Université Lille1 Sciences et Technologies

Géosystèmes

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The Micropalaeontological Society

Geobiology and environments of siliceous biomineralizers

4-6 September 2011
at the University Lille 1 (France)

Organizers:
Taniel DANELIAN, Nicolas TRIBOVILLARD, Jean PRYGIEL & Felipe ARTIGAS

Abstract volume

Schedule of events and timetable for presentations

Sunday September 4th, 2011

18:00-20:00 Reception at the Natural History Museum of Lille.
Musée de Géologie ; 19, rue de Bruxelles 59000 LILLE

Monday September 5th, 2011 (University Campus, near A3)

8:30-9:00 Registration

9:00-9:30 Opening ceremony

9:30-10:00 **J.P. Caulet** - *George Deflandre (1897-1973); the first French naturalist interested in siliceous microfossils*

10:00-10:45 **P. De Wever, S. Gorican & L. O'Dogherty** - *Monsoon as cause of Mesozoic radiolarite deposits in Tethys*

10:45-11:15 - Coffee-break

Silica biomineralization and biogeochemical cycles

11:15-12:00 **P. Tréguer & Ch. De La Rocha** (Keynote talk)
Is the silicic acid leakage hypothesis supported by facts?

12:00-12:20 **Panizzo et al.** - *A* $\delta^{30}Si_{diatom}$ *reconstruction of Holocene productivity of the Southern Ocean, east Antarctica*

12:20-12:40 **A. Sadekov, K. Darling & H. Elderfield** - *Preliminary view on radiolarian geochemistry using secondary ion mass-spectrometry (SIMs) microanalysis: new proxy for paleoclimate?*

12:30-13:00 **L. O'Dogherty, P. De Wever & S. Gorican** - *What forcing mechanism drives radiolarian diversity in the Mesozoic?*

13:00-14:00 Lunch

Diatoms and marine (palaeo-) environments

14:00-14:30 **P. Lopez** - *The impact of ocean acidification on the dynamics of diatom morphogenesis*

14:30-14:50 **J. Tyler, M. Leng, H. Sloane, E. Cox & R. Rickaby** – *Oxygen isotope fractionation during the life and death of diatoms*

14:50-15:10 **L.F. Artigas, M. Dias, C. Arantes, B. Beker, I. do Rosario Marinho-Jaussaud, J. Chicheportiche, L. Courcot** - *Diatoms in the Amazon aquatic*

continuum: dynamics and diversity, from the main river and tributaries to estuarine, coastal and shelf systems under strong continental influence

15:10-15:30 **D.U. Hernandez Becerril, S.A. Baron-Campis & A. Morales-Blake -** *Environmental conditions favoring high densities of planktonic diatoms in coasts of the central Mexican Pacific (April, 2010)*

15:30-16:00 **J. Pike, M. Leng, G. Swann & A. Snelling** - *Diatom silica oxygen isotope records from the Antarctic margin*

16:00-16:30 - Coffee-break

Siliceous plankton and (palaeo-) environmental studies

16:30-16:50 **J. Prygiel** - *Diatoms: ecological status and the European directive for environmental monitoring*

16:50-17:10 **R. Ramanibai, S. Ravichandran & S. Jeyanthi** - *Diatoms as Environmental Indicators for Modern and Paleo studies*

17:10-17:30 **T. Hatin, A. Le Hérissé, L. Droz & T. Marsset** - *Diatoms as sensitive indicators for climatic variability reconstruction through the last 165 Ka in the Zaïre/Congo deep-sea fan*

17:30-17:50 **C. Allen** - *Diatoms of Antarctica and their proxy record*

17:50-18:10 **E.A. Morales, M.H. Novais, L. Hoffmann & L. Ector** - *Current taxonomic studies on the diatom flora (Bacillariophyceae) of the Bolivian Altiplano, South America with possible consequences on palaeoecological assessments*

18:10-18:30 **D. Lazarus, P. Diver, N. Suzuki and members of the IODP Paleontology Coordination Group** – *Tools for synthesis of the deep-sea microfossil record - recent advances in developing the Neptune database, taxonomic dictionaries, and age-model library*

18:30-18:45 Poster presentations

- Discussion around posters

19:30-22:00 Gala dinner (restaurant “L’Escale”)

Tuesday September 6th, 2011 (University Campus, near A3)

Siliceous biomineralization and environments

9:00-9:20 **K. Ogane, A. Tuji, N. Suzuki, R.S. Hori, T. Kurihara, A. Matsuoka** - *Function of pseudopodia in polycystine cells as silica accumulation organelle by PDMPO examination*

9:20-9:40 **N. Suzuki, K. Ogawa, K. Ogane & A. Tuji** - *Patchwork silicification of living polycystine Radiolaria observed with the long-term continuous video recording*

9:40-10:00 **P. Dumitrica** - *Skeletal malformations in some Polycystine Radiolaria and silicoflagellates: link with environmental factors*

10:00-10:20 **J. Witkowski** - *Trends in siliceous plankton productivity (ebridians, silicoflagellates and diatoms) during late middle Eocene greenhouse warming at ODP Sites 748 and 1051*

10:20-10:50 Poster presentations

10:50-11:20 - Coffee-break

Siliceous sediments and their palaeoenvironmental/industrial significance

11:20-11:40 **M. Caridroit, C. Randon & B. Musavu-Moussavou** – *The Carboniferous Lydian rocks (or lydites); a siliceous event?*

11:40-12:00 **T. Gregory** - *Atmospheric controls on the formation of diatom-rich sediments in Adélie Land, East Antarctica*

12:00-12:20 **C. Plet, A. Person, M. de Rafélis** - *Cherts from lakes of the East African Rift are believed to be a good analog to the PreCambrian Cherts. Do they have a biotic origin ?*

12:20-12:40 **N. Sennikov** - *On the depositional depth of Lower Cambrian volcanic-siliceous-terrigenous sequences in the central part of the Gorny Altai (SW Siberia, Russia)*

12:40-13:00 **B. Jones** - *The importance of biogenic silica in the exploration for and exploitation of unconventional shale gas reservoirs*

13:00-14:00 Lunch

Siliceous plankton biodiversity dynamics

14:00-14:20 **D. Lazarus, J. Renaudie, J. Barron. A. Türke & P. Diver** - *Cenozoic diversity history of diatoms and radiolarians - current knowledge, limitations, future prospects*

14:20-14:40 **Verleyen E., Van de Vijver B., Hodgson D.A., Sabbe K., Souffreau C., Nedbalová L., Tavernier I., Sterken M., Jones V.J., Vanormelingen P., Antoniades D., Van Nieuwenhuyze W., Satoshi I., Kudoh S. & Vyverman**

W. - *Poles apart: Interhemispheric contrasts in polar diatom diversity driven by differences in tectonics and glacial history*

14:40-15:00 **J. Renaudie & D. Lazarus** - *Macroevolutionary patterns in Antarctic Neogene radiolarians*

15:00-15:20 **N. Bragin** - *The biostratigraphic, palaeobiogeographic and palaeoclimatic significance of Boreal Triassic radiolarian assemblages from Arctic Russia*

15:20-15:40 **V. Vishnevkaya** - *Evolution of siliceous skeletons of genera of the Family Parvicingulidae (Radiolaria*)

15:40-16:00 **O. Obut, L. Pouille, T. Danelian & N. Sennikov** - *Radiolaria and sponge spicules from the Lower Cambrian of the Altai Mountains (Siberia)*

16:00-16:30 - Coffee-break

The Radiolarian biotic response to oceanographic changes

16:30-16:50 **P.O. Baumgartner, O. Tomson, S. Saraiva, P. Dumitrica & C. Baumgartner-Mora** - *Response of modern, surface-dwelling radiolaria to nutrient-rich river plumes in the Southern Caribbean.*

16:50-17:10 **K. Kuwahara & A. Yao** - *Permian-Triassic transition strata and the Radiolarian record from Japan – A case study of the Gujo-hachiman section*

17:10-17:30 **L. Bragina** - *The importance of Cenomanian Radiolaria from Crimea (Ukraine) to improved understanding of Cenomanian-Turonian Radiolarian biodiversity*

17:30-17:50 **P. Dumitrica** - *Siamese twin skeletons in Mesozoic radiolarians*

Closing ceremony

Poster presentations
All posters will be presented with a 3 min powerpoint presentation

Asatryan G. & Danelian T. - *The importance of Middle Jurassic to Lower Cretaceous radiolarian assemblages for the reconstruction of the Tethyan ocean realm in the Lesser Caucasus (Armenia)*

Bragin N. *Late Jurassic to Early Cretaceous Radiolaria of Nordvik Peninsula, Russia, Arctic*

Bragina L. & Bragin N. - *Triassic and Late Cretaceous high-latitude radiolarian assemblages and their morphological affinity and difference (comparative analysis)*

Bragina L. *Albian - Cenomanian Radiolaria from the Uttatur Formation, Kaveri Basin, Southern India*

Obut O. *Devonian Radiolarian diversity and biostratigraphy from the Altai mountains (Southern Russia)*

O'Dogherty L., De Wever P. & Gorican S. - *Preservation vs. productivity: Assessing the potential of Mesozoic radiolarians as paleoenvironmental proxies*

Pylarczyk E., Danelian T. & Marsset T. - *Pleistocene climatic changes and the polycystine Radiolarian record in the eastern tropical Atlantic*

Pouille L., Danelian T., Popov L. & Ghobadi-Pour M. - *Discovery of a Late Darriwilian – Early Sandbian diverse Radiolarian assemblage from Kazakhstan: a key fauna to better evaluate Radiolarian diversity trends in the context of the Great Ordovician Biodiversification Event*

Tribovillard, N., Bout-Roumazeilles, V., Riboulleau, A., Baudin, F., Danelian, D., Riquier, L. – *Transfer of Germanium to marine sediments: insights from its accumulation in radiolarites and authigenic capture under reducing conditions. Some examples through geological ages*

Vishnevskaya V. - *Recrystallization of Silica in Radiolaria and possible replacement in connection to diagenetic changes*

Vishnevskaya V. - *Radiolaria and Sponge Spicule Si structure evolution as reflection of Ocean change*

Summary of communications

"Diatoms of Antarctica and their proxy record"

Allen Claire

British Antarctic Survey, NERC, High Cross, Madingley Road, Cambridge CB3 0ET, UK, csall@bas.ac.uk

Diatoms have proven highly successful proxies in reconstructing palaeoceanographic conditions in the Southern Ocean. Ecological associations for some fossil-producing Antarctic diatoms are well documented and provide the basis for reconstructing sea ice limits, water mass migrations and relative changes in sea surface temperature. For other diatom species, their scope as a proxy is severely limited by not knowing sufficient about their environmental tolerances. As such, there is scope to improve our understanding of the proxy record and resolve greater detail from the diatom record by identifying and improving our understanding of the specific ecological affinities of diatom groups and species as well as examining how different environmental conditions impact individual diatom species (abundance, forms, resting spore formation, size, morphology etc.) and the fossil record (deposition, preservation, reworking etc.). Here, examples of surface sediment distributions and down-core profiles of several diatoms will be presented to assess the efficacy of existing.

Diatoms in the Amazonas aquatic continuum: dynamics and diversity, from the main River and tributaries to estuarine, coastal and shelf systems under strong continental influence

Artigas Luis Felipe[1], Dias Maxley Barbosa[2], de Oliveira Elizabeth Cristina Arantes[3,4], Beker Beatriz[5], Marinho-Jaussaud Ivaneide do Rosario[1], Chicheportiche Jessica[1], Courcot Lucie[1], Ternon Jean-François[6] & Abril Gwenael[4,7]

[1] Laboratoire d'Océanologie et Géosciences (LOG), CNRS UMR 8187, MREN, Université du Littoral Côte d'Opale, Wimereux, France, Felipe.Artigas@univ-littoral.fr
[2] Núcleo de Pesquisas Aquáticas (NuPAq), Instituto de Pesquisas Científicas e Tecnológicas do Estado do Amapá (IEPA), Macapá, AP, Brazil
[3] Laboratório de Géoquimica (LAGEQ), Instituto de Geociencias, Brasilia, Brazil
[4] Laboratoire des Mécanismes et Transferts en Géologie, IRD, CNRS, Université Paul Sabatier, Toulouse, France
[5] Université de Bretagne Occidentale, Laboratoire LEMAR, Brest, France
[6] UMR 212 Ecosystèmes Marins Exploités– IRD - Centre de Recherche Halieutique Méditerranéenne et Tropicale - Sète et Ile de la Réunion, France
[7] Laboratório de Potamologia Amazônica – LAPA, Universidade Federal do Amazonas, Manaus - Brasil

In the present study, we describe the phytoplankton distribution along the Amazonas River continuum, focusing on Diatoms (Bacillariophyceae), from floodplains and tributaries to central channel and from the estuary to coastal and shelf systems under strong continental influence. Phytoplankton stocks, groups and species were assessed by chlorophyll *a* analysis, *in situ* spectral fluorescence and/or microscopic optical and SEM observations performed in some Amazonas central, estuarine and mouth systems, as well as in some coastal and shelf areas under the direct (Brazil) or remote (French Guiana) influence of Amazonas waters.

We could define a contrasted set of systems in the Amazon continental area, from black and white waters (lowest stock levels and high phytoplankton and diatom diversity) to floodplain waters showing maximum phytoplankton biomass (dominated by non siliceous forms).

