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GLOBAL DISTRIBUTION OF RHAETIAN RADIOLARIAN FAUNAS AND THEIR CONTRIBUTION TO THE DEFINITION OF THE TRIASSIC-JURASSIC BOUNDARY

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This contribution presents a brief synopsis of past and newly studied areas where radiolarian faunas of Rhaetian age are adding to our global understanding of the end of the Triassic, and hence, the Triassic-Jurassic boundary.

Before the finding of complete successions of Rhaetian radiolarian faunas in the Sandilands Formation of Queen Charlotte Islands (QCI), British Columbia, Canada (Carter et al., 1989; Carter, 1990), only scattered records of the fauna were available from disparate regions of the world. These included: Cache Creek, British Columbia (Cordey et al., 1991), Oregon, USA (Yeh, 1989), Austria (Kozur & Mostler, 1981; Kozur 1984a,b); New Zealand (Spörli & Aita, 1988), Japan (Yao et al., 1980 a, b; Yao, 1982; Kishida and Sugano, 1982; Kishida and Hisada, 1986; Yoshida, 1986), China (Kojima & Mizutani, 1987; Kojima, 1989; Mizutani, Shao & Zhang, 1989), Tibet (Wang, Wang & Pei, 1990), the Philippines (Cheng, 1989; Yeh, 1990, 1992), Far East Russia (Bragin, 1986, 1990, 1991), and Oman (Carter, 1993). Following discoveries in QCI, Carter (1993) described many species and established Unitary Associations (UA) zonation for the *Proparvicingula moniliformis* Zone (assemblages 1 plus 2a-d; lower-middle Rhaetian) and the *Globolaxtorum tozeri* Zone (assemblage 3; upper Rhaetian). Since that time, Rhaetian faunas have been discovered in many other areas of the world (Table 1), new species have been described, some well known species have been confirmed to have a cosmopolitan distribution, and the faunas have proved very beneficial for age dating, particularly in areas where other age-diagnostic faunas are absent.

Newly studied areas where Rhaetian radiolarians have provided age dating or contributed to terrane analysis and/or the evolution of Tethys are briefly summarized below in the order they were reported:

The Philippines - Yeh & Cheng (1996) documented Rhaetian faunas from red chert on Busuanga Island. They described new species, reported the presence of other species described from QCI and Japan, and concluded the fauna was late early Rhaetian in age, closely resembling Rhaetian faunas from Central Japan.

Timor - Rose (1997) studied Late Triassic faunas from the River Meto sections of the Aitutu and Wai Luli formations in west Timor, finding comparison with taxa from Tethyan areas. Some Rhaetian taxa documented are cosmopolitan but others have stronger affinities with those in Japan and the Philippines.

Vancouver Island, B.C. - Mushroom Point, Kyuquot area, western coast of Vancouver Island - Carter (1997; internal report to GSC) reported lower Rhaetian faunas (lower part of the *Proparvicingula moniliformis* Zone). The faunas mirror QCI assemblages but also contain some species of lower latitude affinity similar to those of Baja California Sur (see below).

Japan – in a comprehensive study of Triassic and Lower Jurassic faunas of the Mino terrane, central Japan, Sugiyama (1997) documented the fauna, described new species and established 20 zones (TR 0-JR 0B). Rhaetian faunas were assigned to TR 8C: first occurrence (FO) Skirt F (possibly derived from *Haeckelicyrtium takemurai*) (late Norian to early Rhaetian) and TR 8D: FO *Haeckelicyrtium breviora* (early to late Rhaetian).

Turkey - Tekin (1999) studied Late Triassic radiolarians from the Antalyia Nappes, Central Taurides, Southern Turkey. Rhaetian faunas from the Dikmetas section, Cataltepe Nappe of the Antalyia Nappes were assigned to assemblages 2b-2c and 3 of Carter (1993). Later studies of the Hocaköy section of the Gökdere Formation, Alakirçay Nappe (Tekin, 2002), indicated that the radiolarians could be well correlated with Rhaetian faunas from the Mino terrane, central Japan (uppermost two Triassic zones of Sugiyama (1997)) and Queen Charlotte Islands (*Proparvicingula moniliformis* Zone).

