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Subcommission Acritarchs and Related Forms

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On the cover: specimen of *Aureotesta* Vavrdová 1972 emend. Brocke et al. 1998, from the subsurface of the Tadlas Basin, Morocco (Photo by M. vecoli).

THE SECRETARY'S COLUMN

Dear friends,

My 4-year term as Secretary of the Subcommission Acritarchs of the CIMP is coming to its end, as new elections for the CIMP boards will take place in the occasion of the General Meeting to be held in Prague, 2-6 September, 2006.

The CIMP General Meeting remains the only International venue completely dedicated to Palaeozoic Palynology and probably is the best place where to meet colleagues palynologists and to get informed about the state of the art of research in Palaeozoic Palynology. So, I hope many acritarch workers will participate in the Prague meeting: Palaeozoic Palynology in Space and Time. See details on the web site: http://www.cimp2006.wz.cz/

The "Chairman Column" by Reed, below, is quite informative and detailed: it gives a good summary of what happened during 2005 in our small but interesting acritarch community. For this reason, I am keeping this introduction to the essential…

The compilation of the Acritarch Newsletter (my principal task as Subcommission Secretary) has been an interesting and informative annual exercise, and I wish to thank the people who has been sending in their activity reports more or less regularly during the past four years.

Happy reading, and keep up with the good acritarch research!

Marco Vecoli

THE CHAIRMAN'S COLUMN

Greetings Fellow Acritarch Workers and Friends of Acritarchs:

Research by our various members continues to advance the frontiers of knowledge of this enigmatic and fascinating group. Take a look at the papers published and meetings attended by our members in this newsletter to see that, although we may be a small group (no pun intended), we are very active in many organizations, meetings, symposia, and publishing. In addition to our own specializations, we are also engaged in collaborative research with other paleontologists, geochemists, paleobiologists, geologists, and climatologists. In other words, the rest of the scientific community is learning that our particular microfossil group has a lot to offer in terms of solving fascinating research problems. So keep up the good work, and spread the word far and wide on all the exciting work we are doing.

In terms of meetings, we had a successful Paleozoic Microphytoplankton (PhytoPal) Symposium at the 38th Annual Meeting of the American Association of Stratigraphic Palynologists, held in St. Louis, Missouri, September 18-21, 2005 and convened by Richard J. Aldridge, Gary L. Mullins, and myself. Following a brief Introduction about the symposium, Gary Mullins presented an overview of the PhytoPal project and its accomplishments to date. This was followed by five presentations covering various aspects of Paleozoic microphytoplankton. Abstracts of the presentations, as well as two additional acritarch-related presentations at the meeting are provided in this newsletter, as well as a review of the symposium by Gary Mullins.

For those of you unfamiliar with this project, you can find out about its goals, meeting reports, as well as being able to download the Reference Database at: http://www.le.ac.uk/geology/glm2/phytopal.html.

The next major meeting of acritarch workers will be the CIMP General Meeting, September 2-6, 2006 in Prague, Czech Republic. The meeting theme is "Palaeozoic palynology in space and time" and will include a session titled "Palaeozoic marine microplankton." Contributions are welcome on any aspect of marine microplankton, including acritarchs, prasinophycean algae, and associated forms. I hope to see a large turnout of acritarch workers at this meeting and an abundance and diversity of talks and posters relating to acritrarchs and prasinophytes. Members of the PhytoPal project will be presenting their results as well as the overall results from this project. Presentations from students as talks or posters are most welcome on any aspect of Paleozoic palynology, and will be placed in the appropriate session. Let's encourage our students to not only attend this international meeting, but to fully participate in all aspects of it. As I mentioned in my column last year, students are the future of our discipline and we need to be encouraging them to become active in not only CIMP, but also the Acritarch Subcommission. To learn more about the CIMP General Meeting, go to: http://www.cimp2006.wz.cz/. Here you will find all you need to know about the meeting.

In addition to the Palaeozoic marine microplankton session, there will also be a meeting of the Acritarch Subcommission (date and time still to be determined). At the meeting we will take care of the usual Subcommission business, as well as electing a new Chairman and Secretary. Both Marco and my terms are up, and it will be necessary to hold an election for these two positions. Please consider serving your Subcommission in one of these positions. If you are interested, please contact me so your name can be sent forward at the meeting. It has been a pleasure serving as Chairman, and I look forward to the new Chairman taking our group to the next level.

