids 2.9%, cyrtids 35.4%; *sensu* Casey, 1993).

The radiolarian assemblage consists of 60 taxa (Tab.1); dominant taxa include *Spongodiscus* group (8.9%; Pl.1, fig.5), *Lophophaena* spp. (8.4%; Pl.1, fig.1), *Stylodictya validispina* (6%; Pl.1, fig.4), *Pylospira octopyle* (3.5%), *Siphocampe lineata* group (3.3%; Pl.1, fig.2) and *Tetrapyle octacantha* (3%). Many of these predominant groups are spongy Spumellarians, which occur, in warm, shallow waters, according to Blueford (1983), Casey *et al.* (1979a, 1979b) and Wigley (1982). Deep-dwelling Radiolarians *sensu* Palmer (1986), *Cornutella profunda*, *Cyrtolagena laguncula*, *Larcopyle buetschlii* (Kling & Boltovskoy, 1995; Paverd, 1995) were also recovered.

Benson (1966), Casey (1993) and Palmer (1986) noted that Spumellarians are more abundant than Nassellarians in near-shore assemblages.

These results suggest, according to Bonci (1995) an inner shelf deposition environment widely connected with the open sea. Only a few samples studied in this paper can be assigned to well known biostratigraphic zone. Samples 19 and 29 have radiolarian abundance that is too scarce to allow any zonal assignment. No stratigraphically significant taxa have been observed in samples 20, 21, 22, 23 and 24. The presence of *Ommatartus antepenultimus* in sample 25 and the absence of *Ommatartus penultimus* from samples 26, 27 and 28, lead us to assign these samples to *Ommatartus antepenultimus* Zone (Tortonian) according to Nigrini & Sanfilippo (2001).

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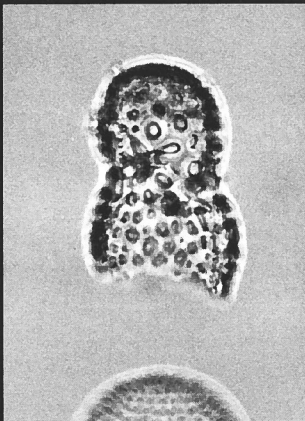
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REFERENCES

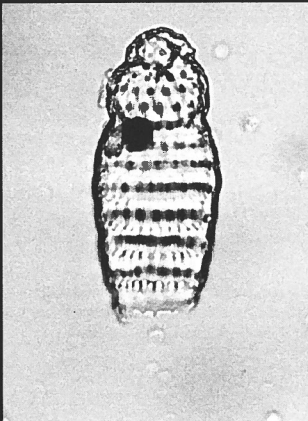
- BAILEY, J.W., 1856, Notice of microscopic forms found in the Soundings of the Sea of Kamtschaktka: Amer. Jour. Sci. Arts, s. 2, 22 (64): 1-6.
- BENSON, R.N., 1966, Recent Radiolaria from the Gulf of California: Unpubl. Ph.D. Thesis, Univ. Minnesota.
- BLUEFORD, J.R., 1982, Miocene actinomid Radiolaria from the equatorial Pacific: Micropaleontology, 28 (2): 189-213.
- , 1983, Distribution of Quaternary radiolarians in the Navarin Basin geological province, Bering Sea: Deep Sea Research, 30: 63-81.
- BONCI, M.C., 1995, L'associazione a diatomee del Miocene superiore di Cappella Monte (Alessandria): Boll. Soc. Paleont. Ital., 34 (2): 163-191.
- , FANUCCI, F., PIRINI RADRIZZANI, C., RIZZI, A., & TEDESCHI, D., 1991, I livelli diatomitici della successione miocenica di Cappella Monte (area di Serravalle Scrivia, Bacino di Alessandria): Boll. Soc. Paleont. Ital., 30 (3): 281-301.
- , MAGNINO, G., PIRINI RADRIZZANI, C., & PRONZATO, R., 1997, Finding of Geodia (Demospongiae) sterrasters in the Late Miocene of Cappella Monte (Alessandria) and comparison with living forms: Boll. Soc. Paleont. Ital., 35 (3): 245-256.
- CAMPBELL, A.S. & CLARK, B.L., 1944, Miocene radiolarian faunas from southern California: Geol. Soc. Amer., Spec. Paper, 51: 1-76.
- CASEY, R.E., 1993, Radiolaria. In Lipps, J.H. (ed.), Fossil Prokaryotes and Protists. University of California, Berkeley, Blackwell Sc. Publ. Boston: 203-247.
- , GUST, L., LEAVESLEY, A., WILLIAMS, D., REYNOLDS, R., DUIS, T. & SPAW, J.M., 1979a, Ecological niches of radiolarians, planktonic foraminiferans and pteropods inferred from studies on living forms in the Gulf of Mexico and adjacent waters: Trans. Gulf Coast Assoc. Geol. Soc., 29: 216-223.