Italy - Amodeo (1999) first recognized Rhaetian radiolarians in the Buccaglione Member of the Scisty Silicei Formation of the Lagonegro Basin, southern Italy. A number of species occurring in QCI were reported and the fauna was correlated with the *Proparvicingula moniliformis* Zone. Reggiani et al. (2005) found Rhaetian and Hettangian faunas in red shales and radiolarites of the Buccaglione Member of the Madonna del Sirino succession in the same area; and Bazzucchi et al. (2005) found early Rhaetian faunas correlative with the *Proparvicingula moniliformis* Zone, in the upper part of the Calcari con Selce Formation, Mt. Crocetta section, Pignola.

Tibet (Xizang, China) - Ziabrev et al. (2004) reported the occurrence of rare Rhaetian species in red chert from the Bainang Terrane, Yarlung-Tsangpo suture, southern Tibet. These faunas have helped record the long history of sedimentation of Tethyan strata in an intra-oceanic island arc subduction complex that was accreted to the Bainang terrane in the Cretaceous.

Queen Charlotte Islands - Central Japan - Carter & Hori (2005) established global correlation for Triassic-Jurassic boundary radiolarian faunas from QIC and Central Japan using identical Rhaetian and Hettangian species from these far disparate areas of Panthalassa.

China - Yeh & Yang (2006) described new species from the Nadanhada Terrane in NE China, and compared age to early Rhaetian species from QCI.

Hungary - Pálfy et al. (2007) discussed Triassic- Jurassic boundary radiolarians from the Csövár section, part of the Transdanubian range unit of the Alcapa terrane, Hungary. The Rhaetian assemblage was assigned to the *Globolaxtorum tozeri* Zone, containing the nominal taxon and other elements common to low latitude faunas of Tethys.

Nevada, USA - Orchard et al. (2007) reported radiolarians of *the Globolaxtorum tozeri* Zone in the Mount Hyatt and Muller Canyon members of the Gabbs Formation in the Ferguson Hill section at New York Canyon. The section is one of several proposed GSSP candidates for the base of the Jurassic System.

Baja California Sur – Whalen et al. (1998) first reported radiolarians and conodonts of Rhaetian age from the sandstone member of the San Hipólito Formation on the Vizcaino Peninsula. Orchard et al. (this volume) presented the detailed stratigraphy of inland and coastal radiolarian-bearing sequences and utilized radiolarian zonation from QCI to date the conodont succession. Long sequences of radiolarians in several sections are assigned to both the *Proparvicingula moniliformis* and *Globolaxtorum tozeri* zones. The radiolarians compare closely with Rhaetian faunas of the Sandilands Formation, QCI, but minor variation exists in the range of some species and other taxa occur that characterize low latitude regions of Tethys.

The updated information presented on Rhaetian radiolarian faunas (Table 1) emphasizes the cosmopolitan distribution of many species and the propensity for radiolarians to occur in different sedimentary facies, hence their usefulness for global correlation. This is significant in dating strata surrounding the Triassic-Jurassic boundary. In years past, little was known of Rhaetian radiolarian faunas but now they are known worldwide as evidenced by the data submitted in this paper. Hettangian faunas, although currently not as well known as Rhaetian ones, are,

TABLE 1. Distribution of radiolarian faunas in Rhaetian strata around the world. QCI, Queen Charlotte Islands, (Carter, 1993); BCS, Baja California Sur (Orchard et al., this volume; Carter, personal collections); NEV, Nevada, USA (Orchard et al., 2007); PHI, Philippines (Yeh, 1990, 1992, Yeh & Cheng, 1996); JAP, Japan (Yao et al., 1980 a,b; Yao, 1982; Sugiyama, 1997); CHI, China (Yang & Mizutani, 1991; Yeh & Yang, 2006); TIB, Tibet (Wang et al., 1989; Ziabrev et al., 2004); NZL, TIM, Timor (Rose, 1994); RUS, Far East Russia (Bragin, 1986, 1990, 1991); ITY, Italy (Amodeo, 1999; Reggiani et al., 2005; Bazzucchi et al., 2005); AUS, Austria (Kozur & Mostler, 1981; Kozur, 1984 a,b); HUN, Hungary (Pálfy et al., 2007); TUR, Turkey (Tekin, 1999, 2002), OMA, Oman (Carter, 1993).