I mentioned earlier about all the publishing our members have been engaged in, and I want to single out one publication in which several of our members have articles. This is the on-line journal *Carnets de Géologie/Notebooks on Geology*. It can be accessed at: http://paleopolis.rediris.es/cg/uk-index.html. Memoir 2005/02 titled "Pre-Cambrian to Palaeozoic Palaeopalynology and Palaeobotany" contains several articles on acritarchs. On-line journals are going to be an integral part of publishing in the future and here is one journal that you should at least look at in terms of future submissions.

On a sad note, our colleague Tadas Jankauskas from Vilnius University, Lithuania, passed away in a boating accident in the Baltic Sea on September 23, 2005. His obituary, written by Zivile Zigaite, and originally published in the Winter 2005 CIMP Newsletter is reprinted here along with a list of his publications. Having shared a few beers with Tadas at recent meetings, I would echo Zivile's comments that he was indeed a cheerful and charismatic person, a talented and broadminded scientist, and one who had an incredible sense of humor, not to mention, from personal experience, one of the strongest handshakes and back pats of anyone I've ever met. He will indeed be missed.

Lastly, if you did respond to our Secretary's call and my reminder to let us know what you are doing, thank you, and if you didn't, shame on you. The Newsletter is one of the best ways to stay current on what all of our colleagues are doing. Please consider responding to our call next year for news items, address changes, and anything else you think might be of interest to our group. If you have students, please encourage them to join CIMP, the Acritarch Subcommission, and to attend as many meetings as possible, present their research, and get to know the people in their field as well as letting us get to know them.

I hope to see many of you at the CIMP meeting in September, and that you will consider presenting a paper or poster in the "Palaeozoic marine microplankton" session. Also, please consider running for the office of Chairman or Secretary. Our organization is only as strong as the membership is active, so please become involved. See you all in Prague this fall.

Reed Wicander

OBITUARY

Tadas Jankauskas (1938 – 2005)
Beloved Professor, Scientist, Sportsman

Our Colleague, palaeontologist, researcher of Precambrian and Early Palaeozoic acritarchs, and popular geology Professor of Vilnius University in Lithuania, Dr. Tadas Rimas Jankauskas died on 23rd of September 2005, due to a fatal accident. A passionate fisherman, and former well known wrestler, he went to a dangerous fishing area at the Curonian Gulf on the Baltic Sea. Unfortunately, the boat couldn't stand the strong autumn wind.

Tadas was born on 4th of March 1938, in Kaunas, Lithuania. His intellectual and wealthy parents were a target of victimization and repression, caused by the Soviet occupation during the World War II. As participants of the resistance movement against the Soviet System, Tadas's family were exiled to Siberia, Tomsk district, where Tadas started at primary school.

In 1956 he entered the Technical University of Tomsk, and graduated in 1961 as a geologist and mining engineer. As an intelligent and hard-working student, he was noticed and was invited to teach at the Department of Geology of the same University, where he gave several courses, such as Physical Geology, Palaeontology and Earth History, Structural Geology and Regional Geology. He also lead several field courses as well.

Tadas defended his Doctoral theses "Precambrian and Cambrian geology of the western part of East Sayan" in 1965. Eventually, his numerous scientific publications reached Lithuania, and in 1970 the Lithuanian Academy of Science and Director of the Institute of Geology in Vilnius asked Tadas Jankauskas to come back to work in Lithuania. Tadas has agreed with no doubt.

In 1974 Tadas was nominated as a senior researcher and become the head of the Laboratory of Palaeontology in the Institute of Geology in Vilnius. His main research covered Upper Precambrian and Cambrian biostratigraphy of Baltic States, Byelorussia and western Russia. He described a lot of new acritarch species, published the first acritarch biozonation scheme of Cambrian of Lithuania, and contributed to understanding of the regional stratigraphy of the East European Platform.

For two years (1975-1977) Tadas Jankauskas worked for the Syrian oil company in Damascus, and after comprehensive micropalaeontological and lithological investigations, he published the first lithostratigraphical scheme for the Palaeozoic of Syria in 1978.