The main estuarine waters were sampled during different situations and were globally characterized by low biomasses but high diatom diversity. The direct and remote influence of the Amazon waters over the coastal and continental shelf waters was investigated during a series of coastal cruises and one shelf cruise. The large amounts of particulate and dissolved matter driven from continental sources constitute the main drivers of phytoplankton dynamics in these areas (mostly dominated by diatoms), depending mainly on the hydrodynamical features. Phytoplankton blooms were detected in inner shelf stations under remote Amazonas influence, in areas which showed however a high spatio-temporal variability in phytoplankton dynamics according to Amazonas plume waters circulation.

The importance of Middle Jurassic to Lower Cretaceous radiolarian assemblages for the reconstruction of the Tethyan ocean realm in the Lesser Caucasus (Armenia)

Asatryan Gayané[1] & Danelian Taniel[2]

[1] Institut des Sciences Géologiques, Académie National des Sciences d'Arménie, 24a avenue Baghramian, Erevan, 375019, Arménie gaianeas@rambler.ru
[2] Université Lille 1, Laboratoire Géosystèmes (FRE 3298 CNRS) UFR des Sciences de la Terre, bâtiment SN5, 59655 Villeneuve d'Ascq cedex, France. taniel.danelian@univ-lille1.fr

Biostratigraphic constraints for the sedimentary cover of the ophiolites preserved in the Lesser Caucasus are of key importance for the palaeogeographic and geodynamic reconstruction of the greater area between Eurasia and the South-Armenian Block, a Gonwanian micro-continent during the Late Palaeozoic – Early Mesozoic time. The two main ophiolitic zones recognised in the Lesser Caucasus are linked to the evolution of the Neotethys ocean.

The Vedi ophiolite constitutes a large tectonic klippe. Relatively well-preserved Middle Jurassic (Bajocian) radiolarians were extracted from radiolarites overlying pillow lavas and intercalated with variolitic lavas. The fauna is fairly diverse, although dominated by small Nassellarian species, typical of the Tethyan bioprovince. In another locality, at a small side valley of the river Vedi a few metres-thick radiolarites intercalated with lavas yielded a fairly well-preserved mid Oxfordian to early Tithonian assemblage, establishing thus that submarine volcanic activity continued till at least the Late Jurassic.

Amongst the various localities studied along the Sevan ophiolite (located along the Sevan-Akera suture zone and considered to have been formed in a slow spreading back-arc basin) three have allowed to obtain identifiable radiolarians. The assemblages yielded by cherts of the Sarinar section can be correlated with the mid Oxfordian-early Tithonian interval (U.A.Z. 9-11). The intercalation of tuffites within these radiolarian cherts suggests that subaerial volcanic activity took place at this period. In the Dali section, radiolarites overly spilitic lavas and are intercalated by tuffites. The identifiable radiolarians are correlated with the late Tithonian to Berriasian interval (U.A.Z. 12-15), suggesting that oceanic crust was being formed at the Jurassic/Cretaceous transition and was accompanied by subaerial volcanic activity. In the Dali section, radiolarian cherts that overlie both spilitic lavas and plagiogranites were deposited during the latest Tithonian–early Berriasian interval (U.A.Z. 13-14). Metric blocks of oolitic limestones, which were redeposited on a slope depositional environment, slid at the Jurassic/Cretaceous transition into the oceanic basin in which radiolarian ooze was being accumulated. Results from the Tzgnaged outcrop north of the lake Sevan and from the Vank section in Karabagh, suggest that radiolarian ooze accumated at least until the late Valanginian to late Barremian/early Aptian (UAZ 18-22) based essentially on the occurrence of *Acanthocircus carinatus perforatus*.

Response of modern, surface-dwelling radiolaria to nutrient-rich river plumes in the Southern Caribbean

Baumgartner Peter O., Tomson Oliver, Saraiva Sarah, Dumitrica Paulian & Baumgartner-Mora Claudia

Institut de Géologie et Paléontologie, Université de Lausanne, Anthropole, CH-1015 Lausanne, Switzerland. Peter.Baumgartner@unil.ch

We collected surface (0-10 m) plankton samples using a 100 µm mesh plankton net near Carriacou (Grenada) and Barbados in February 2009, September 2009 and September 2010. These periods best document the seasonal variations in the intensity of the fluvial influence of the Orinoco River in the southeastern Caribbean. During February 2009, the marine area was free of fluvial influence (sea surface salinity (SSS) = 35.5 ‰). Fluvial influence was moderate during September 2009 (SSS) = 34.50 ‰) during El Niño conditions. It was strong in September 2010 (SSS = 31.25 ‰) during a normal discharge peak of the river.

We determined and counted under the SEM 300-800 specimens of polycystine radiolaria per sample to characterize the influence of the Orinoco River plume.

Overall radiolarian abundance and species richness correlate negatively with fluvial influence. The spumellarian/nassellarian ratio varies according to seasons (55-74% spummellarians with low river input), while spumellarians dominate during strong river input (95%).

Under zero or moderate fluvial influence, radiolarian assemblages are similar. They are very different from those with high fluvial influence. The radiolarian *Pterocorys campanula* is a characteristic species of faunas under zero and moderate fluvial influence, while *Plegmosphaera pachypila* is characteristic of waters with a high fluvial influence. The observed changes in living radiolarian assemblages correlate well with measured hydrochemical changes caused by the Orinoco River plume. However, river plume faunas have nothing in common with Atlantic upwelling faunas. The observed faunal changes may become an important proxy for the study of past changes in riverine influence in fossil assemblages.

Late Jurassic to Early Cretaceous Radiolaria of Nordvik Peninsula, Russia, Arctic

Bragin Nikita

Geological Institute RAS, Pyzhevsky 7, Moscow 119017, Russia, bragin.n@mail.ru

The section of Jurassic–Cretaceous boundary beds in the Nordvik Peninsula (Arctic Siberia) is characterized by two radiolarian assemblages (Bragin, 2009, 2011a). The first assemblage (*Arctocapsula magna* Bragin, *A. congelata* Bragin), of middle Volgian age, is dominated by radiolarians belonging to the boreal genus *Arctocapsula*. It is possible to see characteristic prevalence in abundance of a few typical Boreal taxa and presence of several species characteristic of southerly regions, which are apparently of wide geographic range. The second assemblage (*Acaeniotylopsis nordvikensis* Bragin, *Echinocampe aliferum* Bragin) is confined to upper Volgian and basal Berriasian depositss. Representatives of the family Echinocampidae dominate this assemblage. It is noteworthy that none of the identified taxa is known from Tethyan sections; Moreover, the assemblage includes none of the suprageneric taxa that are characteristic of the low latitudes. For instance, the assemblage lacks the Late Jurassic families Williriedellidae and Saturnalidae. The complete absence of Pantanelliidae from the Nordvik assemblage implies that it is certainly of Boreal affinity and lacks warm-water radiolarians. Thus, the radiolarian assemblage of the upper Volgian from the Nordvik section consists almost exclusively of high-latitude taxa that never occur in Tethyan sections, although some of them could migrate into the biogeographic realm of transitional assemblages. The studied assemblages are clearly characterized by the quantitative domination of cyrtoids, the absence of prunoids and the rare occurrence of stauraxons. Such characteristics as taxonomic composition and morphological diversity can be used as paleoclimatic indicators.

The biostratigraphic, palaeobiogeographic and palaeoclimatic significance of Boreal Triassic radiolarian assemblages from Arctic Russia

Bragin Nikita

Geological Institute RAS, Pyzhevsky 7, Moscow 119017, Russia, bragin.n@mail.ru

The knowledge of Triassic boreal radiolarians is rather poor; to date, they have been recorded in a few sections of Omolon Massif (Bragin and Egorov, 2000), Svalbard (Tekin et al., 2006) and Kotel'nyi Island, Arctic Russia (Bragin, 2011). The last locality represents abundant material. Radiolarians are recorded at many stratigraphic levels of the Middle and Upper Triassic, which are represented by clays with interbeds of limestone and combustible schist and phosphatic, calciferous, and sideritic concretions. Six subsequent radiolarian assemblages are recognized in the section of Kotel'nyi Island in the interval from Late Anisian to Middle Norian. The fact that these assemblages include taxa that are recorded more southerly, including paleotropical localities, and support dating based on mollusks, enables the use of these data for Boreal–Tethyan correlation of Triassic deposits and to trace Triassic radiolarian zones to Arctic Region. The greatest similarity to Tethyan associations (up to 40% common species) is observed in the Late Carnian and Early Norian, that is, the periods of the greatest penetration of thermophilic mollusks into this basin. We can interpret the appearance of warm-water taxa due to warm current coming from Pacific via suspected North Anyi Paleo-ocean. Nevertheless, Triassic radiolarian assemblages from Kotel'nyi Island significantly differ from the coeval radiolarians of Pacific and Mediterranean. They are characterized by domination of genus *Glomeropyle* Aita et Bragin, which presents only in Arctic and in the New Zealand and displays bipolar distribution pattern. Triassic radiolarian assemblages of these regions display clear affinity (Aita, Bragin, 1999; Bragin, Egorov, 2001). Radiolarians can serve as paleoclimatic indicators for the Triassic.

Albian - Cenomanian Radiolaria from the Uttatur Formation, Kaveri Basin, Southern India

Bragina Liubov

Geological Institute RAS, Pyzhevsky 7, Moscow 119017, Russia, l.g.bragina@mail.ru

The Uttatur Formation (Albian – Turonian) belongs to the deposits of Kaveri Basin that are developed along the eastern coast of Southern India and cover the interval from Upper Jurassic to Neogene. This Formation is composed of clastics (clays and sandstones) with interbeds of limestones and with phosphatic concretions. The total thickness of the Kaveri Formation is more than 500 m, with its basal part represented by reefal limestones. The Kaveri Formation is characterized by abundant assemblages of ammonoids and other mollusks, and by planktonic foraminifers; all these fossils were used for detailed biostratigraphy. Radiolaria are present in phosphatic concretions; their assemblage from the lower part of the formation (Upper Albian – Lower Cenomanian) is represented by common Albian – Cenomanian taxa: *Acaeniotyle amplissima* (Foreman), *A. macrospina* (Squinabol), *Savaryella novalensis* (Squinabol), *S. quadra* (Foreman), *Amphipyndax stocki* (Campbell et Clark), *Archaeodictyomitra montisserei* (Squinabol), *Holocryptocanium barbui* Dumitrica, *Tubilustrium transmontanum* O'Dogherty and others. This assemblage is taxonomically similar to coeval Tethyan assemblages, although it is less diverse.

The importance of Lower Cenomanian Radiolaria from Crimea (Ukraine) to imporved undertanding of Cenomanian Radiolarian biodiversity

Bragina Liubov

Geological Institute RAS, Pyzhevsky 7, Moscow 119017, Russia, l.g.bragina@mail.ru

The reference section of the Cenomanian in Crimea, located in the slopes of Selbuchra Mountain (SW Crimea), was studied in detail. It is characterized by foraminifers, radiolarians, ammonoids, inoceramids, plants and other fossils. Radiolaria are present in dark grey clayey limestones, and are commonly replaced by pyrite but all structures remained well preserved. Lower Cenomanian strata (*Mantelliceras mantelli* Zone) yield well-preserved radiolarian assemblages, represented by 95 species (*Acaeniotyle diaphorogona* Foreman, *A. longispina* (Squinabol), *A. macrospina* (Squinabol), *Alievium* sp. ex gr. *A. sculptus* (Squinabol), *Archaeocenosphaera* ? *mellifera* O'Dogherty etc.). Some rare species like *Mallanites romanus* O'Dogherty were also observed. Almost all species are known from the Cretaceous of the Mediterranean realm: Italy (O'Dogherty, 1994; Salvini, Marcucci Passerini, 1998), Spain (O'Dogherty), Turkey (Bragina, 2004). This assemblage can be correlated with Mediterranean zonal assemblages, such as the *Dactyliosphaera silviae* Zone and *Patellula spica* Subzone (Lower Cenomanian – lower part of Middle Cenomanian). Such affinity suggests that Crimea was positioned in the Tethyan Realm of radiolarian paleobiogeography. The presence of *Cavaspongia tavrica* Bragina and *Distylocapsa squama* O'Dogherty in the dated Lower Cenomanian give us opportunity to correct data on their stratigraphic ranges. The obtained data show that radiolarian biodiversity in the Lower Cenomanian was still high even in the relatively shallow-water basins (like Crimea), and that many Mediterranean taxa migrated up to the northern boundary of the Tethyan Realm.

Triassic and Late Cretaceous high-latitude radiolarian assemblages and their morphological affinity and differency (comparative analysis)

Bragina Liubov & Bragin Nikita

Geological Institute RAS, Pyzhevsky 7, Moscow 119017, Russia, bragin.n@mail.ru

High-latitude Mesozoic Radiolaria bear a particular interest for Boreal-Tethyan correlation and paleobiogeography. We need to distinguish common and different features of Triassic and Late Cretaceous high-latitude assemblages of Radiolaria. We use material from Triassic of Arctic and NE Siberia (Bragin, Egorov, 2001; Bragin, 2011) and Late Cretaceous of Western Siberia (Amon, 2000) and Kamchatka (Vishnevskaya, 2005; Bragina, 1991).

1. Triassic assemblages are dominated by morphotypes with bipolar main spines (*Pseudostylosphaera*), and pylomate forms (*Glomeropyle*). Late Cretaceous assemblages are dominated by forms with bipolar three-bladed main spines (*Amphisphaera*), by prunoids (*Amphibrachium*), spongy discoids (*Orbiculiforma*), by three-rayed (*Paronaella*), four-rayed (*Crucella*) and multirayed stauraxons (*Pentinastrum*); pylomate forms (*Spongopyle*) are not common.