Radiolarian species	QCI	BCS	NEV	PHI	JAP	CHI	TIB	TIM	RUS	ITL	AUS	HUN	TUR	OMA
Amuria sp. A sensu (Carter 1993)	X	X												
Artonius elizabethae Sugiyama					X			X					X	
Betraccium aff. *inornatum* Blome sensu Carter 1993	X	X		X	X					X				
Betraccium nodulum Carter	X	X												
Betraccium perilense Carter	X			X									X	
Bipedis acrostylus Bragin	X	X			X				X	X			X	
Bistarkum cylindratum Carter	X	X											X	
Canoptum triassicum Yao	X	X		X	X	X			X			X		
Canoptum aff. *unicum* Pessagn &Whalen sensu Carter 1993	X	X					cf						X	
Canoptum (= *Neocanoptum*) sp. A sensu Carter 1993	X	X												
Cantalum gratum Carter	X			X										
Cantalum sp. A sensu Carter 1993	X	X												
Canutus? *beehivensis* Carter	X	X												
Citriduma asteroides Carter	X	X		cf	X							X	X	
Citriduma sp. C sensu Carter 1993	X	X						cf		X				
Crucella flowerpotensis Carter	X	X												
Crucella? sp. A sensu Carter 1993	X	X												
Crucella sp. A sensu Yeh & Cheng 1996		X	X	X										
Deflandrecyrtium carterae Yeh & Cheng		X		X	X	X								
Deflandrecyrtium ithacanthum Sugiyama	X	X		X	X	X		X					X	
Deflandrecyrtium nobense Carter	X	X												
Deflandrecyrtium sp. A sensu Carter 1993	X	X		X										
Entactinosphaera? *amphilapes* Carter	X	X												
Entactinosphaera? *spinulata* Carter	X	X												
Eptingium amoenum Carter	X	X		X										
Eptingium onesimos Carter	X	X												
Eucyrtid gen. et sp. indet. sensu Carter 1993	X	X												X
Ferresium teekwoonense Carter	X	X												
Ferresium triquetrum Carter	X	X											X	
Ferresium sp. A sensu Carter 1993	X	X												
Ferresium sp. B sensu Carter 1993	X	X											X	
Fontinella clara Carter	X	X								X				
Fontinella habros Carter	X	X												
Fontinella inflata Carter	X	X								X				
Fontinella louisensis Carter	X	X		X						X				
Fontinella primitiva Carter	X	X								X				
Globolaxtorum hullae (Yeh & Cheng)	X	X		X	X					X			X	
Globolaxtorum tozeri Carter	X	X			X					X			X	X
Haeckelicyrtium breviora Sugiyama		X			X							?	X	
Haeckelicyrtium karcharos Carter	X	X		X	X				cf					
Haeckelicyrtium takemurai Yeh & Cheng		X		X	X	X							X	
Hagiastrum giganteum Carter & Hori	X	X			X									
Hagiastrum? *pacificum* Sugiyama	X	X		X	X	X				X				
Hagiastridae sp. B sensu Yeh & Cheng 1996		X		X										
Icrioma? *cistella* Carter	X	X											X	
Icrioma? sp. A sensu Carter 1993	X	X	?							X				
Kahlerosphaera sp. A sensu Carter 1993	X	X												
Kungalaria newcombi Dumitrica & Carter	X	X						X						
Laxtorum capitaneum Carter	X	X		cf								X	X	
Laxtorum aff. *kulense* Blome sensu Carter 1993	X	X		X										
Laxtorum perfectum Carter	X	X				X						X	X	

Table 1.(continued)