In 1979-1980 Tadas published his three major studies on palaeontology, lithology and stratigraphy of the Upper Precambrian and Cambrian of the East European Platform ("Palaeontology of Upper Precambrian and Cambrian of western East European Platform", "Stratigraphy of Upper Precambrian and Cambrian of East European Platform", and "Lithology and Palaeogeography of Upper Precambrian and Cambrian of East European Platform"), in Russian. All three monographs were translated into English and published in Poland during 1983-1984. At the same time Tadas completed his Doctoral habilitation theses "Upper Precambrian and Cambrian microfossils of the East European Platform, and their stratigraphic significance". Later Tadas also distinguished himself as the editor of an extensive atlas published in 1989 on Precambrian microfossils of the Soviet Union.
Tadas Jankauskas was a member of the European Geological Society and International Commission of Cambrian Microfossils, as well as Chairman of the Lithuanian Stratigraphical Commission since 1996.

During 1980s, Tadas organized numerous seminars and symposiums in Vilnius, St. Petersburg, Irkutsk and other cities, consulting young specialists in Tallinn, Tartu, Moscow, St. Petersburg, and Syria as well, participating in doctoral theses defense committees in universities in Sweden, Russia, Georgia and India.
In 1993 Tadas Jankauskas started to teach in the Department of Geology and Mineralogy Vilnius University, where he became a Professor in 1995. Since that time teaching occupied the main part of his working time: he gave extensive courses in Tectonics, Facies and Formations, Sedimentology, Regional Geology of Baltic States, Theoretical and Applied Stratigraphy and others. Being a man of strong humour, he like nobody else, gained a strong following amongst the student audience, filling classrooms and supervising several tens of diploma theses in Precambrian and Palaeozoic geology.
Tadas Jankauskas was a cheerful and charismatic person and a talented and broadminded scientist, as well as an experienced geologist and popular professor. For those of us who met Tadas, it is impossible to forget his heartiness and incredible sense of humor.

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THE THIRD PHYTOPAL MEETING AND WORKSHOP AT ST. LOUIS

The Phytopal Group met for the third time in St. Louis, Missouri, U.S.A., in the occasion of the meeting of the American Association of Stratigraphic Palynologists (AASP), on September 20, 2005. Previous meetings were held in Leicester, U.K. (December 2003) and Lille, France (December 2004).

As for the previous meetings (see Acritarch Newsletter N° 19 and 20), we re-publish here the abstracts of the talks presented to the Phytopal session at St. Louis.

Participants to the 3rd Phytopal Meeting in St. Louis (from left to right). Reed Wicander, Paul Strother, Thomas Servais, Malgorzata Moczydlowska-Vidal, Gary Mullins, Stewart Molyneux, Dick Aldridge, Ken Dorning.

QUANTITATIVE PARTICULATE ORGANIC MATTER AS AN INDICATOR OF PALEOPRODUCTIVITY AND TRANSGRESSIVE-REGRESSIVE CYCLES IN THE UPPER DEVONIAN NEW ALBANY SHALE SOURCE ROCK (INDIANA)

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A number of studies have focused on organic petrology and geochemistry as tools for determining the source, type, and degree of degradation of organic matter in Upper Devonian petroleum source rocks of the Illinois, Michigan, and Appalachian Basins. Additionally, while numerous studies have investigated the palynological content of chronostratigraphically equivalent black shales from these basins, no palynologic studies have investigated the distribution patterns of particulate organic matter in the Upper Devonian New Albany Shale of Indiana.

This study is based on preliminary investigations carried out on 30 samples that span a 2.5-foot interval of the Frasnian-Famennian boundary in the Kavanaugh Well #1-3 core (Daviess County, Indiana). The results presented here are part of an on-going high-resolution, multidisciplinary investigation using palynological, mineralogical, and biogeochemical data. The objective is to provide an insight into late Devonian vegetation and phytoplankton response to numerous global transgressive-regressive cycles which culminated in the Upper Kellwasser mass extinction at the Frasnian-Famennian boundary.

Comparisons of quantitative kerogen categories including total land-derived palynomorphs, marine forms, and phytoclasts of macrophyte plant debris can be used to provide detailed paleoenvironmental analyses and palynofacies boundaries within sequence stratigraphic variations during the Frasnian. Ratios of independently assessable marine to terrestrial organic-walled acid-resistant microfossils illustrate (1) the degree of input of plant debris into the basin indicating increased or decreased continental drainage, climatic fluctuations, and/or changes in growth patterns of coastal vegetation, and (2) fluctuations in trophic conditions due to changing bathymetry and/or energy regimes. These initial palynofacies results will be correlated with maceral, isotopic, and elemental signatures (i.e. organic petrography; Rock-Eval hydrogen index values; TOCorg; δ13C, δ15N; C/N ratios; and C, N, P, S %'s) to better understand the relationship between dissolved and particulate organic matter, sea-level fluctuations, and large shifts in carbon-13 isotopic values.