2. Spheroids with apophyses of spines (*Kahlerosphaera*) are common in the Triassic assemblages, but absent in the Cretaceous. Spheroids with hollow spines (*Capnuchosphaera*) and with two-bladed spines (*Zhamojdasphaera*) are present only in the Triassic.

3. Saturnalids are rare both in Triassic and Late Cretaceous high-latitude assemblages.

4. Three-rayed stauraxons (*Paronaella*) are rare in the Triassic but common in the Cretaceous.

5. Discoids in the Triassic are relatively rare. Cretaceous discoids are more diverse and common.

6. Multicyrtoid nassellarians with longitudinal ridges are rare in the Triassic (*Whalenella*), but common in the Cretaceous (*Pseudodictyomitra*).

7. Hat-shaped Nassellaria are absent in the high-latitude Triassic and Cretaceous assemblages.

8. Boreal Radiolaria strongly differ during evolution, and only morphotypes with bipolar main spines and pylomate forms retain their significance as high-latitude indicators.

The Carboniferous lydian rocks (or lydites) ; a siliceous event ?

Caridroit Martial[1], Randon Carine[2] & Musavu-Moussavou Benjamin[3]

[1] Université Lille 1, Laboratoire Géosystèmes (FRE 3298 CNRS) UFR des Sciences de la Terre, bâtiment SN5, 59655 Villeneuve d'Ascq cedex, France, martial.caridroit@univ-lille1.fr
[2] Université P. et M. Curie, 4 Place Jussieu, 75252, Paris, France.
[3] Université de Sciences et Techniques de Masuku, Gabon.

In many Tournaisian-Visean marine sections in Europe and other countries such as in Mexico, Turkey, … , the presence of lydian rocks or lydites is common. These siliceous rocks are radiolarian cherts, usually black in colour and rich in organic carbon. They consist of regularly-bedded deposits within limestone successions. In many other sections, even if lydites are absent, it is quite common that in this interval of time (Tournaisian-Visean), radiolarian remains in limestone series are well preserved (or at least, have a better preservation than in the underlying and overlying strata). So for many authors, these siliceous deposits represent a siliceous event which may represent an increase of the siliceous planktonic production, such as radiolarians.

The analysis of Tournaisian-Visean platform sections from the Pyrenees (France), Montagne Noire (France), Cantabric Chain (Spain) and, also, deep and distal radiolarites deposits from Thailand (Devonian to Middle Permian series) shows this event is related to complex factors.

Firstly, the underlying and overlying strata around the lydites are commonly rich in radiolarian skeletons which have been transformed into calcite. In such conditions, the skeletons cannot be extracted and this occurrence is not, or rarely, indicated in the descriptions of sections.

Secondly, even it is quite difficult to have a quantitative approach concerning the radiolarian remain amount compared with the sedimentation rate, it is clear that the siliceous event is above all a non-calcareous deposit event.

From this report and some stratigraphical, sedimentological and geochemical studies, we may suggest that the Tournaisian-Visean "siliceous event" reflects both global and local factors, which may explain this "event".

This study allows also discussing the biodiversity variations through time and points out the importance of understanding the taphonomy before discussing the biodiversity increase or mass extinction as for the P/T boundary extinction.

Georges Deflandre (1897-1973), the first French naturalist interested in siliceous microfossils

Caulet Jean-Pierre

242 rue de la Fure, 38 850 Charavines, jean.caulet@free.fr

Still a school teacher and without any university degrees, G. Deflandre began at 26 years old to work on protists, mostly focusing on micro-algae from French lakes and rivers until 1926 when he submitted his thesis. In 1930 he was appointed as a research assistant at the Museum (Paris) and began to be interested in microfossils until he became the head of the Micropaleontology Dpt. that was founded for him at the Museum in 1943 and where he continued to work until his death. During 50 years, he published more than 300 papers. Beside his important work on calcareous coccoliths from the Mesozoic and Cainozoic deposits from France, he focused more and more on siliceous microfossils that were not really studied in France until then. As a result he erected 37 new genera and 141 new species of Ebridians, Silicoflagellates, siliceous Foraminifers and Radiolarians. His discovery and description of archaic Carboniferous radiolarians from the Montagne Noire (South France) are the first important contribution to the knowledge and evolution of this group. He demonstrated that many of these primitive forms disappeared at the end of the Palaeozoic showing that the admitted idea that radiolarians had not evolved much throughout the geological record was wrong, opening thus the way to modern evolutionary research on this group. He managed also to point out the inaccuracy of the Haeckelian classification for radiolarians and, together with Jean and Monique Cachon, submitted new ideas about the evolution of these planktonic forms.

Monsoon as cause of Mesozoic radiolarite deposits in the Tethys

De Wever Patrick[1], Goričan Špela[2] & O'Dogherty Luis[3]

[1] *Muséum National Histoire Naturelle, 43 rue Buffon, MNHN, 75 005 Paris, pdewever@mnhn.fr*
[2] *Institute of Paleontology, ZRC SAZU Novi trg 2, Ljubljana, SI-1000 Slovenija, Spela@zrc-sazu.si*
[3] *Dpto. Geologia, Facultad de Ciencias del Mar y Ambientales, Universidad de Cádiz, 11510 Puerto Real, Spain, lodogher@uca.es*

Radiolarite facies is one of the characteristic features of the Tethyan Mesozoic realm. Since it is found associated with ophiolitic complexes it was suggested at the beginning of the twentieth century to be genetically associated with the silica gave off by volcanic activity. This idea endured for decades although nowadays there are no siliceous sediments along mid ocean ridges. In the seventies, a sort of holistic explanation was the carbonate compensation depth (CCD) until it appeared that this surface was far more complex than initially thought. Fifteen years ago, it was suggested that radiolarites would preferably be comparable with zones of high bioproductivity such as those related with upwellings.

Radiolarite facies belong to an important siliceous complex of Mesozoic age. It characterized Mesozoic sediments from the Tethys. This sedimentary pile was deposited in elongated and narrow basins laying in intertropical zone, in western (Liguria, Pindos-Olonos, …) as well as in central Tethys (Oman, Iran …) . This sedimentary groove belonged to the Tethyan Ocean and bordered the eastern edge of Gondwana. It extended from Hawasina region (Oman) in the south, through Pichakun (South Iran, Neyriz series), Kermanshah (Western Iran) and ended with Kocali basin (Turkey). Its approximate length covered more than 3000 km for a width of two or three hundred kilometres. These gutters have been compared with the gulf of Baja California (Western part of Mexico) and the Owen basin, in the western Indian Ocean. These basins show the same size, the same latitude range and the same high biosilica productivity due to upwellings. The Owen basin seems to be a favourite example since its bioproductivity is driven by monsoons. Monsoon are due to the juxtaposition of a landmass and watermass in a latitudinal position (current examples are Texas, North of the Gulf of Mexico, Sierra Leone north of the Gulf of Guinea, in W Africa, Australia, Bangladesh, North of the Gulf of Bengal). Mesozoic monsoons were active in northwest Tethys since the huge borderline, more than 12 000 km long, in a latitudinal position, separated a landmass in the north, from the Tethyan Ocean, in the south. The seasonal changes in wind direction were able to trigger strong upwelling currents in the Western part of the Tethys Ocean as the Indian monsoon presently leads seasonal upwelling in Somalia and Owen basins. These high bioproductivity zones enabled siliceous sediments to accumulate.

Siamese twin skeletons in Mesozoic radiolarians

Dumitrica Paulian

Institut de Géologie et Paléontologie, Université de Lausanne, Anthropole, Dorigny, Lausanne 1015, Switzerland; mailing address: Dennigkofenweg 33, CH-3073 Gümligen, Switzerland, Paulian.Dumitrica@unil.ch

Siamese twins or conjoined radiolarian skeletons are very rare and are especially known in some Holocene Collosphaeridae and Actinommidae and interpreted as a result of reproduction by binary fission. In the Mesozoic faunas some cases of Siamese twins have already been reported several years ago in the Saturnalidae and Mendacastrinae (a special group of Hagiastridae) from the lower Tithonian of the Solnhofen area, South Germany. In the present paper we report on an interesting case of *Tritrabs worzeli* (Pessagno) from the same early Tithonian fauna and a very few cases from the middle Anisian (Pelsonian) and early Ladinian. Among them it is to mention *Oertlispongus inaequispinosus* with 2 main spines, a monocyrtid nassellarian with double spicule, which is the only nassellarian Siamese twin skeleton so far known, and a species of *Spongopallium*.

The presentation illustrates and discusses all the Mesozoic cases of Siamese twin skeletons, compares them with the Holocene cases and tries to interpret them.

Skeletal malformations in some Polycystine Radiolaria and silicoflagellates: link with environmental factors

Dumitrica Paulian[1] & Bjørklund Kjell R.[2]

[1] *Institut de Géologie et Paléontologie, Université de Lausanne, Anthropole, Dorigny, 1015 Lausanne, Switzerland; mailing address: Dennigkofenweg 33, CH-3073 Gümligen, Switzerland, Paulian.Dumitrica@unil.ch*
[2] *Natural History Museum, University of Oslo, Department of Geology, P.O.Box 1172 Blindern, NO-0318 Oslo, Norway*

Polycystine Radiolaria and Silicoflagellates are planktic and exclusive marine protists with siliceous skeleton, but whereas the former are stenohaline, the latter can also live in waters with a salinity as low as about 15‰. The data we present and discuss are not an exhaustive study on the link between the environmental factors and disturbances in test morphology of these protists. We only want to present a few cases of polycystine radiolarians and silicoflagellates when some environmental factors, especially variation in salinity and probably temperature, are suspected to determine, in some species, the appearance of anomalies in a much higher degree than usually happens. It is known that each species responds differently to some changes in the environment. This is well evident in the group we discuss.

In this talk we report on two cases of Polycystine Radiolaria. One is about the appearance of numerous anomalies concerning the number and position of spines of the radiolarian species *Gonosphaera primordialis* Jøergensen occurring in the Red Sea. The other, already published, is about the anomalies in the ring building of the early Tithonian saturnalid radiolarians from the Solnhofen area, southern Germany.

Regarding the silicoflagellates we remind and discuss: a) on the already known cases of the anomalies in the species *Distephanus octogonus* (Ehr.) from the waters of the strait of Bosphorus, and b) those observed in the species *Dictyocha fibula* Ehr. from the Gulf of San Matias, Argentina. We will also discuss about some anomalies occurring in some species of silicoflagellates from the lower Sarmatian of Romania.

Controls on the formation of diatom-rich sediments in Adélie Land, East Antarctica

Gregory T.R.[1], Pike J.[1], Crosta X.[2], Massé G.[3] & Hall I.R.[1]

[1] *School of Earth and Ocean Sciences, Cardiff University, Main Building, Park Place, Cardiff, CF10 3AT, UK, GregoryTR@cardiff.ac.uk*
[2] *UMR-CNRS 5805 EPOC, Avenue des Facultés, 33400 Talence, France*
[3] *CNRS, Université Pierre et Marie Curie, 4 Place Jussieu, 75252, Paris, France*

The Adélie Land continental margin of East Antarctica provides unique records of Holocene climate change within the Antarctic cryosphere due to the high sedimentary accumulation rates and significant variations in the seasonal extent of sea ice. The sub-annually resolved core MD03-2601 (66°03.07'S, 138°33.43'E, 746 m water depth) from the Dumont d'Urville trough, Adélie Land, presents a unique insight into atmospheric and oceanic processes impacting on biogenic sedimentation in Adélie Land during the Holocene. We have used resin embedding of continuous 1.5 m sections of the core to analyse the diatom content of the sediments using back-scattered electron imagery on a Scanning Electron Microscope. Diatomaceous sediments recovered from the relatively warm Hypsithermal period (between ca. 4.5 and 8 ka BP) exhibit a strong seasonal melt signal at the start of annual laminations, but at the mid-Holocene climatic transition into the relatively cooler Neoglacial we witness a change in the nature of annual lamination deposition. Sediments deposited during the later Neoglacial period are more variable, with annual sequences variously displaying either a strong melt signal or a greater influence of wind on ice break up. Furthermore, an increase in the presence of bioturbated horizons during the late Holocene suggests an increase in bottom water formation, concurrent with a greater annual extent of sea ice recorded in the decadally resolved diatom record at this time.

Diatoms as sensitive indicators for climatic variability reconstruction through the last 165 Ka in the Zaïre/Congo deep-sea fan

Hatin Tristan[1], Le Hérissé Alain[2], Droz Laurence[3] & Marsset Tania[4]

[1] *Ecole Doctorale des Sciences de la Mer, Domaines océaniques UMR 6538 CNRS, IUEM, Université de Brest, 6 Avenue Le Gorgeu, 29238 Brest Cedex 3 ; tristanh29@gmail.com*
[2] *Domaines océaniques UMR 6538 CNRS, IUEM, Université de Brest, 6 Avenue Le Gorgeu, 29238 Brest Cedex 3, alain.le.herisse@univ-brest.fr*
[3] *Domaines océaniques UMR 6538 CNRS, IUEM, Université de Brest, 1 Place Nicolas Copernic, 29280 Plouzané, France*
[4] *IFREMER, Département des Géosciences Marines, 29280 Plouzané, France*

A high-resolution qualitative and quantitative diatom study was performed on the reference core KZAI-02, drilled offshore Angola at 3418 m water depth, in hemipelagic domain and the axial zone of Zaire deep-sea fan. The core section showing a continuous sedimentation and restricted turbiditic activity, is used for a multi-proxy analysis: XRF, Total Organic Carbon content, lightness analysis, palynological and micropaleontological analysis. It runs from MIS 6.6 to MIS 1, allowing a climatic reconstruction on the north-western African margin in the equatorial-subtropical zone, during two almost complete glacial-interglacial cycles.