EXPLANATION OF PLATE 1

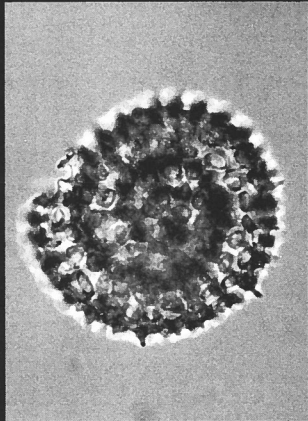
- Fig. 1 – *Lophophaena* spp.
 Fig. 2 – *Siphocampe lineata*
 Fig. 3 – *Lithelius nautiloides*
 Fig. 4 – *Stylodictya validispina*
 Fig. 5 – *Spongodiscus* group
 Fig. 6 – *Stichocorys delmontensis*
 Fig. 7 – *Hymeniastrum* group
 Scale bar = 100µm.



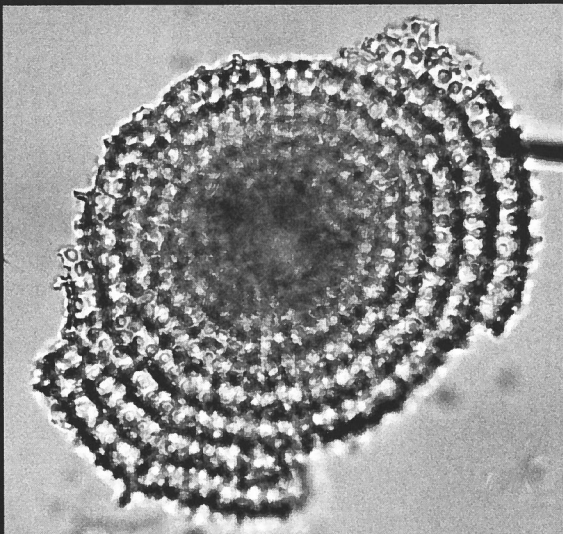
1



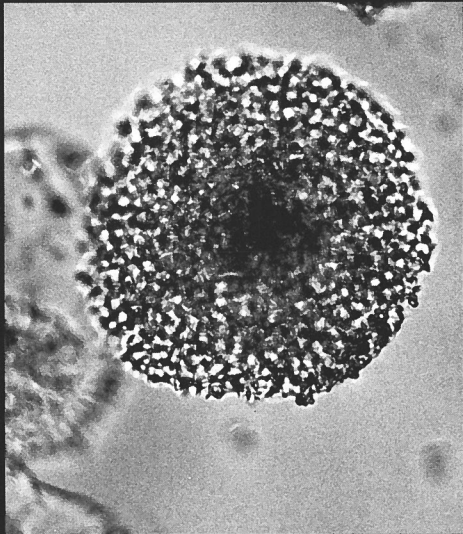
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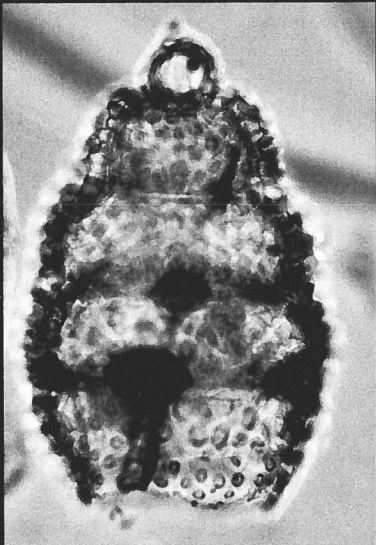
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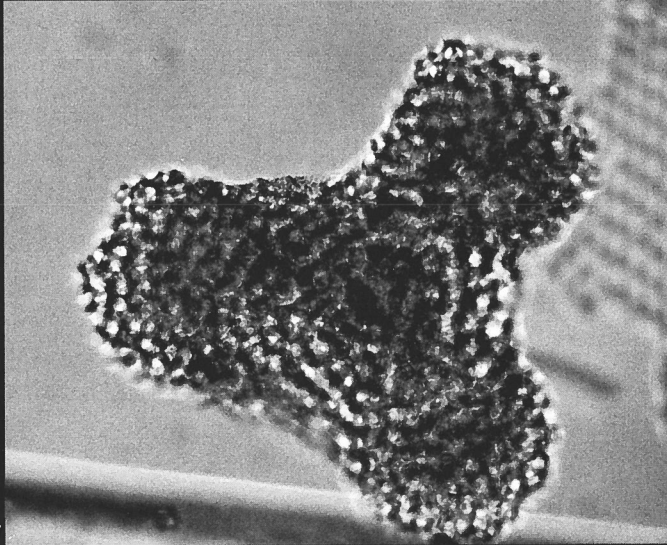
4