Future research will integrate these data with quantitative absolute palynological counts and sedimentologic evidence (X-ray diffraction), as well as the results of molecular organic geochemical analyses, in order to provide a more complete evaluation of the temporal trends and controls on palynomorph phytoplankton diversity and abundance, as well as organic carbon production and accumulation, operating in the Illinois Basin during the late Devonian. On a larger scale, integration of this Laurussian, low-latitude composite dataset with data on thermally immature, high-latitude black shales from the Madre de Díos Basin in northern Bolivia (Western Gondwana) will

provide a global context for organic matter distribution patterns and black shale deposition in intracontinental seas.

PHYTOPLANKTON ABUNDANCE AND SPECIES DIVERSITY CHANGES THROUGH THE CAMBRIAN, ORDOVICIAN AND SILURIAN OF AVALONIA AND LAURENTIA

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Acritarch and prasinophyte species diversity has been documented for the Lower Palaeozoic from sections in the British Isles, part of the microcontinent of Avalonia and southeast part of Laurentia. Overall, acritarch species diversity is greatest on open marine shelf sea areas, with lower diversity assemblages recorded on open ocean and nearshore settings.

Species diversity is low to moderate through much of the Cambrian, but increases into the Tremadoc. Ordovician species diversity is highly variable, depending on depositional environment. Species diversity is low during the early Llandovery, but increases greatly into the late Llandovery.

Phytoplankton abundance is remarkably high in the latest Cambrian to Tremadoc interval, with numbers often exceeding 100,000 per gram. In contrast, Silurian assemblages often contain 200 to 2000 specimens per gram.

ACRITARCH COLOR: A NEW THERMAL MATURITY INDICATOR

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Like spores, acritarchs change color and become darker with increasing thermal maturity. The color of acritarchs of the genus Veryhachium has been correlated with vitrinite reflectance data so that the former can be used to assess the thermal maturity of vitrinite-deficient sediments.

Devonian samples containing vitrinite and acritarchs from Belgium, Canada, Spain, the USA, and Venezuela have been investigated. In addition, Lower Palaeozoic samples from Jordan, which contain acritarchs but no vitrinite, have been studied. In these samples, chitinozoa reflectance has been used as a proxy for vitrinite reflectance, using published correlations of these two parameters.

Colors of acritarchs have been determined in transmitted light based on red / green / blue (RGB) intensity using a Leica Q-win® image analysis system; vitrinite reflectance (Rr) has been measured using standard techniques. Preliminary results suggest that the most rapid change in acritarch color occurs at higher levels of organic maturity than the corresponding colour change in miospores.

The technique developed may be most useful in determining the maturity of rocks that are mature to marginally post-mature with regard to the ‘oil window’. Attempts have been made to find inexpensive standards for calibration purposes but the reproducibility of results from different laboratories has still to be investigated.

EARLY CAMBRIAN ACRITARCHS: MORPHOLOGICAL DISPARITY, LIFE CYCLE AND BIODIVERSITY

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Several radiation and extinction events of phytoplankton, revealed in the fossil record by acritarchs, which are predominantly related to unicellular green algae, are recognized on a global scale during the

Cambrian Period. The early Cambrian radiation of phytoplankton was one of the most prominent biotic events of the time, and a part of the Cambrian explosion, that resulted in the appearance of numerous new species with complex morphology. The appearance of ornamented acritarchs, both morphologically innovative and diverse, is unique. This conspicuous association of microbiota lasted for ca. 15-20 million years (Myr), coinciding with the emergence of several new clades of bilaterian metazoans, and became largely extinct at the beginning of the Middle Cambrian. Subsequently evolving morphotypes (known from the Phanerozoic) represent mostly the repetition and re-combination of morphological features invented during the initial Cambrian radiation, with the exception of some more advanced excystment structures (pylomes).

Based on phenetic morphological features alone, around 120 early Cambrian form-species are listed in the recent database (PhytoPal Project). However, because some species produced various, morphologically distinct stages in their life cycle, which may be preserved and thus recognized as separate form-species, the apparent number of species is overestimated and burdened with some error.