Marine diatoms *Thalassionema nitzchioides* and *chaetoceros* reveal that coastal upwelling in the Zaire fan region was strong during glacial stages and weaker during interglacial stages. The continental signal derived from freshwater and low salinity diatoms as *Aulacoseira* spp. and *Cyclotella litoralis*, provided information about humid conditions on land and/or movements of the Congo River plume. An absence of diatoms during stage 5-e (Eemian) could be interpret as a heavy post depositional dissolution during warm climate.

The microfossil data suggest a change in the environmental conditions in younger period of the dissolution interval from predominantly marine to mixed marine/brackish/fresh conditions. This abrupt change in environmental conditions could be a consequence of a major reorganization in the depositional environment of the Congo River delta. This reorganization may be the result of a shift of the Angola- Benguela front causing displacement of the Congo River plume.

Environmental conditions favoring high densities of planktonic diatoms in coasts of the central Mexican Pacific (April, 2010)

Hernández-Becerril David U.[1], Barón-Campis Sofia A.[2] & Morales-Blake Alejandro[3]

[1] *Instituto de Ciencias del Mar y Limnología, Universidad Nacional Autónoma de México (UNAM), Cd. Universitaria, México, D.F., dhernand@cmarl.unam.mx*
[2] *Instituto Nacional de Pesca, SAGARPA, Pitágoras 1320, México, D.F.*
[3] *Facultad de Ciencias Marinas, Universidad de Colima, Manzanillo, Colima*

Despite previous information dealing with studies of marine phytoplankton in the Mexican Pacific coastal waters, high densities or blooms of planktonic diatoms have not been documented with detail. During the oceanographic cruise "MareaR II" (26 April to 6 May, 2010), along coasts of the central Mexican Pacific, we recorded various points with discoloration of the water ("red tides"), and measured some environmental variables and collected phytoplankton samples to analyze these particular events. Satellite images of the study area showed surface temperatures relatively low (21-22ºC). Variables measured *in situ* yielded, in those especial locations, surface temperature and dissolved oxygen relatively lower than expected (21ºC, and 4.5 mg L^{-1}, respectively), whereas nitrates and nitrites were particularly higher than in other stations (up to 11.73 µM, at 5 m). *In situ* fluorescence indicated high chlorophyll concentrations at subsurface (around 10-12 m). We estimated high phytoplankton densities, by microscopical analysis, yielding 2.69 X 10^6 cells L^{-1} at surface, 8.56 X 10^6 cells L^{-1} at 10 m, with up to 7.49 X 10^6 cells L^{-1} of the chain-forming, planktonic diatom *Chaaetoceros* spp. (mainly *C. socialis*); other diatoms such as *Pseudonitzschia* spp. and *Detonula pumila* were relatively abundant, whereas low abundances of dinoflagellates and photosynthetic ciliates (5 % of the total numbers) were detected. According to the evidence from variables observed, including the vertical profiles of certain variables, we can infer that a post-upwelling condition was occurring by the period we detected high concentrations of phytoplankton, and that this condition favored assemblages specially dominated by diatoms.

The importance of biogenic silica in the exploration for and exploitation of unconventional "shale gas" reservoirs

Jones Robert (Bob) Wynn

Advanced Geosciences Team, BG Group, Reading, and Department of Palaeontology, The Natural History Museum, London, UK, Bob.Jones@bg-group.com

Unconventional "shale gas" reservoir storage capacity is proportional to and controlled by Total Organic Carbon, and is highest in rocks with the highest TOCs, i.e., petroleum source-rocks.

Producibility is controlled by brittle fracture propensity, and is highest in rocks with the highest such propensity, including siliceous rocks. The silica content of siliceous rocks can be either biogenic, or abiogenic. Fracture propensity is anecdotally higher in biogenic than in abiogenic siliceous rocks.

The "ideal" shale gas reservoir is at least arguably therefore a biogenic siliceous source-rock, such as the Middle Devonian Marcellus Shale of the Appalachian Basin. Note also in this context that there is a strong positive correlation between biogenic silica and TOC, and a weak negative correlation between abiogenic silica and TOC.

Biogenic siliceous source-rocks are subject to a range of stratigraphic and palaeobiological controls, with important implications for the exploration for and exploitation of shale gas reservoirs.

These controls include the evolution and extinction of silica biomineralisers such as sponge spicules, radiolarians and diatoms, and the production and preservation of biogenic silica.

Preservation of biogenic silica is generally in the form of crystalline quartz. The diagenetic phase transitions from unstable precursor opals to stable crystalline quartz are accompanied by the expulsion of pore fluids and the collapse of the pores, and associated decreases in porosity and increases in bulk density. On account of the increases in bulk density, the diagenetic fronts are sometimes image-able on seismic data, typically, in section view, in the form of cross-cutting reflectors.

Permian-Triassic transition strata and the Radiolarian record from Japan – A case study of the Gujo-hachiman section -

Kuwahara Kiyoko[1] & Yao Akira[2]

[1] *Faculty of Clinical Education, Ashiya University, Ashiya 659-8511, Japan, permorads@kcn.jp*
[2] *Department of Geosciences, Osaka City University, Osaka 558-8585, Japan*

Permian-Triassic boundary (PTB) of Japan has been confirmed by researching the conodont and radiolarian fossils in several sections (e.g., Ubara section: Yamakita et al., 1999). Here we focus on the Gujo-hachiman section as a block in the Jurassic accretionary complex of the Mino terrane.

The Gujo-hachiman section (GC section, Kuwahara et al., 1991) consists of chert (4.6m), siliceous mudstone (5cm), and black shale with siliceous mudstone layers (0.7m), in ascending order. Changhsingian radiolarians were extracted from the chert and siliceous mudstone. Conodonts have not been obtained, but a small amount of spheroidal radiolarians with Permian radiolarians were found from black shale.

The horizon of the PTB is uncertain, because *Hindeodus parvus*, index conodont fossil of the basal Triassic, was not found. However it may locate near the base of the black shale based on the correlation with the other age-determined sections, as the Ubara section.

Radiolarian fauna of the Changhsingian chert maintains more than 100 species. *Albaillella triangularis* seems decrease its size in siliceous mudstone layer than that in chert. Permian radiolarians in the lower part of black shale are still enigma, it may survivals or it may reworked ones. Spheroidal radiolarians in black shale are compared with ones of the Lower Triassic Sphaerid zone by Yao and Kuwahara (1997). The facies of strata and the radiolarian faunas show drastic change near the PTB. The marine environment for radiolarians in pelagic Panthalassa may show rapid deterioration.

Tools for synthesis of the deep-sea microfossil record - recent advances in developing the Neptune database, taxonomic dictionaries, and age-model library

Lazarus David[1], Diver Pat[2], Suzuki Noritoshi[3] & members of the IODP Paleontology Coordination Group[4]

[1] Museum für Naturkunde, Invalidenstrasse 43, 10115 Berlin, Germany, david.lazarus@mfn-berlin.de
[2] Divdat Consulting, 1392 Madison 6200, Wesley, Arkansas, 72773 USA
[3] Institute of Geology and Paleontology, Tohoku University, Sendai, 980-8578 Japan
[4] www.iodp.org / search affiliated sites for: Paleontology Coordination Group

Detailed, accurate, consistent data is needed to synthesize marine microfossil occurrences in space and time using modern paleobiologic and biostratigraphic methods. The Neptune database (Lazarus 1994; Spencer-Cervato 1999) was an initial attempt to provide a suitable tool. Based on published (Cenozoic) DSDP and early ODP microfossil reports, originally using 'pre-SQL' software, it was ported to modern PostgresSQL and provided with additional data by the Chronos project in the early 2000's. A new version (NSB: Neptune Sandbox Berlin) has recently been created which provides direct sql-query access and customization for research. NSB includes data cleaning options (Pacman) to remove anomalous occurrences due to reworking, age model errors etc. In a parallel effort, the Paleontology Coordination Group of IODP has been editing and merging the microfossil taxonomic name lists from both Neptune and IODP to permit cross-database federation and to create a substantially improved taxonomic basis for research. Most microfossil group edits are now complete. The radiolarian list for example has 40% more resolved valid species and 50% more resolved synonyms than in the current version of Neptune. Neptune/NSB will soon be updated to use the new taxonomy, with a resultant major increase in the potential quality of research results. Revision of age models and loading more recent (late ODP and IODP) data is however just beginning. Together with improved primary data (e.g. Renaudie, this meeting), the new version of Neptune should provide an improved foundation for future research in many areas of marine micropaleontology.

Cenozoic diversity history of diatoms and radiolarians - current knowledge, limitations, future prospects

Lazarus David[1], Renaudie Johan[1], Barron John[2], Türke Andreas[1] & Diver Pat[3]

[1] Museum für Naturkunde, Invalidenstrasse 43, 10115 Berlin ; david.lazarus@mfn-berlin.de
[2] United States Geological Survey, 345 Middlefield Road, Menlo Park, CA, 94025 USA
[3] Divdat Consulting, 1392 Madison 6200, Wesley, Arkansas, 72773 USA

Biosiliceous marine plankton diversity history provides insight into general mechanisms of plankton evolution, and the interaction between climate, evolution, and major geochemical cycles. Largely Cenozoic deep-sea sediments recovered by deep-sea drilling provide the best preserved record of this history, but various limitations on available data still restrict our ability to reconstruct diversity. These include incomplete, frequently biased recording of diversity (e.g., biostratigraphic marker-dominated data), reworking, age model errors and, particularly in older sediments, systematic poor preservation overprints (Lazarus in press).

Neptune database (Lazarus 1994; Spencer-Cervato 1999) total compiled diatom species richness shows major step-wise diversity increase at the Eocene-Oligocene boundary and in the mid-Miocene, and is closely linked to known paleoceanography, but does not account for sample size bias. Sample-size standardized diversity (Rabosky and Sorhannus 2009) shows no net Cenozoic increase but the subsampling methods are biased by data recording and other errors. Based on new analyses of Neptune and a new literature compilation of species ranges, we show that diatom diversity likely rose significantly in the Cenozoic, primarily by increased provincialism in high latitudes.

Radiolarian diversity curves from Neptune are also presented. These show patterns similar to those for diatoms although current data is limited and the patterns seen likely contain major artefacts.

New methods, e.g. Pacman (Lazarus et al. in press) can identify/remove many artefacts from current data, but truely robust diversity estimates will require collection of new, sampling standardised, whole assemblage data from a suitable suite of samples.

Radiolaria and sponge spicules from the Lower Cambrian of the Altai Mountains (Siberia)

Obut O.[1], Pouille L.[2], Danelian T.[2] & Sennikov N.[1]

[1] Trofimuk Institute of Petroleum Geology and Geophysics, Siberian Branch of RAS, Acad. Koptyug av. 3, Novosibirsk 630090, Russia, obutot@ipgg.nsc.ru
[2] Université Lille 1, Laboratoire Géosystèmes (FRE 3298 CNRS) UFR des Sciences de la Terre, bâtiment SN5, 59655 Villeneuve d'Ascq cedex, France. lauren.pouille@ed.univ-lille1.fr;taniel.danelian@univ-lille1.fr

Fairly well-preserved and abundant polycystine radiolarians and siliceous sponge-spicules are studied from the Lower Cambrian Shashkunar Formation, middle stream of the Katun'River, Gorny Altai, south of West Siberia, Russia. The age of the carbonate-siliceous sedimentary sequences that yielded microfossils is Botomian as established by the trilobites (*Parapagetia – Serrodiscus* zone) and archaeocyathids (Repina, Romanenko, 1978; Zybin et al., 2000) found previously. Variegated siliceous shales yielded radiolarians and sponge spicules; these microfossils may be sometimes very abundant to form radiolarite and spongolite layers. Radiolarians belong to three genera (*Archaeocenosphaera, Altaiesphaera, Parechidnina)* and 4 species, including an unidentified Archaeospicularian gen. and sp. (Obut, Iwata, 2006; Pouille et al., 2011). Even after hydrofluoric acid leaching (to extract them from these siliceous rocks) the obtained radiolarians provide sufficient details of their test structure to throw light on the early evolutionary history of polycystine Radiolaria. Diverse sponge spicule associations include various swollen and pinular pentactines, hexactines, stauractines, triactines, tetractines, Chiasters (Demospogea), dichopentactines, triosauractines, monaxons, which often occur together with the radiolarians.

Preservation *vs*. productivity: Assessing the potential of Mesozoic radiolarians as paleoenvironmental proxies

O'Dogherty Luis[1], De Wever Patrick[2] & Goričan Špela[3]

[1] *Facultad de Ciencias del Mar, Universidad de Cádiz, 11510 Puerto Real, Spain, lodogher@uca.es*
[2] *Muséum National d'Histoire Naturelle, 43 Rue Buffon, F-75005 Paris, pdewever@mnhn.fr*
[3] *Paleontoloski Institut Ivana Rakovca ZRC SAZU, Novi trg 2, SI-1000 Ljubljana, Slovenia, spela@zrc-sazu.si*

In the past three decades diversity and abundance of radiolarians have been used successfully in Recent marine deposits and Cenozoic deep sea cores for estimating paleoenvironmental and paleoceanographic conditions. Despite of the great success experienced by the radiolarians in deciphering the oceanographic conditions of past environments, similar holistic approaches in Mesozoic rocks are scarce and sometimes inadequate.

The reason of such shortcomings is the unequal preservation displayed through the Mesozoic as a consequence of Silica transformation during diagenesis as well as acid treatments required for their extraction from hard siliceous or carbonate rocks.