5

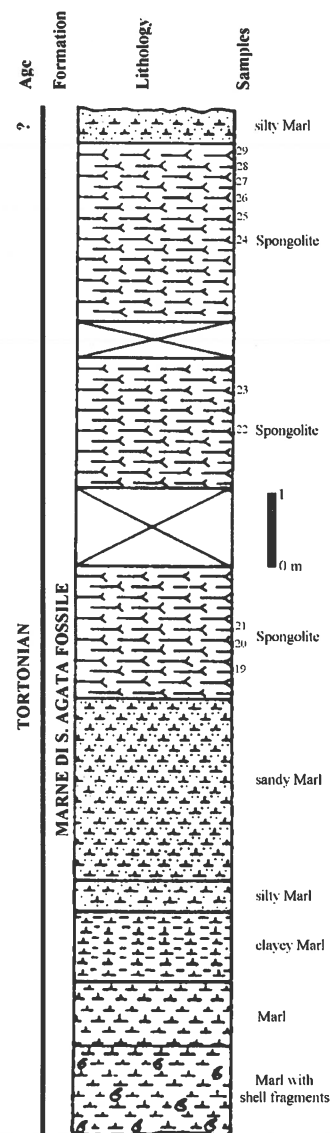


6



7

TAXA / Samples	19	20	21	22	23	24	25	26	27	28	29
<i>Acrobotrys</i> sp. Sharma et al., 1999		R	F	F	R	R	R	R	R	F	
Actinommidae spp.	R	C	C	F	C	F	C	C	F	C	F
<i>Actinomma leptodermum</i> (Jorgensen, 1900)		R	R		R		F				
<i>Anthocyrtidium</i> group Riedel et al., 1985			R	R	R		R				
<i>Arachnocorallium</i> group Riedel et al., 1985		F			F	F	F			R	
<i>Botryopyle</i> sp.						R	R				
<i>Botryopyle</i> sp.1			R		R		F	R	R		
<i>Botryostrobus</i> group Riedel et al., 1985		R	R	R		R	C		F	R	R
<i>Carpocanarium papillosum</i> (Ehrenberg, 1872)		R	R	R		R	R		R		R
<i>Carpocanistrum</i> spp. Nigrini & Lombardi, 1984		R	R	R	R	R	R				
<i>Cenosaera riedelli</i> Blueford, 1982							R	R	R		
<i>Collosphaerid</i> group Riedel et al., 1985		R	R	R		R	R	R	R	R	R
<i>Cornutella profunda</i> Ehrenberg, 1858		R	F		F	R	F		F	F	R
<i>Cubotholus</i> sp.									F		
<i>Cycladophora davisiana</i> (Ehrenberg) <i>davisiana</i> (Petrushevskaya, 1967)							R				
<i>Cyrtolagena laguncula</i> Haeckel, 1887			R		R					R	
<i>Cyrtocapsella</i> spp.		F	F		F	R	F	R		R	
<i>Eucyrtidium cienkowski</i> Haeckel, 1887		R	R			R				R	
<i>Eucyrtidium acuminatum</i> (Ehrenberg, 1844)			R				R		R		
<i>Helisoma dispar</i> Blueford, 1982		R	F		R					R	
<i>Hexacanthum</i> group B Riedel et al., 1985		R	F	R	R	R	F	R	R	R	
<i>Hymenastrium</i> group Riedel et al., 1985		R	R	R	F		R	R	R	R	
<i>Lamprocyclas</i> group Riedel et al., 1985		R	R	R			F	R	F		
<i>Larcoidea</i> spp.		C	C	C	C	F	C	C	C	C	R
<i>Larcopele butschlii</i> Dreyer, 1889		R	R	F	F	R	F	F	F	F	R
<i>Larospira quadrangula</i> Haeckel, 1887			R			R					
<i>Litharachnium</i> sp. Riedel et al., 1974							R		R		
<i>Lithelius minor</i> Jorgensen, 1900		R	R		R	R	F	F	R	R	
<i>Lithelius nautiloides</i> Popofsky, 1908		R	R	R	R	R	F	R	F	R	
<i>Lithocarpium polyacanthum</i> (Campbell & Clark, 1944)		R			R	R	C	R	R	R	