Radiolarian species	QCI	BCS	NEV	PHI	JAP	CHI	TIB	TIM	RUS	ITL	AUS	HUN	TUR	OMA
Laxtorum porterheadense Carter	X	X										X		
Livarella densiporata Kozur & Mostler	X	X		X	X	X		X		X	X		X	X
Livarella gifuensis Yoshida	X			X	X	X			X	X				X
Livarella longus Yoshida		X		X	X	X	X		X	X		X	X	X
Livarella valida Yoshida	X	X		X	X	X				X		X	X	X
Loupanus thompsoni Carter	X	X												
Mesosaturnalis acuminatus Carter	X	?												cf
Nabolella (=*Squinabolella*) aff. causia sensu Carter 1993	X	X								X			X	
Nabolella desrochersi (Carter)	X	X												
Nabolella? *trispinosa* (Carter)	X	X		?	X			X					X	
Nabolella? cf. *trispinosa* (Carter) sensu Yeh & Cheng 1996		X		X										
Nabolella sp. C sensu (Carter 1993)	X	X												
Natraglia spp.	X	X						X	X				X	
Octostella dihexacanthus (Carter)	X	X			X								X	
Pantanellium aff. *fosteri* Pessag& Blome sensu Carter 1993	X	X												
Pantanellium newkluense Carter	X	X		X	cf	X				X				
Paratriassoastrum crassum Carter	X	X	X		X	X								
Paratriassoastrum omegaense Carter	X	X								X			X	
Paratriassoastrum parvum Kozur & Mostler				X	X					X				
Paronaella pacofiense Carter	X	X		X	X		cf						X	
Parvibrachiale spp.		X			X									
Pentactinocarpus sevaticus Kozur & Mostler	X										X		X	
Poulpus sp. A sensu Yeh & Cheng 1996		X		X										
Praecitriduma apexensis Carter	X	X												
Praecitriduma canthofistula Carter	X	X											X	
Praecitriduma mostleri Kozur	X	X		X							X			
Proparvicingula moniliformis Carter	X	X		cf			?		X	X				
Psedacanthocircus troegeri Kozur & Mostler	X													X
Pseudohagiastrum monstruosum Pessagno	X	X						X						
Pseudohagiastrum? *tasuense* Carter	X	X												
Pseudohagiastrum sp. A sensu Carter 1993	X	X												
Pseudoheliodiscus beattiense (Carter)	X	X						X	cf					
Pseudoheliodiscus decilobum Carter	X			X										
Pseudoheliodiscus huxleyensis (Carter)	X	X		X					cf	cf				
Pseudoheliodiscus sandspitense (Blome)	X	X		X				X		X			X	cf
Pseudoheliodiscus sp. B sensu Carter 1993	X	X												
Pseudoheliodiscus sp. A sensu Yeh & Cheng 1996		X		X										
Serilla ellisensis (Carter)	X	X				X							X	
Serilla stalkungi (Carter)	X	X		X					X				X	
Serilla tledoensis (Carter)	X	X		X	X					X			X	
Serilla conclusum (Carter)	X	X			X									
Syringocapsa rhaetica Kozur& Mostler		X								X	X	X	X	
Tetraporobrachia composita Carter	X	X				X		X					X	
Tetraporobrachia sp. C sensu Carter 1993	X	X												
Tetraporobrachia sp. D sensu Carter 1993	X	X												
Tipperella spp. (= Spum indet. D sensu Carter 1993)	X	X											X	
Tricornicyrtium dikmetaensis Tekin		X		X	X								X	
Vegicyclia austriaca Kozur & Mostler	X	X			X						X		X	
Spumallaria indet. gen A, sp. A sensu Yeh 1992		X		X										
Spumellaria indet. gen et sp. indet. B sensu Carter 1993	X	X											X	

nevertheless, becoming more and more recognized and understood as time passes. More research in needed in this area to expand our global knowledge of Hettangian radiolarians.

REFERENCES

Amodeo, F., 1999, Il Triassico terminale-Giurassico del Bacino Lagonegrese. Studi stratigrafici sugli Scisti Silicei della Basilicata (Italia meridionale), The uppermost Triassic-Jurassic of the Lagonegro Basin, Stratigraphic studies on the Scisti Silicei Formation in Basilicata (southern Italy): Mémoires de Géologie (Lausanne), no. 33, 121 p, + 10 pls.

Bazzucchi, P., Bertinelli, A., Ciarapica, G., Marcucci, M., Passeri, L., Rigo, M. and Roghi, G., 2005, The Late Triassic-Jurassic stratigraphic succession of Pignola (Lagonegro-Molise Basin, Southern appenines, Italy): Bollettino Societ Geologica Italiana, v. 124, pp. 143-153.

Bragin, N. Ju., 1986, Triassic biostratigraphy of deposits in south Sakhalin: New proceedings, Academy of Science of the USSR, Moscow, Geological Series no. 4, p. 61-75 (in Russian).

Bragin, N. Ju.,1990, Triassic biostratigraphy of radiolarian deposits in Eastern USSR; in Radiolarian Biostratigraphy: Academy of Science of the USSR (Urals Department), Sverdlovsk, p. 26-31 (in Russian).

Bragin, N. Ju.,1991, Radiolaria and Lower Mesozoic units of the USSR east regions: Academy of Sciences of the USSR: M. Nauka, Transactions. v. 469, p. 1-125 (in Russian, with English summary).

Carter, E.S., 1990, New biostratigraphic elements for dating Upper Norian strata from the Sandilands Formation, Queen Charlotte Islands, British Columbia, Canada: Marine Micropaleontology, v. 15, p. 313-328.