Even with these limitations, Mesozoic radiolarians can reveal a good deal of paleoceanographic information but some fundamentals are required. Here, we present a simple procedure to validate whether a set of samples can be analysed for paleoenvironmental and paleoceanographic reconstructions or not. This technique should control three basic aspects: Preservation, total abundance and Nassellarian/Spumellarian species diversity ratio. The analysis of five thousand samples revealed that the best proxy samples must display the following characteristics: i) the preservation index (PI) should range between 1-4 (excellent to average); ii) the total abundances (AI) should range between 4-5 (common to abundant), and iii) the Nassellarian/Spumellarian species diversity ratio (N/N+S) should be comprised between 0.4-0.7 for assemblages having a diversity of 40 or higher. This research has also shown that much better results for quantitative taxonomic analyses in the Mesozoic are obtained in limestones or siliceous-limestones than in cherts or radiolarites.

What forcing mechanism drives radiolarian diversity in the Mesozoic?

O'Dogherty Luis[1], De Wever Patrick[2] & Goričan Špela[3]

[1] *Facultad de Ciencias del Mar, Universidad de Cádiz, 11510 Puerto Real, Spain, lodogher@uca.es*
[2] *Muséum National d'Histoire Naturelle, 43 Rue Buffon, F-75005 Paris, pdewever@mnhn.fr*
[3] *Paleontoloski Institut Ivana Rakovca ZRC SAZU, Novi trg 2, SI-1000 Ljubljana, Slovenia, spela@zrc-sazu.si*

A couple of years ago the Mesozoic Working Group of InterRad produced a complete and revised catalogue of radiolarian genera. The data set considered all radiolarian genera and species described as new since 1876. These collections contain 915 genera and 6288 species described in 446 publications. This work summarises quantitatively the progress made on the taxonomy of Mesozoic radiolarians over the last 140 years and it provides an overview of 170 years of radiolarian literature. A special care was given to the analysis of valid *vs*. invalid genera (synonyms, homonyms, *nomina dubia*), so that the number of valid genera in the Mesozoic now accounts for 593 in total. The data set being homogeneously gathered allows to interpret the evolution of the biodiversity by analysing curves of generic diversity for the three orders of Mesozoic radiolarians: Spumellaria, Entactinaria and Nassellaria. The pattern and general trend of these curves are similar; especially they show comparable patterns at the main turnover points.

In order to understand what forcing factors were behind the evolution of radiolarian diversity through the Mesozoic we compare our set of curves against several paleoceanographic proxies (Carbon isotopes, Strontium isotopes, Temperatures and Sea level). Two signals, the Strontium and Carbon isotopes fluctuations, keep a striking relationship with the diversity. For instance, the most prominent extinctions occur during periods of major perturbation in the Carbon cycle, but the fluctuation of diversity shows an opposite trend with the Strontium isotopes. This suggests that diversity appears to be greatest when there were large amount of open marine habitats and moderate levels of productivity. The taxonomic diversity in Mesozoic radiolarians seems to have kept a common direct response to the extent of continental inundation by seawater.

Function of pseudopodia in polycystine cells as silica accumulation organelle by PDMPO examination

Ogane Kaoru[1], Tuji Akihiro[1], Suzuki Noritoshi[2], Hori Rie S.[3], Kurihara Toshiyuki[4] & Matsuoka Atsushi[5]

[1] Department of Botany, National Museum of Nature and Science, 4-1-1 Amakubo, Tsukuba, 305-0005, Japan, ogane@mtc.biglobe.ne.jp
[2] Institute of Geology and Paleontology, Graduate School of Science, Tohoku University, Sendai, 980-8578, Japan
[3] Department of Earth Sciences, Graduate School of Science and Engineering, Ehime University, Matsuyama 790-8577, Japan
[4] Graduate School of Science and Technology, Niigata University, Niigata 950-2181, Japan
[5] Department of Geology, Faculty of Science, Niigata University, Niigata 950-2181, Japan

Polycystine radiolarians are characterized by a siliceous skeleton. We found that pseudopodia accumulate the silica under acidic conditions by culturing experiment with PDMPO. PDMPO is a fluorescent probe that deposits with silica on the newly developed skeleton (Ogane et al., 2009: Plankton and Benthos Research 4(3)). The material was collected from surface waters (ca. 4m depth) using a plankton net off Sesoko Island, Okinawa, southwest Japan. We followed the PDMPO methods of Ogane et al. (2009). A total of 50 cells of 22 species were examined, and the skeletons of 27 cells from 14 species successfully dyed with PDMPO. Of these, six cells of five species showed green fluorescent light on their pseudopodia as well as skeleton.

The green fluorescent light on the pseudopodia suggests an acidic condition is arisen on or inside the pseudopodia of these cells, and then these polycystines are concluded to accumulate silica with acidic pseudopodia. On the other hand, most of cells showed green fluorescent light only from skeletons. This result implies that pseudopodia are not always acidic, and the accumulation of silica in pseudopodia is not always an inevitable process during the silicification in polycystines.

Pseudopodia are known to have functions for catching prey and assimilating them (Matsuoka, 2007: Swiss Journal of Geoscience 100). Our PDMPO experiment further recognizes an important function for pseudopodia to accumulate silica with acidic conditions, although the biochemical process to precipitate opal from dissolved silica in the oceans.

A $\delta^{30}Si_{diatom}$ reconstruction of Holocene productivity of the Southern Ocean, east Antarctica

Panizzo Virginia[1], Cardinal Damien[2,3], Crosta Xavier[4] & Mattielli Nadine[1]

[1.] Department of Earth and Environmental Sciences, Université Libre de Bruxelles, CP160/02 Avenue F.D. Roosevelt 50, 1050 Brussels, Belgium, virginia.panizzo@ulb.ac.be
[2.] LOCEAN – IPSL, Université Pierre et Marie Curie, 4 Place Jussieu, Boite 100, F-75252 PARIS Cedex 05
[3.] Section of Mineralogy and Geochemistry, Royal Museum for Central Africa, Leuvensesteenweg, 13, B-3080 Tervuren - Belgium
[4.] UMR-CNRS 5805 EPOC, Avenue des Facultés, Université Bordeaux I, 33405 Talence Cedex, France

Coastal and continental shelf zones are among the most productive ecological provinces of the Southern Ocean and account for c. 76% and 3.5% of the total primary productivity of the marginal ice zone and southern ocean respectively (Denis et al., 2009). Diatoms account for a large proportion of primary productivity in these regions. Piston core MD03-2601 was recovered in 2003 off the coast of Adélie Land, east Antarctica (66°03.07'S, 138°33.43'E, 746 m water depth) and $\delta^{30}Si_{diatom}$ as analysed by MC-ICP-MS were conducted on a total of 40 samples at regular intervals across a total 4000 cm (c. 1000-11,000 years BP) of the core to reconstruct productivity changes. $\delta^{30}Si_{diatom}$ is reported as delta values relative to the NBS28 standard. $\delta^{30}Si_{diatom}$ values fluctuate between -0.01 and +0.82‰, with analytical standard errors less than ±0.08, over the duration of the record, with higher values indicating increased utilisation. Increasing $\delta^{30}Si_{diatom}$ values are concomitant with increases in *Chaetoceros* resting spores, reflecting periods of higher diatom productivity associated with longer periods of surface water stratification. These correspond with millennial periodicities of increased productivity[1]. Main trends in the percentage abundance of summer diatom species (predominantly *Fragilariopsis kerguelensis*) show a decline after c. 3500 years BP and a change to the dominance of spring diatom assemblages (e.g. *Fragilariopsis curta*), reflecting prolonged sea ice cover (Crosta et al., 2008). Overall results show that after the Hypsithermal period (c. 3500 years BP), during the late Holocene Neoglacial, productivity is reduced.

References :
Denis et al. (2009) Paleoceanography 24, PA3207.
Crosta et al (2008) Marine Micropaleontology 66: 222-232.

Pleistocene climatic changes and the polycystine Radiolarian record in the eastern tropical Atlantic (deep-sea Congo fan)

Pilarczyk Elodie[1], Danelian Taniel[1] & Marsset Tania[2]

[1] Université Lille 1, Géosystèmes FRE CNRS 3298, bâtiment SN5, 59655 Villeneuve d'Ascq cedex, France. pilarczyk_elodie@live.fr, taniel.danelian@univ-lille1.fr
[2] IFREMER, Département des Géosciences Marines, 29280 Plouzané, France. Tania.Marsset@ifremer.fr

The hemipelagic sediments that were recovered by the KZAI-02 core of IFREMER are poor in carbonates but rich in siliceous microfossils. This is a reference core used in a multidisciplinary study led by IFREMER (and in collaboration with TOTAL) to understand the interplay of climatic and oceanographic changes in the accumulation of deep see sediments off the Congo river.

Polycystine radiolarian are well-preserved, abundant and diverse throughout the core. We were able to identify nearly ninety different species. The presence of species *Cycladophora davisiana* is of particular significance because fluctuations of its relative abundance have been previously used as a high-resolution stratigraphic tool for poor-carbonate sediments. Our quantitative results suggest that some abundance peaks may be correlated with glacial stages (i.e. the « b1 » and « b2 » peaks appear to have occurred place during the MIS 2, the « d » peak during MIS 4). This is one of the rare studies of *Cycladophora davisiana* in the low latitudes. The pattern of fluctuations can be correlated with the one established in the high latitudes of the Atlantic ocean.

In addition, we were interested in the ecological/biogeographic caracteristics of all the species observed in the entire assemblage in order to explore the relative abundance of subgroups which appear to share common biogeographic affinities. Some of these sub-assemblages can be associated with specific water masses present in the tropical Atlantic; Changes in their relative abundance highlight the oceanographic changes that may have occurred in the area during the Pleistocene climate change.

Deglacial and Holocene diatom silcia oxygen isotope from the west Antarctic Peninsula

Pike J.[1], Leng M. J.[2], Swann G. E. A.[3] & Snelling A.[2]

[1] School of Earth and Ocean Sciences, Cardiff University, Main Building, Park Place, Cardiff, CF10 3AT, UK, PikeJ@cardiff.ac.uk
[2] NERC Isotope Geoscience Laboratory, British Geological Survey, Keyworth, Nottingham, NG12 5GG, UK
[3] School of Geography, University of Nottingham, University Park, Nottingham, NG7 2RD, UK

Antarctica and its ice sheets have played, and continue to play, a major role in the global ocean-atmosphere system, hence, it is crucial that we have a sound understanding of the past behaviour of Antarctica and its ice sheets with a view to understanding their variability under a warming climate. Ice cores and ocean sediments provide insights into the timing and nature of the rapid climate transition that occurred at the last deglaciation (~13-11 kyr BP) and the Southern Ocean is key to mechanisms proposed such rapid climate transitions. In order to further investigate processes that originate in Antarctica and are involved in changes in global climatic conditions it is necessary to understand the transfer mechanisms of ocean-climate signals from the Antarctic ice sheets, across the continental margin, into the Southern Ocean. ODP Site 1098 (Palmer Deep, west Antarctic Peninsula) and NBP01-01 JPC43B contain laminated sediment sequences through the last deglaciation and mostly non-laminated full Holocene records. We will present new diatom silica oxygen isotope measurements from the deglacial and Holocene sediments that provide a means of obtaining information on fresh water flux, salinity, sea surface temperature and currents. Lamina-scale measurements from the deglaciation are used to investigate potential diatom vital and habitat effects and seasonality in fresh water flux. Preliminary Holocene records are interpreted in terms of changes in melt water input and iceberg discharge.

Cherts from lakes of the East African Rift are believed to be good analogs to Precambrian cherts. Do they have a biotic origin ?

Plet Chloé, Person Alain & de Rafélis Marc

UPMC laboratoire ISTeP, Biominéralisation et paléoenvironnements sédimentaires, chloe.plet@hotmail.fr, alain.person@upmc.fr

Mechanisms of formation of Precambrian cherts, first bacteria-bearing (>3Gyr), could also be approached by the study of actual and subactual silicifications from alkaline lakes of East African Rift. These silicifications have been studied by geochemists since the 1970's, from the angle of mineral precipitation sequences, related to silica solubility, pH (between 10 and 12) and temperature (from 35 to 75°C), leading to the discovery of new Na-silicates (magadiite and kenyaite).

However, Röhricht and Behr (2000) and Behr (2002) suggested that a biotic component could play an important role in the formation of these cherts, by highlighting the presence of *Gloecocapsa* and *Pleurocapsa* bacteria.

Nevertheless, the fact that these bacteria are conserved into the silica does not imply that they are at the origin of their formation.

From a recent sampling of lakes Bogoria, Baringo, Magadi and Natron (August and September 2010), a sedimentological and petrographic study has been carried out on silicifications from Holocene and Pleistocene deposits in order to contribute to point out the biotic or abiotic origin of these cherts.

It appears that different mechanisms of precipitation are involved with biotic and abiotic mediation, according to the location from which the sample comes from.

Discovery of a Late Darriwilian – Early Sandbian diverse Radiolarian assemblage from Kazakhstan: a key fauna to better evaluate Radiolarian diversity trends in the context of the Great Ordovician Biodiversification Event

Pouille Lauren[1], Danelian Taniel[1], Popov Leonid[2] & Ghobadi-Pour Mansoureh[3]

[1] Université Lille 1, Laboratoire Géosystèmes (FRE 3298 CNRS) UFR des Sciences de la Terre, bâtiment SN5, 59655 Villeneuve d'Ascq cedex, France. lauren.pouille@ed.univ-lille1.fr;taniel.danelian@univ-lille1.fr
[2] Department of Geology, National Museum of Wales, Cathays Park, Cardiff CF10 3NP, U.K. Leonid.Popov@museumwales.ac.uk
[3] Department of Geology, Faculty of Sciences, Golestan University, Gorgan, Iran. Mghobadipour@yahoo.co.uk

Ordovician oceans witnessed profound changes in the structure of marine communities and food web during the "Great Biodiversification Event". Our understanding of the origin, establishment and biodiversity dynamics of modern marine ecosystems at this period is very fragmentary. More particularly, data are rare and incomplete regarding radiolarians, a major component of the oceanic heterotrophic plankton in the early paleozoic marine ecosystem.