<i>Lithomelissa setosa</i> (Jorgensen, 1900)		R	R		R		F		R	R	
<i>Lithomelissa</i> spp.		F	R		R	R	F	R	R	F	R
<i>Lophophaena</i> spp.		C	A	C	C	F	C	C	C	C	F
<i>Nassellaria</i> ind.	R	F	C	C	C	C	C	C	C	F	F
<i>Ommatartus didymus</i> (Ehrenberg, 1844)		R		R		R		R			
<i>Ommatartus antepemulimus</i> Riedel & Sanfilippo, 1970							R				
<i>Phormospyris stabilis</i> (Goll) <i>scaphipes</i> (Haeckel, 1887)		R	R		R	R	R		R	R	
<i>Phormospyris stabilis stabilis</i> (Goll, 1968)										R	
<i>Phortidium polycladum</i> Tan and Tchang, 1976		F	F	R	F		F	F	C	F	
<i>Prunopyle</i> sp. O'Connor, 1997			R				F		R	R	
<i>Pseudodictyophimus</i> group Riedel et al., 1985		R		R	R	R					
<i>Pterocanium</i> group Riedel et al., 1985										R	
<i>Pyrolena armata</i> (Haeckel, 1887)		R	F			R	R	F	F	R	R
<i>Pylospira octopyle</i> Haeckel, 1887		F	F		F	F	C	C	F	F	R
<i>Siphocampe arachnea</i> (Ehrenberg) group Nigrini, 1977		C	F	R	R		R	F	F	C	
<i>Siphocampe lineata</i> (Ehrenberg) group Nigrini, 1977		F	F	R	F		C	C	F	C	
<i>Siphocampe nodosaria</i> (Haeckel, 1887)		F			R	R	F	R	R	R	R
<i>Spongocore puella</i> Haeckel, 1887										R	
<i>Spongodiscus</i> group Riedel et al., 1985		C	A	F	C	F	A	C	A	C	
<i>Stylochlamydim</i> <i>vemistum</i> (Bailey, 1856)		R	R	R			R				
<i>Spumellaria</i> ind.	F	C	C	C	C	C	A	C	C	C	F
<i>Stichocorys delmontensis</i> (Campbell & Clark, 1944)		R	R		R	F	F			R	
<i>Stylochlamydim asteriscus</i> Haeckel, 1887		F	R	R	R		F	R	R	R	
<i>Stylodictya aculeata</i> Jorgensen, 1905		F	F	R	R	R	R	R	R	C	R
<i>Stylodictya validispina</i> Jorgensen, 1905		C	C	F	C	C	A	C	C	C	F
<i>Stylosphaera</i> spp. Riedel et al., 1985		R			F			R		R	
<i>Tetrapyle octacantha</i> Müller, 1858		F	C	F		F	C	F	F	R	
<i>Thecosphaera</i> spp. Riedel et al., 1985			R					R	R		
<i>Trissocyclidae</i> spp.		R	R	R	R	F	C	R	R	F	R
<i>Zygocircus</i> group Riedel et al., 1985									R		R