Similarly, the number of form-species of Leiosphaeridia may be exaggerated because of the lack of reliable and objective features to distinguish them by morphological habit. Conversely, convergence among some sphaeromorphic taxa, which belong not only to different biological species but also algal orders as shown by their wall ultrastructure, leads to underestimation of the actual number of species.

Acritarch form-species reflect, in fact, the morphological disparity of phytoplankton, displayed by ornamented cysts, internal dormant/reproductive cells and external vegetative envelopes that may pertain to a single species, and various ecological variants of discrete species. Although phytoplankton disparity does not correspond strictly to its biodiversity, it has been simplified as such in the biodiversity curves constructed on the form-species counts. This may not be a significant misinterpretation because higher disparity depends to some degree on higher diversity and altogether some under- and overestimation of the number of form-species may mutually compensate and diminish the error in recognizing the true biodiversity.

Set in a chronostratigraphic frame, it can be seen that the relative change of phytoplankton between time slices reflects the “waxing and waning” of phytoplankton disparity and biodiversity, although not as a true count of taxa, which may never be accurately deciphered in the fossil record.

ACRITARCH DIVERSITY TRENDS IN A DEEP-WATER SETTING: A CASE HISTORY FROM THE EARLY-MIDDLE ORDOVICIAN OF AVALONIA

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In recent years, much interest has focused on the ‘Great Ordovician Biodiversification Event,’ during which an extraordinary range of adaptive radiations appeared in ‘Paleozoic-‘ and ‘Modern-type’ biotas. As part of the investigation into the patterns and origins of Ordovician biodiversity, total diversity trends have been published for acritarch microfloras from the Yangtze Platform (South China) and North Africa (data from Algeria, Tunisia, and Libya). Based on these published data sets, it has been suggested that acritarch diversity mirrors transgressive-regressive episodes, with acritarch diversity increasing during marine transgressions, and decreasing during regressions. There is no doubt that this relationship is displayed by the

published data, and is also seen in other paleogeographical areas, for example on the Arabian Plate where marine flooding events are characterized by relatively high acritarch diversity. This, however, seems to be only half the story, with a different pattern emerging for successions in other paleoenvironmental settings.

All the studies cited above are on material from peri-cratonic platform successions. In deeper water successions, the diversity trend appears to reverse. The Early-Middle Ordovician succession of northern England, up to 5000 m thick, was deposited as muddy, silty and sandy turbidites in a deep marine environment on the margin of Avalonia, with a major olistostrome in the southern part of the outcrop. The most diverse acritarch assemblages occur (a) towards the base of the exposed succession, the messaoudensis-trifidum assemblage, which spans the Tremadoc-Arenig boundary (approximately mid Ibexian), and (b) in the upper Arenig (mid Whiterockian), the hamata-rarirrugulata assemblage. In both cases, increases in diversity coincide with lowstands. In contrast, the mid Arenig Highstand Interval, which coincides with the diversity peak on the Yangtze Platform, is characterized by low diversity in northern England.

A possible explanation for these observations, and one that can be tested further, is that acritarch assemblages track their preferred position along an inshore-offshore gradient during periods of transgression and regression, in a manner analogous to that proposed for graptolite faunas. In this scenario, high diversity assemblages migrate onto platform areas during periods of transgression/highstands, consistent with previous suggestions, but retreat to continental margins during regressions/lowstands.

THE DIVERSITY OF THE LOWER PALEOZOIC PHYTOPLANKTON: THE PHYTOPAL PROJECT

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From the perspective of the fossil record, the Paleozoic phytoplankton was principally composed of the cysts of acritarchs and the phycomata of prasinophyte algae, with other rare algal forms, such as members of the Zygnemataceae (e.g., Circulisporites), Botryococcaceae (e.g., Botryococcus), Hydrodictyaceae (e.g., Deflandrastrum) and possible Scenedesmacaceae (e.g., Morcoa) also being recorded.

The phytoPal Project (http://www.le.ac.uk/geology/glm2/phytopal.html) was initiated to improve our understanding of the diversity fluctuations in these fossils during the Paleozoic. Diversity changes can then be related to global climate patterns, and macrofaunal diversity and extinction events, such as the Cambrian explosion and the extinction events at the end Ordovician, during the Late Devonian, and at the Permian–Triassic boundary.