We here report on a diverse and well-preserved radiolarian fauna from Kazakhstan, which was sampled from the Shundy Formation of the Aksuran Mountain, North Balkhash region. The Shundy Formation is composed of bedded black or dark grey limestones; they represent accumulation on the slope of a carbonate platform. Identified trilobites suggest an Upper Darriwilian to Sandbian age (Dw3-Sa1).

On the basis of SEM observations on over 600 specimens, the taxonomic study conducted so far on radiolarian suggests the presence of 4 families, 9 genera and 35 species. The radiolarian fauna is dominated by representatives of the family Inaniguttidae with the presence of 19 species belonging to Inanihella, Triplococcus, Inanigutta, Inanibigutta and Oriundogutta. Interestingly, this assemblage is characterized by the presence of abundant three-shelled radiolarians and it also appears to contain a number of new, previously unknown, morphotypes.

The significant diversity of this assemblage contributes to improve knowledge of radiolarian diversity for the Upper Darriwilian to Sandbian age, previously considered to be of the order of 15 species. We focused on the study of the internal structure of the skeleton which allows us to identify new morphotypes and to conduct a taxonomic revision of the Inaniguttidae.

Diatoms: ecological status and the European directive for environmental monitoring

Prygiel Jean

Service Connaissance et Expertise des Milieux Naturel Aquatiques, Agence de l'Eau Artois-Picardie, 200 rue Marceline, 59508 Douai cedex, France & laboratoire Géosystèmes, Université de Lille1, 59655 Villeneuve d'Ascq cedex, France, j.prygiel@eau-artois-picardie.fr

Except for derogations, the Water Framework Directive of December 2000 aims at the good status of water bodies for both underground and surface waters in 2015. Each water body belong to a unique type for which reference conditions have been identified from sites which are considered as non impacted or very low impacted by human activities. These reference conditions have been defined for micropollutants, macropollutants, and biological quality elements which is the most important part of the status assessment system. The good status is characterized by a slight deviation to the reference conditions. The status of rivers in France is assessed through the surveillance control network which includes 1673 sites following the rules of the French Surveillance ministerial decree of January 2010. Diatoms are an essential biological element of quality for rivers. They are present everywhere and most of the European countries have for a long time a diatom based monitoring methodology which can be applied for natural rivers as well as for heavily modified or artificial ones such as canal. In France the Diatom Biological Index or IBD (Afnor, T90-354) is used. It is particularly dependant on nutrients (phosphorus, nitrogen) and biodegradable organic matter (dissolved oxygen, BOD, ammonium…) and complies with the diatom CEN standards for sampling, enumeration, and taxa identification. It is based on over 600 taxa for which ecological profiles have been identified from the analysis of biological and chemical national data sets. Index calculation consists in counting and identifying at least 400 diatoms per site and then to calculate the ecological profile of a unique taxon supposed to represent the whole diatom community. This profile is finally transformed into a score between 1 (very bad quality) and 20 (very good quality). Reference conditions and thresholds for status classes have been defined for each of the 120 river types existing in France. As diatoms and diatom indices are used for a long time in France by the services of the Ecology Ministry and private companies; long series exist for most of the large basins. These series show that the water biological status expressed by diatoms is increasing for natural rivers due to the treatment of urban and industrial water discharges as well as to the phosphorus policy from the 90'. It is not the case for heavily modified and artificial rivers at least in the north of France where the status remains unchanged. Studies are currently running at the national scale to include teratological forms for micropollutants (especially metals) in the IBD index, and in the north of France to study the possibility to use specific grids for canalized rivers.

Diatoms as Environmental Indicators for Modern and Paleo studies

Ramanibai R.[1], Ravichandran S.[2] & Jeyanthi. S.[1]

[1] Aquatic Biodiversity unit, Department of Zoology, University of Madras, Guindy Campus, Chennai – 25, Tamil Nadu India ; rramani8@hotmail.com.
[2] Centre for Water Resources, Anna University, Guindy, Chennai – 25, Tamil Nadu. India

Benthic algae play a significant role in food webs and also used for observing long term trends in community changes that can occur because of nonpoint source of pollution. Diatoms which occur in large numbers and are well preserved due to the presence of frustules Their distinctive characteristic feature is the possession of siliceous cell walls, used to define and classify species conformity. Since silica resists against degradation, diatoms are well preserved in fresh water as well as marine sediments. The persistence of diatom frustules in the reservoir environment enables prehistoric conditions to be constructed based on the narrow ecological preferences of most species. The present study reveals the distribution and abundance of diatom community of Krishnagiri reservoir utilize for agricultural purposes along with domestic needs.

Surface water and sediment samples were collected through PVC pipe inturn sliced into 3 sections with the 5 cm intervals. Each section was sieved into 2 fractions using 50 µm and 120 µm sieve. Water quality parameters were also analysed using standard methods.

Sediment diatom samples were preserved in 4 % formalin. Specimens were identified with the help of authentic literature. Totally 24 diatom species were identified. Morphometric measurements and SEM photographs were taken. Abundance and distribution of sediment diatoms at different locations of Krishnagiri reservoir were estimated.

The benthic algal community observed reflected watershed manipulations by human activity. Presence of indicator organism implicates anthropogenic activities as being detrimental and also strengthens the usefulness of diatoms as ecological indicators. The results will be discussed in detail in the text.

Diatoms have been used to be reliable indicators of specific water quality problems such as organic pollution, eutrophication, acidification and metal pollution. They are sensitive to changes in nutrient concentrations. Each taxon itself has a specific optimum and tolerance for nutrients such as phosphate and nitrogen. Analysis of diatoms in reservoir sediments is a useful tool to detect the recent environmental change along with anthropogenic impact, or to place modern conditions in a regional or historical context.

Macroevolutionary patterns in Antarctic Neogene radiolarians

Renaudie Johan & Lazarus David B.

Museum für Naturkunde, Leibniz-Institut für Evolutions- und Biodiversitätsforschung an der Humboldt-Universität zu Berlin, Invalidenstraße 43, 10115 Berlin, Germany, lebuveurdelune@hotmail.com, david.lazarus@mfn-berlin.de

Antarctic Neogene sediments record major changes in oceanography linked to climate cooling and increased glaciation of the polar regions and are a key archive for paleoceanographic and paleoclimate studies. In addition to the more widely employed diatoms, Antarctic Neogene sediments contain abundant well preserved radiolarians. These faunas are diverse, evolve rapidly and offer in principle a major resource for improved biostratigraphy or macroevolutionary studies. However, their potential is greatly underdeveloped: only a small fraction of the recovered diversity has yet been recorded consistently. In a new long-term effort to comprehensively document these microfossils, we collected quantitative, full fauna data consisting of counts of ca 7000 specimens per sample from timeseries at several selected Antarctic sites. Nearly 500 species have been identified from the early Miocene to the Holocene (vs less than 200 species in all prior publications), including ca 100 forms new to science. Maximum within sample diversity reaches ca 200 (vs ca 60 in prior studies). The diversity pattern will be compared with both a preexisting macroevolutionary analysis of published biostratigraphic-only data from the same fauna (Lazarus, 2002) and reconstructions produced using modern, computationally-intensive, statistical tools based on occurrence data extracted from databases. We will finally discuss those preliminary results (diversity pattern as well as changes in the community structure and composition) in relation with the known paleoenvironmental history of the Antarctic Neogene.

Preliminary view on radiolarian geochemistry using secondary ion mass-spectrometry (SIMs) microanalysis: new proxy for paleoclimate?

Sadekov Aleksey[1], Darling Kate[1] & Elderfield Henry[2]

[1] University of Edinburgh, School of GeoSciences, West Mains Road, Edinburgh EH9 3JW, UK, Aleksey.Sadekov@ed.ac.uk
[2] Department of Earth Sciences,University of Cambridge, Cambridge CB2 3EQ, UK

Geochemistry of radiolarian shells remains largely unknown compared with other marine protozoa such as foraminifera and diatoms, which are commonly-used proxies for paleoclimate reconstructions. This is primarily due to analytical difficulties in obtaining accurate measurements from the microscopic siliceous shells of radiolaria. In this work, we employ a novel microanalytical approach to study radiolarian geochemistry with the primary aim of revaluating the potential use of radiolaria as paleoclimate proxy. Preliminary results based on □11B composition of Cenosphaera sp. suggest that biogenic silica is prone to digenesis, altering the outer shell surface and significantly modifying its geochemistry. However, our results also demonstrate that using microanalytical techniques, such as SIMs, it is possible to accurately analyse the unaltered parts of radiolarian shells and potentially use them for paleoclimate reconstructions.

Depths of formation of Early Cambrian volcanic-siliceous-terrigenous strata at the central part of the Gorny Altai (SW Siberia, Russia)

Sennikov Nikolay V.

[1] *Trofimuk Institute of Petroleum Geology and Geophysics, Siberian Branch of RAS, Acad. Koptyug av. 3, Novosibirsk 630090, Russia. SennikovNV@ipgg.nsc.ru*

Early Paleozoic volcanic-sedimentary sequences of the Gorny Altai were studied in order to estimate tentative depths of sedimentation. In the Katun zone, the Early Cambrian siliceous-carbonate–terrigenous Shashkunar Formation, formed on the paleo-oceanic highs of the pale-Asian ocean, was investigated. Geological and lithological data as well as facies analysis and bio-indicators were taken into account.

Geological data on the underlain Manzherok (eroded volcanic uplift on the oceanic bottom) and overlaying Cheposh (algal-reef structure formed in the photic zone) formations along with litho- and facies analysis (thin-lamination, microlamination, absence signs of waves influence, etc.) point out that the Shashkunar Formation was probably accumulated in depths situated between 200 and 1,000 m.

Among bio-indicators are: taxanomic diversity and population density of radiolarian associations, state of preservation of radiolarian test. Bio-indicators revealed: 1) taxonomic diversity of the Early Cambrian radiolarians is relatively “abundant” (4 species, 3 genera); 2) taphocenosis density is “medium” (10-100 specimens in 1 cm^2 in the thin section); 3) preservation of radiolarian tests – as “50-75% from intravital”. Obtained lithological and paleontological data suggest that recovered associations inhabited cold-temperate waters at 100 to 500 m depths. Taking into account average population density of the Shashkunar radiolarians, they should inhabited waters no less than 200 m. Relatively good state of preservation of radiolarian tests allow to assume that they were transported to the basin’s bottom on the depths no more than 100-200 m. Summarizing all data the Shashkunar Formation could be formed at approximately 400 m depths.

Patchwork Silicification and disposal activity of siliceous fragments in Living Polycystine Radiolaria with the Long-term Continuous Video Recording

Suzuki Noritoshi[1], Ogawa Kazuhiro[1], Ogane Kaoru[2] & Tuji Akihiro[2]

[1.] Institute of Geology and Paleontology, Graduate School of Science, Tohoku University, 6-3 Aoba, Aramaki, Aoba-ku, Sendai City, 980-8578 JAPAN, suzuki.noritoshi@nifty.com
[2.] The Botany Department, Natural Museum of Nature and Science, 4-1-1 Amakubo, Tsukuba City, 305-0005 JAPAN.

Silicification process in living polycystine Radiolaria has been studied with indirect methods (Suzuki 2006; doi: 10.1666/0022-3360(2006)80[849:OGAVIT]2.0.CO;2) and direct ones (Ogane et al., 2009, doi: 10.3800/pbr.4.89 ; Ogane et al. 2010, doi: 10.1016/j.marmicro.2010.08.005). For direct observation of silicification process in polycystines, we tried to incubate polycystine cells with the addition of dissolved silica (final concentration 10μM) and f/2 culture medium during the 11th Radiolarian Observation Tour of Living Radiolarians at Sesoko Island, hosted by Atsushi Matsuoka (Niigata Univ.), November, 2009.

Approximate 10 polycystine cells kept for a few days in this incubation, of which one cell of *Pentapylonium* (?) sp. formed silicified particles. This silification process was continuously recorded for 21-hours with a digital video camera.

During the observation, the overall framework of the skeleton more or less has thickened and spiny portion of the skeleton also lengthened. The other but the most important silification process is to form patchwork of pore frame. Several pieces of isolated pore frame with a few completely and incompletely closed pores abruptly appeared in the bush of short pseudopodia. Not only did patchwork of pore frame appear, the cell disposed most of these pieces outside of the cell by elongation of pseudopodia.

Lithelids and pylonids silicify nonstop in our PDMPO experiments, and such polycystines may not control silification even if the concentration of dissolved silica is changed. For avoiding the overgrowth of the skeleton, these polycystines form isolated patchworks of siliceous skeleton, and throw them away from the cell.

Is the silicic acid leakage hypothesis supported by facts?

Tréguer Paul & De La Rocha Christina

European Institute for Marine Studies, Université de Bretagne Occidentale, Brest, France, Paul.Treguer@univ-brest.fr

It has been hypothesized that the large and regular atmospheric carbon dioxide changes (about 80 ppmv) over the last few glacial – interglacial cycles can be explained by changes in the marine biological pump through variations in iron fertilization of marine plankton that trigger variations in ocean nutrient utilization or shifts in dominant plankton types. The Silicic Acid Leakage Hypothesis (SALH, Brzezinski et al., 2002), which highlights the key role of the Southern Ocean in climate change, is a contribution to this theory, which has been challenged by facts and model outputs.