Tab. 1 – A) Relative abundance of radiolarian taxa of the spongolitic levels of Cappella Montei, sample 19-29. Letter codes are explained in the " MATERIALS AND METHODS " chapter. B) The Cappella Montei stratigraphic section (modified from Bonci, 1995).

- , SPAW, J.M., KUNZE, F., REYNOLDS, R., DUIS, T., McMILLEN, K., PRATT, D. & ANDERSON, V., 1979b, Radiolarian ecology and development of the radiolarian component in Holocene sediments, Gulf of Mexico and adjacent seas with potential paleontological applications: *Trans. Gulf Coast Assoc. Geol. Soc.*, 29: 228-237.
- DREYER, F., 1889, Morphologische Radiolarienstudien. I. Die Pylombildungen in vergleichend-anatomischen und entwicklungsgeschichtlicher Beziehung bei Radiolarien und bei Protisten überhaupt, nebst system und Beschreibung neuer und des bis jetzt unbekannten pylomatischen Spumellarien: *Jen. Zeitschr. Naturw.*, 23 (16): 1-138.
- EHRENBERG, C.G., 1844, Einige vorläufige Resultate seiner Untersuchungen der ihm von der Sudpolreise des Capitain Ross, so wie von den Herren Shayer und Darwin zugekommenen Materialien über das Verhalten des Kleinsten Lebens in den Ozeanen und den grossten bisher zugänglichen Tiefen des Weltmeers: *K. Preuss. Akad. Wiss. Berlin, Ber. Verh.*: 182-207.
- , 1858, Kurze Charakteristik der 9 neuen Genera und der 105 neuen Species des ägäischen Meeres und des Tiefgrundes des Mittelmeeres: *K. Preuss. Akad. Wiss. Berlin, Monatsber.*, Jahrg. 1858: 10-40.
- , 1872, Mikrogeologische Studien als Zusammenfassung seiner Beobachtungen des kleinsten Lebens der Meeres- Tiefgründe aller Zonen und dessen geologischen Einfluss: *K. Preuss. Akad. Wiss. Berlin, Monatsber.*, Jahrg. 1872: 265-322.
- GOOL, R.M., 1968, Classification and phylogeny of Cenozoic Trissocyclusidae (Radiolaria) in the Pacific and Caribbean basins. Part I: *J. Paleontol.*, 42 (6): 1409-1432.
- HAECKEL, E., 1887, Report on the Radiolaria collected by H.M.S. Challenger during the years 1873-1876: *Rep.Sci.Results Voy. H.M.S. Challenger, Zool.*, 18: 1-1803.
- JØRGENSEN, E., 1900, Protophyten und Protozoen im Plankton aus der Norwegischen Westküste: *Berbens Mus. Aarborg*, 6: 205-229.
- , 1905, The protist plankton and the diatoms in botton samples: *Berbens Mus. Skrift ser.1*, 7: 49-151/195-225.
- KLING, S.A. & BOLTOVSKOY, D., 1995, Radiolarian vertical distribution patterns across the California Current: *Deep Sea Research*, 42: 191-231.
- MÜLLER, J., 1858, Über die Thalassicollen, Polycystinen und Acanthometren des Mittelmeeres: *K. Preuss. Akad. Wiss. Monatsber. For 1857*: 474-503.