Carter, E.S., 1993, Biochronology and Paleontology of uppermost Triassic (Rhaetian) radiolarians, Queen Charlotte Islands, British Columbia, Canada: Mémoires de Géologie (Lausanne) no. 11, 175 p.

Carter, E.S., 1997, Report on limestone samples from Mushroom Point, Kyuquot area, west coast Vancouver Island: Internal report to Geological Survey of Canada, 7 Feb. 1997.

Carter, E.S. and Hori, R.S., 2005, Global correlation of the radiolarian faunal change across the Triassic-Jurassic boundary: Canadian Journal of Earth Science, 42, p. 777-790.

Carter, E.S., Orchard, M.J., and Tozer, E.T., 1989, Integrated ammonoid-conodont-radiolarian biostratigraphy, Late Triassic Kunga Group, Queen Charlotte Islands, British Columbia: in Current Research, Part H, Geological Survey of Canada, Paper 89-1H, p. 23-30.

Cheng, Y-N, 1989, Paleozoic and Lower Mesozoic radiolarian assemblages from the Busuanga Islands, North Palawan Block, Philippines: Bulletin of the National Museum of Natural Science, Taiwan, No.1, p. 129-176.

Cordey, F., Gordey, S.P., and Orchard, M.J., 1991. New biostratigraphic data from the northern Cache Creek Terrane, Teslin map area, southern Yukon: in Current Research, Part E; Geological Survey of Canada, Paper 91-1E, p. 67-76.

Kishida, Y. and Sugano, K., 1982. Radiolarian zonation of Triassic and Jurassic in outer side of Southwest Japan: News of Osaka Micropaleontologists v. 5, p. 271-300 (in Japanese, with English abstract).

Kishida, Y. and Hisada, K., 1986, Radiolarian Assemblages of the Sambosan Belt in the western part of the Kanto Mountains, Central Japan: News of Osaka Micropaleontologists, v. 7, p. 25-34 (in Japanese, with English abstract).

Kojima, S., 1989, Mesozoic terrane accretion in Northeast China, Sikhkote-Alin and Japan regions: Palaeogeography, Palaeoclimatology, Palaeoecology, v. 69, p. 213-232.

Kojima, S. and Mizutani, S., 1987. Triassic and Jurassic Radiolaria from the Nadanhada Range, Northeast China: Transactions and Proceedings Palaeontological Society of Japan, 148, p. 256-275.

Kozur, H., 1984a, New radiolarian taxa from the Triassic and Jurassic: Geologisch - Paläontologische Mitteilungen, Innsbruck, v. 13 (2), p. 49-88.

Kozur, H., 1984b. The Triassic radiolarian genus, *Triassocrucella* gen. nov. and the Jurassic *Hagiastrum* Haeckel, 1882: Journal of Micropalaeontology, v. 3 (1), p. 33-35.

Kozur , H. & Mostler , H. 1981, Beiträge zur Erforschung der mesozoischen Radiolarien. Teil IV: Thalassosphaeracea HAECKEL, 1862, Hexastylacea HAECKEL, 1882, emend. Petrushevskaja, 1979, Sponguracea HAECKEL, 1862 emend. und weitere triassische Lithocycliacea, Trematodiscacea, Actinommacea und Nassellaria: Geologisch - Paläontologische Mitteilungen, Innsbruck, Sonderband 1, 208 p. (in German, with English abstract).

Mizutani, S., Shao, J.A. and Zhang, Q.L., 1989, The Nadanhada terrane in relation to Mesozoic tectonics on continental margins of East Asia: Acta Micropalaeontologica Sinica, 63, p. 204-216 (in Chinese with English abstract).

Orchard, M.J., Carter, E.S, Lucas, S.G. and Taylor, D.G., 2007, Rhaetian (Upper Triassic) conodonts and radiolarians from New York Canyon, Nevada, USA. Albertiana 35, p. 59-65.

Orchard, M.J.. Whalen, P.A., Carter, E.S. and Taylor, H.J., in press, Latest Triassic conodonts and radiolarian-bearing successions in Baja California Sur: This volume.

Pálfy, J., Demény, A., Haas, J., Carter, E.S., Görög, A., Halász, D., Oravecz-Schäffer, A., Hetényi, M., Márton, E., Orchard, M.J., Ozsvárt, P., Vetö, I., Zajzon, N. Triassic-Jurassic boundary events inferred from integrated stratigraphy of the Csövár section, Hungary: Palaeogeography, Palaeoclimatology, Palaeoecology, 224, p. 11-33.