The silicic acid unused in Antarctic and subAntarctic surface waters escapes the Southern Ocean through Antarctic Mode Water (SAMW), and is transported via the thermocline to the subtropical and equatorial oceans. In the modern Southern Ocean (SO), a lack of iron in surface waters might significantly contribute to the growth of highly silicified diatoms (typified by elevated Si/C and Si/N ratios as high as 4), in surface waters replete in nitrate but depleted in silicic acid. During the Last Glacial Maximum (LGM), evidence has been given (e.g. Brzezinski et al., 2002) that iron fertilization of the Southern Ocean due to intense dust deposits from the atmosphere (e.g. Kumar et al., 1995) favoured the primary production and the growth of less silicified diatoms (Si/N molar ratios decreasing to about 1). So, at this time, SAMW with a higher silicic acid to nitrate ratio would transport a silicic acid excess out to the lower latitudes, where it would favor diatom growth over that of non-siliceous phytoplankton like coccolithophorids. Given that the reaction of bicarbonate and calcium ions to form the calcium carbonate plates of coccolithophorids results in the formation of carbon dioxide, fewer coccolithophorids means less CO2 rejected to the atmosphere, potentially explaining a portion of the drawdown in atmospheric CO2 during glacial times.

Modelling studies (e.g. Sarmiento et al., 2004) have shown that the nutrients delivered by the SAMW support three quarters of the marine primary production occuring north of 30°S in the modern ocean including that occuring in the highly productive coastal upwelling zones off South Africa and South America. Thus variations in the composition of SAMW should have a strong impact on the biological carbon pump. SO opal records support the SALH in that they show less total SO opal burial during the last glacial period than in the Holocene. However, within the Atlantic and Indian sectors, opal burial south of the Antarctic Polar Front (APF) during the LGM was less than during the Holocene, but this was an offset by increased opal burial north of the APF, resulting in no detectable net change through time in either sector (Kumar et al., 1995, François et al., 1997; Frank et al., 2000; Chase et al., 2003). In the Pacific sector, however, whereas opal burial south of the APF decreased during the glacial, and burial north of the APF increased, the increase north of the APF appears to have been insufficient to offset the decrease in opal burial (Chase et al., 2003). All in all, the upwelling supply of Si remained essentially inchanged. To summarise: according to these studies the opal burial in the SO during the LGM allows for excess Si to have been transported out of the SO into the thermocline, and eventually to the low latitudes.

On the other hand, there is an increasing number of experimental data and model outputs that challenge the SALH or outright fail to support it. Physical (ocean circulation, temperature, mixing) and biogeochemical (alkalinity, nutrient inventory) changes have the potential to explain the the vast majority of the glacial-interglacial cycle in atmospheric CO2

without invoking iron-fertilization in the Southern Ocean (Peacock et al., 2006). In addition, although glacial opal burial exceeded Holocene burial in the equatorial Atlantic, the reverse trend is true for the equatorial Pacific (Bradtmiller et al., 2007; Bradtmiller, 2010). Comparison of δ30Si records from the SO to records of biogenic silica accumulation from low-latitude upwelling systems indicate a strong negative correlation between the silicic acid content of SO surface waters and opal deposition at low latitudes during the last 80 kyr BP (Crosta et al., 2007). Although the extent to which Si isotope fractionation during dissolution influences sedimentary records of δ30S and needs further investigation (Desmarest et al., 2009; De La Rocha et al., submitted), this implies that Si leakage was somehow rendered ineffective during the LGM when the silicic acid content of SO waters was high. Opposite effects of nutrient uptake and oceanic circulation are invoked (Crosta et al., 2007).

Transfer of Germanium to marine sediments: insights from its accumulation in radiolarites and authigenic capture under reducing conditions. Some examples through geological ages

Tribovillard Nicolas[1], Bout-Roumazeilles Viviane[1], Riboulleau Armelle[1], Baudin François[2], Danelian Taniel[1] & Riquier Laurent[3]

[1] Université Lille 1, Géosystèmes FRE CNRS 3298, bâtiment SN5, 59655 Villeneuve d'Ascq cedex, France, Nicolas.Tribovillard@univ-lille1.fr
[2] Université Pierre et Marie Curie-Paris 6, Institut des Sciences de la Terre de Paris, UMR CNRS 7193, 75252 PARIS cedex 05, France
[3] Université de Bourgogne, Biogéosciences Lab, UMR CNRS 5561, 21000 Dijon, France

In the geosphere, germanium (Ge) has a chemical behavior close to that of silicon (Si), and Ge commonly substitutes for Si (in small proportions) in silicates. Studying the evolution of the respective proportions of Geand Si through time allows us to better constrain the global Si cycle. The marine inventory of Ge present as dissolved germanic acid is facing two main sinks known through the study of present sediments: 1) incorporation into diatom frustules and transfer to sediments by these "shuttles", 2) capture of Ge released to pore water through frustule dissolution by authigenic mineral phases forming within reducing sediments. Our goals are to determine whether such a bio-induced transfer of Ge is also achieved by radiolarian and whether

Ge could be trapped directly from seawater into authigenic phases with no intervention of opal-secreting organisms (shuttles). To this end, we studied two Paleozoic radiolarite formations and geological formations dated of Devonian, Jurassic and Cretaceous, deposited under more or less drastic redox conditions. Our results show that the Ge/Si values observed for these radiolarites are close to (slightly above) those measured from modern diatoms and sponges. In addition, our results confirm what is observed with some present-day reducing sediments: the ancient sediments that underwent reducing depositional conditions are authigenically enriched in Ge. Furthermore, it is probable that at least a part of the authigenic Ge came directly from seawater. The recurrence and extent (through time and space) of anoxic conditions affecting sea bottoms have been quite important through the geological times; consequently, the capture of Ge by reducing sediments must have impacted Ge distribution and in turn, the evolution of the seawater Ge/Si ratio.

Oxygen isotope fractionation during the life and death of diatoms

Tyler Jonathan[1], Leng Melanie[2], Sloane Hilary[2], Cox Eileen[3] & Rickaby Rosalind[1]

[1] Department of Earth Sciences, The University of Oxford,
Jonathan.Tyler@earth.ox.ac.uk
[2] NERC Isotope Geosciences Laboratory, Nottingham
[3] The Natural History Museum, London

Oxygen isotope analysis of diatom silica (δ18Odiatom) is rapidly becoming established as a palaeoclimate proxy using lake and marine sediments. In principle, the oxygen isotope ratio of diatom silica is a function of the isotopic composition of ambient water and growth temperature. However, exact controls over δ18Odiatom remain poorly understood, including the fractionation associated with silica biomineralisation during diatom growth, and the effects of diagenetic processes operating post death. Early culture experiments and field observations suggest an underlying temperature dependence on silica-water fractionation of ~0.2‰/ºC during diatom growth (Brandiss M.E. et al., 1998 ; Moschen R. et al., 2005). However, significant δ18Odiatom offsets have been observed between living diatoms and surface sediments which suggest that diagenetic processes also affect the sedimentary signal (Schmidt M. et al., 1997 ; Moschen R. et al., 2006 ; Tyler J.J. et al., 2008). Here, we address these uncertainties using laboratory cultures of freshwater and marine diatoms. In particular, we assess the thermal dependency of fractionation between diatom species and the influence of additional 'vital' effects. In addition, isotope fractionation associated with experimental condensation of fresh diatom silica is investigated. New results will be presented and discussed with respect to establishing best practice for the laboratory treatment of diatom silica, and for interpreting past climate change from sedimentary δ18Odiatom records.

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Poles apart: Interhemispheric contrasts in polar diatom diversity driven by differences in tectonics and glacial history

Verleyen E.[1], Van de Vijver B.[2], Hodgson D.A.[3], Sabbe K.[1], Souffreau C.[1], Nedbalová L.[4], Tavernier I.[1], Sterken M.[1], Jones V.J.[5], Vanormelingen P.[1], Antoniades D.[6], Van Nieuwenhuyze W.[1], Satoshi I.[7], Kudoh S.[7] & Vyverman W.[1]

[1] Protistology and Aquatic Ecology, Biology Department, Ghent University, Krijgslaan 281-S8, 9000 Ghent, Belgium, Elie.Verleyen@UGent.be
[2] National Botanic Garden of Belgium, Department of Bryophytes & Thallophytes, Domein van Bouchout, B-1860 Meise, Belgium
[3] British Antarctic Survey, Natural Environment Research Council, High Cross, Madingley Road, Cambridge CB3 0ET, UK
[4] Charles University in Prague, Department of Ecology, Viničná 7, 128 44 Prague 2, Czech Republic
[5] University College London, Environmental Change Research Centre, Gower Street, London, WC1E 6BT, UK
[6] Grupo de ecología y fisiología de fitoplancton, Sección Limnología, Universidad de la República, Iguá 4225, CP11400, Montevideo, Uruguay
[7] National Institute of Polar Research, 10-3, Midori-machi, Tachikawa-shi, Tokyo, 190-8518, Japan

Arctic and Antarctic floras and faunas differ strongly in their overall composition and diversity, reflecting interhemispheric differences in climate history and landmass connectivity. In contrast, prevailing microbial biogeographic theory predicts that Arctic and Antarctic ecosystems should harbor the same microbial communities, with allopatric speciation being rare as a result of the ubiquitous dispersal of microbes. Here we show that, contrary to this paradigm, patterns of biodiversity and endemism in the diatom floras of Arctic and Antarctic lakes are strongly divergent. Antarctic communities are impoverished and imbalanced relative to their Arctic counterparts, and are characterized by high levels of endemism, the absence of key functional groups, an overrepresentation of terrestrial lineages, and a general paucity of globally successful genera. Comparison of contemporary Antarctic floras with fossil Miocene assemblages and molecular clock analysis of diversification patterns point to high rates of local extinction during Neogene and Quaternary glacial maxima, in combination with radiations through allopatric speciation in refugia. We dovetail our dataset of the contemporary flora with our paleoecological records and show that particular species are only present in regions that escaped full glaciation during at least the last glacial cycle. In contrast, regions that were fully ice-covered during glacial maxima are characterized by an impoverished diatom flora, which is dominated by regional endemic species that colonized the lakes after glacial retreat. We propose that processes controlling the distribution and diversification of microorganisms can operate at similar spatial and temporal scales as those for macroscopic organisms, leading to strikingly congruent biogeographic patterns.

Evolution of siliceous skeletons of genera of Family Parvicingulidae (Radiolaria)

Vishnevskaya Valentina S.

Geological Institute RAN, Moscow 119017, Russia, valentina@ilran.ru

The Paleozoic–Middle Mesozoic phase of progressively growing species diversity that attained its maximum in the terminal Tithonian, when radiolarian forms with more than 30 chambers appeared. The gradual segmentation of radiolarians from one to 30 chambers and more represented a characteristic trend of their progressive diversification in the Paleozoic–Middle Mesozoic era. The Late Mesozoic regressive phase in evolution of radiolarians commenced exactly in the Cretaceous time. A steady decline of species diversity in the Early and initial Late Cretaceous was accompanied by gradual decrease in size of their skeletons with lowering amount of chambers in the tests that was typical of postabdominal chambers in particular. All these sudden changes in generally growing biodiversity trend could be provoked by abiotic factors, for instance by anoxic events, climatic cooling, or even by meteorite impact. Radiolarians representing the genus Parvicingula as well as others high-conical parvicingulids are clear indicators of their affinity with the Boreal province and climatic cooling (Pessagno, 1977; Hull, 1995; Kiessling, 1999; Vishnevskaya, 2009).

Appearance of a group of high-conical parvicingulids at the Triassic-Jurassic boundary in high latitudes of the Northern Hemisphere is most likely due to global cooling. In the course of the Jurassic- beginning of the Early Cretaceous, this group evolved, spreading in high latitudes of the entire Pacific paleogeographic province, and even penetrated into the Arctic and Antarctic regions.

The earliest representative of this family is Genus Proparvicingula Carter, 1993, which indicate the first occurrence in Rhaetian (Late Triassic). Probably, Genera Nitrader Cordey et Carter, 1996 (Hettangian-Sinemurian) and Atalantria Cordey et Carter, 2007 (Hettangian-Pliensbachian) derived from Genus Proparvicingula Carter, 1993. The Rhaetian-Sinemurian Proparvicingula Carter, Hettangian-Pliensbachian Atalantria Cordey and Carter and Hettangian-Sinemurian Nitrader Cordey et Carter differ from more youngest Proparvicingula Carter (1993), Parvicingula Pessagno (l977), and Ristola Pessagno and Whalen (1982) by possessing two rows of pores between circumferential ridges instead of three rows. Genus Pseudoristola Yeh, 1987 (Pliensbachian – early Toarcian) and Triversus Takemura, 1986 (late Pliensbachian - Callovian), could derive from Atalantria Cordey et Carter, 2007. Genus Proparvicingula Carter, 1993 is possible ancestor of Praeparvicingula Pessagno et Blome et Hull, 1993 (middle Toarcian-Barremian) and Parvicingula Pessagno, 1977. Just at the same time Genus Elodium Carter, 1988 (middle Toarcian-Aalenian) makes the first occurrence, from which Canelonus Hull, 1997 (late Bajocian-Callovian) could derive. The extinction datum of Family Parvicingulidae takes place in the end of Barremian or early Aptian and corresponds to OAE 1 (Figure 1).

This research was supported by the Russian Foundation for Basic Research, project nos. 09-05-00342 and 10-04-00143, and the Program of the Presidium of the Russian Academy of Sciences "The Origin and Evolution of the Biosphere".