- NIGRINI, C., 1977, Tropical Cenozoic Artostrobiidae (Radiolaria): *Micropaleontology*, 23 (3): 241-269.
- & LOMBARDI, G., 1984, Guide to Miocene Radiolaria: Special Publication Cushman foundation for Foraminiferal Research, 22: 422 pp.
- & SANFILIPPO, A., 2001, Cenozoic radiolarian stratigraphy for low and middle latitudes with descriptions of biomarkers and stratigraphically useful species, *ODP Tech. Note*, 27 [Online]. Available from World Wide Web: <<http://www-odp.tamu.edu/publications/tnotes/tn27/index.html>>. [Cited 2002-11-10].
- O'CONNOR, B., 1997, Lower Miocene Radiolaria from Te Kopua Point, Kaipara Harbour, New Zealand: *Micropaleontology*, 43 (2): 101-128.
- PALMER, A., 1986, Cenozoic Radiolarians as indicators of neritic versus oceanic conditions in continental-margin deposits: U.S. mid-Atlantic coastal plain: *Palaios*, 1: 122-132.
- PAVERD, P.J. VAN DE., 1995, Recent polycystine Radiolaria from the Snellius-II expedition. Unpublished Ph.D. Thesis, University of Amsterdam.
- PETRUSHEVSKAYA, M.G., 1967, Radiolaria of the orders Spumellaria and Nassellaria of the Antarctic Region: *Biol. Rep. Sov. Antarctic Exped.* (1955-1958), 3: 2-187.
- POPOFSKY, A., 1908, Die Radiolarien des Antarktis (mit Ausnahme der Tripyleen): *Deutsche Südpolar-Expedition, 1901-1903*, 10 (Zool. Vol.2) (3): 183-305.
- RIEDEL, W.R., & SANFILIPPO, A., 1970, Radiolaria, Leg 4, Deep Sea Drilling Project. In Bader, R.G., Gerard, R.D., *et al.*, Initial Reports of Deep Sea Drilling Project, Vol. 4: 503-575. Washington D.C.: U.S. Government Printing Office.
- , —, & CITA M.B., 1974, Radiolarians from the stratotype Zanclean (Lower Pliocene, Sicily): *Riv. Ital. Paleont.*, 80 (4): 699-734.
- , WESTBERG-SMITH, M.J., & BUDAI, A., 1985, Late Neogene Radiolaria and Mediterranean paleoenvironments. In Stanley, D.J. & Wezel, F.-C. (eds.), *Geological Evolution of the Mediterranean Basin*: 487-523. Springer-Verlag, New York.
- SHARMA, V., SING, S., & RAWAL, N., 1999, Early Middle Miocene Radiolaria from Nicobar Islands, Northeast Indian Ocean: *Micropaleontology*, 45 (3): 251-277.
- TAN, Z., & TCHANG, T.-R., 1976, Studies on Radiolaria of the East China Sea II. Spumellaria, Nassellaria, Phaeodaria, Sticholonchea: *Studia Marina Sinica*, 11: 217-310.
- WIGLEY, C.R., 1982, Composition of radiolarian thanatocoenosis and biocoenosis from the oligotrophic Gulf of Mexico and the eutrophic southern California sea: *Trans. Gulf Coast Assoc. Geol. Soc.*, 32: 309-317.

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