Reggiani, L., Bertinelli, A., Ciarapica, G., Marcucci, M., Passeri, L., Ricci, C. and Rigo, M., 2005, Triassic-Jurassic stratigraphy of the Madonna del Sirino succession (Lagonegro Basin, Southern Appennines, Italy): Bollettino Societ Geologica Italiana, v. 124, p. 281-291.

Rose, G., 1994, Late Triassic and Early Jurassic radiolarians from Timor, Eastern Indonesia. Unpublished Ph.D. thesis, University College London, 413 p.

Spörli, K.B. and Aita, Y., 1988, Field trip guide to Waipapa basement rocks, Kawakawa Bay, Auckland, Workshop of Radiolaria 1988: Geological Society of New Zealand Miscellaneous Publication 39, 27 p.

Sugiyama, K., Triassic and Lower Jurassic radiolarian biostratigraphy in the siliceous claystone and bedded chert units of the southeastern Mino Terrane, Central Japan: Bulletin of the Mizunami Fossil Museum, no. 24, p. 79-193.

Tekin, U.K., 1999, Biostratigraphy and systematics of late Middle to Late Triassic radiolarians from the Taurus Mountains and Ankara region, Turkey: Geologisch-Paläontologische Mitteilungen Innsbruck, Sonderband 5, 202 p. + 47 pls.

Tekin, U.K., 2002, Late Triassic (late Norian-Rhaetian) radiolarians from the Antalyia Nappes, Central Taurides, Southern Turkey: Revista Italiana di Paleontologia e Stratigrafia, v. 108(3), p. 415-440.

Wang, Y-J., Wang, J-P. and Pei, F., 1990, A late Triassic radiolarian fauna in the Dingqing ophiolite belt, Xizang (Tibet): Acta Micropalaeontologica Sinica 19(4), p. 323-336.

Whalen, P.A., Carter, E.S., and Orchard, M.J., 1998, Rhaetian radiolarians and conodonts near the Triassic-Jurassic boundary in Baja California Sur: Vancouver, August 12-25, 1998, 5th International Symposium on the Jurassic System, Abstracts and Program, p. 95.

Yang, Q. and Mizutani, S., 1991, Radiolaria from the Nadanhada Terrane, Northeast China: the Journal of Earth Sciences, Nagoya University, v. 38, p. 49-78.

Yao, A., 1982, Middle Triassic to Early Jurassic radiolarians from the Inuyama area, Central Japan: Journal of Geosciences, Osaka City University, v. 25 (4), p. 53-70.

Yao, A., Matsuda, T., and Isozaki, Y., 1980a, Triassic and Jurassic Radiolarians from the Inuyama Area, Central Japan: Journal of Geoscience, Osaka City University, v. 23, p. 135-154.

Yao, A., Matsuda, T., and Isozaki, Y., 1980b, Triassic and Jurassic Radiolarians in Inuyama of the Mino Belt: Abstract Program, 1980 Annual Meeting Geological Society of Japan, p. 221.

Yeh, K.-Y., 1989, Studies of Radiolaria from the Fields Creek Formation, east-central Oregon, U.S.A.: Bulletin of the National Museum Natural Science, Taiwan, No. 1, p. 43-110.

Yeh, K.-Y., 1992, Triassic Radiolaria from Uson Island, Philippines: Bulletin of the National Museum of Natural Science, Taiwan, No. 3, p. 51-91.

Yeh, K.-Y. and Cheng, Y-N., 1996, An Upper Triassic (Rhaetian) radiolarian assemblage from Busuanga Island, Philippines: Bulletin of the National Museum Natural Science, Taiwan, No.7, p. 1-43.

Yeh, K-Y. and Yang, Q., 2006, Radiolarian assemblages from T-J boundary strata, Nadanhada Terrane, NE China: Acta Micropalaeontologica Sinica, 23(4), p. 317-360.

Yoshida, H., 1986, Upper Triassic to Lower Jurassic radiolarian biostratigraphy in Kagamigahara City, Gifu Prefecture, central Japan: Journal of Earth Science, Nagoya University, v. 34, p. 1-21 + 17 pls.

Ziabrev, S.V., Aitchison, J.C., Abrajevitch, A.V., Badengzhu, Davis, A.M. and Luo, H., 2004, Bainang Terrane, Yarlung-Tsanpo suture, southern Tibet (Xizang, China): a record of intra-Neotethyan subduction – accretion processes preserved on the roof of the world: Journal of the Geological Society, London, v. 161, pp. 523-538.