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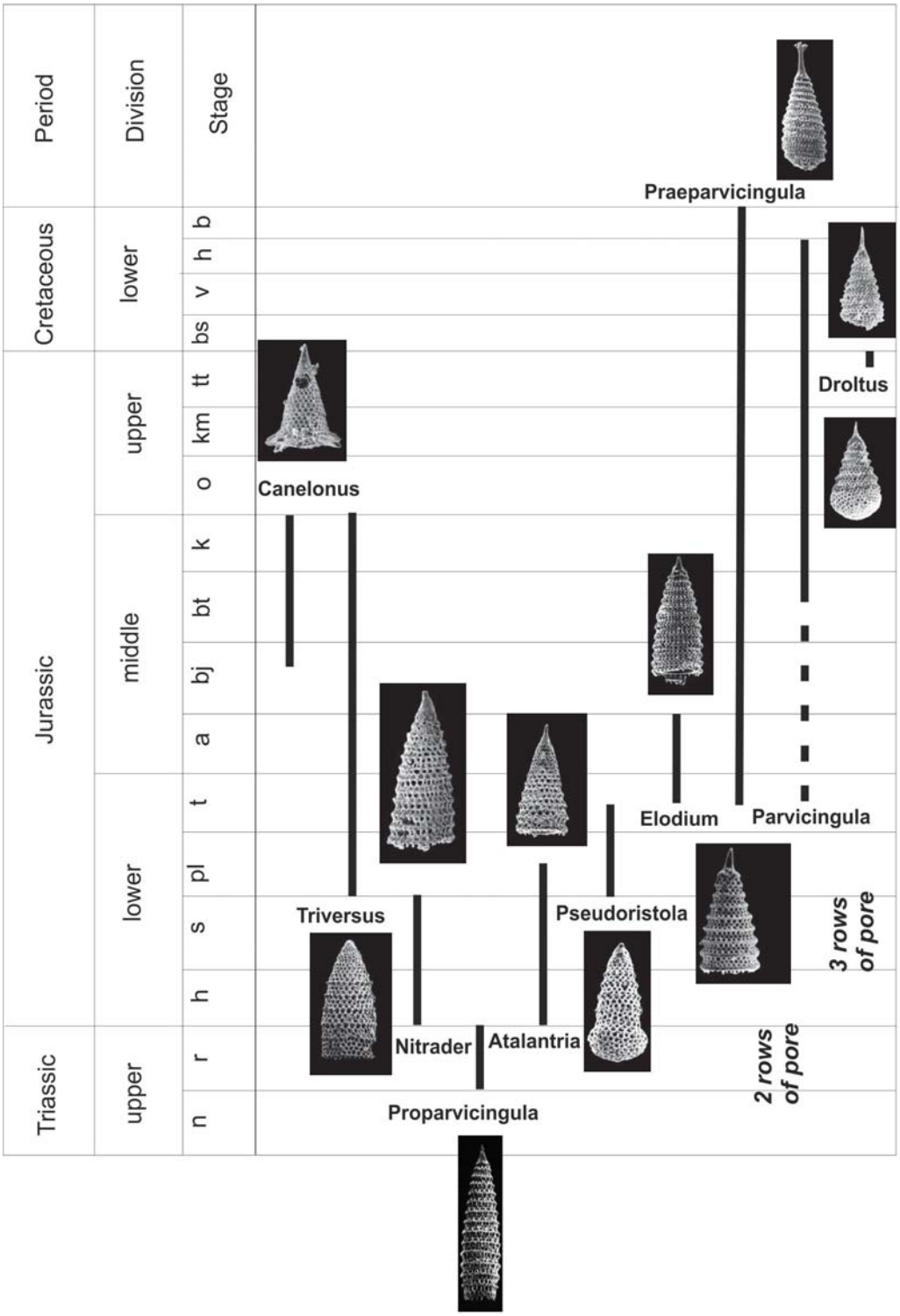
Fig. 1. The possible phyletic relationships of high-conical genera of Family Parvicingulidae Pessagno.



Radiolaria and Sponge Spicule Si structure evolution as reflection of Ocean change

Vishnevskaya Valentina S.

Geological Institute RAN, Moscow 119017, Russia, valentina@ilran.ru

At first Bengtson (1986) proposed to assign to the Porifera type of Radiolaria which have one isolated or four to numerous spicules aggregated by interloching and / or fusing to form a shell with spicules consisting of as many as about thirty point-centered rays and which now belonging to an f ancient Family Echidninnidae (Wom, Below, 1999). So as the same aggregates of spicules were considered as Porifera or as Radiolaria. It means that they have something in common.

In 1966 Benson (1966) indentified sponge spicule as Spumellina incertae sedis Form A and Form B. In 1967 Huang (1967) described new radiolarian genus and species Hataina ovata Huang. This species later was determined by Benson (1983) in sediments of Leg 65 and later by other specialists. Sometimes these sponge spicule = sterrasters were considered as a problematic microorganisms or Radiolaria (Inoue, Iwasaki, 1975; Riedel, 1986). Only Alexandrovich (1992) which investigated materials of leg. 127, reports that sponge spicules have been erroneously classified as a radiolarians. Nevertheless several radiolarian workers continued to determine genus and species Hataina ovata Huang. On this reason, it is necessary to revise these data and tried to find data on recent sterrasters as well as on findings in geological records. The similarity, difference and connections among detail structures of Sponge microspicules and Radiolaria spines and their evolution have been considered and illustrated. Trends of morphological changes of radiolarian and sponge spicule elements during million of years show the decrease of its volume size, lost of siliceous type of inner spicules or decrease of its size in Radiolaria.

The main peculiarity of sterraster is orientation of miriade of microspicules to centre of body similar to point-centered rays of the most ancient Cambrian Radiolaria of Family Echidninnidae (Won, Below, 1999), which Bengtson (1986) proposed to assign to the Porifera.

Sponges, being benthos forms, conserved macro- and microspicules, but significantly developed and improved them from thick massive to thin graceful during geological time from Proterozoic up to Recent, while Radiolaria lost heavy weight engineering in process of ocean expance during Late Mesozoic-Cenozoic. An influence of different percentage of HF (from 5 up to 50% and during time from 1 up to 24 hours) on morphological structures of surface walls of sterrasters and selenaster, as well as radiolarians is considered.

The work was supported by programs "Origin and Evolution of the Biosphere" of the Presidium RAS, and by the Russian Foundation for Basic Research, project nos. 09-05-00342.

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The recrystallization of Silica in Radiolaria and possible replacement in connect to diagenetic changes

Vishnevskaya Valentina S.

Geological Institute RAN, Moscow 119017, Russia, valentina@ilran.ru

The examination of diagenetic changes in radiolarian skeletons showed very interesting results. The evidence of replacement of Si by chemicals and others organisms indicates some published data. For example, the chemical replacement of Si by pyrite (FeS_2) has been described in paper of Thurow, 1988 based on materials of ODP (Leg. 103).The replacement of Si by Au was discovered by Anderson, Gordey, 1991 p. 48, fig. 2. The replacement of Si by Mn was illustrated in Vishnevskaya 2001 p. 14, fig. 8, b,g.

New evidence of the chemical replacement of Si or recristallization of Si due to the increasing pressure and temperature, as well as through the percolation of interstitial fluids is observed based on radiolarians derived from Sakha Republica (Yakutia); coordinates 68^0 20^I - $68^0 50^I$ N; $140^0 00^I$ - $140^0 30^I$ E. Investigated radiolarians were extracted from chert, associated with tuffaceous aleurolites alternated with clay. Tournesian-Visean radiolarian assemblage is characterized by Entactinia vulgaris vulgaris Won, E. variospina Won, Bientactinosphaera altasulcata (Won), Palacantholithus stellatus Deflandre, Belowea? tenuistesta Won, Brianellum ruestae Cheng. The microanalyses of chemical elements identified Si, Al, K, Ca, O. Due to the registry of such chemical elements zeolite mineral fillipsite was recorded.

The chemical replacement of Si by chlorite is observed in three places of high latitude of Russia: in Yakutia (Chersky Ridge) and in the Pechora and Volga Basins.

Sinemurian radiolarian assemblage of the Chersky Ridge includes Parahsuum simplum Yaj, Fantus exiguus Yeh, Stichocapsa biconica Matsuoka, Plesus aptus Yeh, Lantus praeobesus Carter and others, among them numerous representatives of fam. Livarellidae Kozur et Mostler.

Volgian assemblages of the Pechora and Volga Basins contain abundant Parvicingulidae with external cephalic spines and apophyses, which are typical for Boreal province. The most part of radiolarian skeletons replacement by chlorite. The replacement of Si by dolomite within radiolarian skeletons was fixed in Tethyan province (Small Caucasus).

Also replacement of Si radiolarians by calcite ($CaCO_3$) nannofossils was shown in De Wever et al., 1986, p. 180-181, plate 12; as well as in Vishnevskaya, 2001, p. 327, fig. 6 on plate 115. About focus on the diagenesis of radiolarian skeletons and their possible connection with the properties of some reservoir rocks we can see in the thin sections.

The work was supported by programs "Origin and Evolution of the Biosphere" of the Presidium RAS, and by the Russian Foundation for Basic Research, project nos. 09-05-00342.

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Trends in siliceous plankton productivity during late middle Eocene greenhouse warming: the record of diatoms, ebridians and silicoflagellates at ODP Sites 748 and 1051

Witkowski Jakub[1,2], Bohaty Steven M.[3], Harwood David M.[4] & McCartney Kevin[5]

[1] *Faculty of Geology, University of Warsa, Poland, jwitkowski@student.uw.edu.pl*
[2] *Faculty of Earth Sciences, University of Szczecin*
[3] *University of Southampton, U.K.*
[4] *University of Nebraska-Lincoln, U.S.A.*
[5] *University of Maine at Presque Isle, U.S.A.*

The Middle Eocene Climatic Optimum (MECO) is a transient global warming event that took place ~40 million years ago (Ma). Warming of both surface and deep waters by 4-6°C over a ~500 thousand year (kyr) interval is reported during this event. Eocene sections recovered at ODP Sites 748 (Kerguelen Plateau, Southern Ocean) and 1051 (Blake Nose, subtropical North Atlantic Ocean) contain expanded sedimentary records that span the MECO event. The MECO intervals at both sites contain rich and diverse siliceous microfossil assemblages, which include diatoms, radiolarians, silicoflagellates and ebridians, as well as endoskeletal dinoflagellates, chrysophyte cysts and synurophyte scales. We use variations in absolute abundance of the dominant siliceous microfossil groups at these sites as a paleoproductivity proxy.

Quantitative, high-resolution records of siliceous microfossils across the MECO intervals of Sites 748 and 1051 reveal contrasting patterns in siliceous plankton productivity. A significant increase in biosiliceous sedimentation is observed at Site 748. Ebridians and radiolarians are the dominant component of the assemblages at this site, while silicoflagellates and diatoms are less abudant. Site 1051 displays a considerable decrease in siliceous microfossil abundance coincident with the peak of the MECO event. Moreover, Site 1051 is characterized by an assemblage dominated by diatoms and radiolarians. In contrast to Site 748, the abundance of ebridians is low at this site, and silicoflagellates are nearly absent. Thus, during the MECO event, a brief episode of eutrophication took place at Site 748, while nutrient levels are interpreted to have decreased at Site 1051.

These contrasting trends in siliceous plankton productivity reflect the differences in paleoceanographic settings of both sites, and a geographically diverse, dynamic course of the late middle Eocene greenhouse warming.

Current taxonomic studies on the diatom flora (Bacillariophyceae) of the Bolivian Altiplano, South America with possible consequences on palaeoecological assessments

Eduardo A. Morales[1, 2], Maria Helena Novais[3], Lucien Hoffmann[3] & Luc Ector[3]

[1] *Herbario Criptogámico, Universidad Católica Boliviana San Pablo, Cochabamba, Bolivia; e-mail: edu.morales2006@gmail.com*

[2] *Patrick Center for Environmental Research, The Academy of Natural Sciences, Philadelphia, USA*

[3] *Public Research Centre - Gabriel Lippmann, Department of Environment and Agro-Biotechnologies (EVA), 41 rue du Brill, L-4422 Belvaux, Luxembourg; e-mail: novais@lippmann.lu, hoffmann@lippmann.lu, ector@lippmann.lu*

[4] *Departamento y Carrera de Biología, Universidad Mayor de San Simón, Cochabamba, Bolivia*

A recent investigation of epipsammic and epilithic material from streams and ponds from the Bolivian Altiplano has shown that the diatom communities are very rich and could be more diverse than previously considered. The present investigation was based on detailed taxonomical analyses combining light and electron microscopy with a critical review of published information and revision of type material. This method first revealed a higher number of taxa than that reported in the literature for the Altiplano, a literature produced based on light and electron microscopy, but using mainly European floras as basis for identification. Secondly, it became evident that some of the taxa often reported from the Altiplano actually do not occur or are less common in waters from this region. These findings have important repercussions on past palaeoecological assessments for the Altiplano, which have been based on ecological information for taxa developing in ecosystems of highly contrasting ecology. Here we present the case of three araphid diatoms, which were reported as known taxa from Europe and elsewhere, but in fact correspond to taxa new to science. Two of the three new taxa are rather common in Altiplanic waters. It is recommended that a) a flora for this region is developed utilizing sound microscopy data and reviewing pertinent type material, b) key common taxa used for past palaeoecological studies in the Altiplano are reviewed using a taxonomically thorough and critical method, and c) future palaeoecological studies for the Andes are supported by prior sound taxonomical analysis.

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