To establish the timing of the diversity fluctuations, a database of all of the published Paleozoic phytoplankton taxa has been created. This database

includes both taxonomic information (e.g., previous taxonomic assignments, synonyms and homonyms) and stratigraphic information (e.g., age of the nomenclatural type and other reported occurrences). The stratigraphic range of each taxon has been determined using the expertise of several Paleozoic phytoplankton workers, named above, using reliable published data.

We present here our preliminary results on the diversity of the Paleozoic phytoplankton related to the standard stages of the ICS/IUGS International Stratigraphic Chart. To assess the validity of these diversity fluctuations, key datasets have been identified that accurately record the distribution of microphytoplankton through periods of apparent diversity change (e.g., the late Silurian and early Devonian). Furthermore, additional detailed work is being undertaken on the Cambrian and Carboniferous, where significant changes in phytoplankton diversity are recognized to have occurred.

WAS THERE A PHYTOPLANKTON BLACKOUT IN THE LATE PALEOZOIC?

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Previously published biodiversity studies (e.g., Tappan and Loeblich, 1973; Downie, 1984) and the new database of the phytoPal project (http://www.le.ac.uk/geology/glm2/phytopal.html) show a rapid decline in acritarch abundance and diversity at the end of the Devonian. The acritarchs never fully recovered from this major "extinction," while the dinoflagellates only radiated in the early Mesozoic (e.g., Fensome et al., 1996; Falkowski et al., 2004). Riegel (1996) first designated this low level of phytoplankton diversity in the Late Paleozoic as the "phytoplankton blackout."

The relative absence of the cysts of phytoplanktonic organisms in the Carboniferous and Permian was considered by some authors to reflect a breakdown in primary production that was related to the interaction of the marine and terrestrial realms, and their influence on nutrient input to the oceans (e.g., Tappan, 1968; Martin, 1996). The lack of fossilized late Paleozoic microphytoplankton was therefore interpreted by several authors as a major disturbance in primary production, food webs, and community structures during that period.

However, it is unlikely that the apparent absence or scarcity of phytoplankton in the late Paleozoic indicates a real lack of, or a low, primary production in the plankton because late Paleozoic marine ecosystems were basically "intact" which suggests that the food chain must have been undisturbed. Benthic filter feeders such as brachiopods and bryozoans were highly diverse in the late Paleozoic and this would be impossible without high primary productivity. In addition, it is well known that the larval stages of some marine invertebrates were planktotrophic, for example the larvae of gastropods. Nützel (1998) demonstrated that the diameter of the initial whorl, and the number of gastropod protoconch whorls, were well suited to infer larval strategies (planktotrophic vs. nonplanktotorophic). Such planktotrophic gastropod larvae have also been found in the late Paleozoic (Nützel and Mapes, 2001).

As the fossil record of the late Paleozoic does not indicate a collapse of the marine invertebrates, there must have

been microphytoplankton in the late Paleozoic. What was this microphytoplankton that constituted the base of the foodweb?

Taking into consideration that most palynologists have only investigated the larger acritarch cysts (> 20 μm), the smaller specimens (2-20 μm) are usually unknown, whereas the Paleozoic picoplankton (0.2 –2 μm) and bacterioplankton remain totally unknown. In modern oceans, the productivity of these latter parts of the microphytoplankton is considered to be comparable to, or greater than, phytoplankton primary productivity (e.g., Herndl, 1997).

Furthermore, Head (1996) estimated that, based on the number of dinoflagellates living today, only about 13% to 16% of all species produce fossilizable resting cysts. It is thus possible that most acritarch-producing organisms were unable to produce (larger) cysts in the late Paleozoic, or that these did not fossilize.

Although we observe a “blackout” in the fossil record, it seems unrealistic that a real “phytoplankton blackout” occurred during the late Paleozoic and earliest Mesozoic.

ACRITARCH AND PRASINOPHYTE BIODIVERSITY CHANGES THROUGH THE LATE SILURIAN TO EARLIEST DEVONIAN: AN OVERVIEW

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The distribution, abundance, and diversity of the present-day phytoplankton is affected by factors such as the availability of light, nutrients, temperature, salinity, water depth, distance from shoreline, circulation patterns, and latitude. These same factors presumably affected the Paleozoic phytoplankton, which was dominated by the organic-walled acritarchs and prasinophyte algae.

This study focuses on the changes in the organic-walled phytoplankton biodiversity during the late Silurian (Ludlow and Pridoli) through the earliest Devonian (early Lochkovian). This was a time of major compositional changes in the organic-walled phytoplankton. Important paleogeographic, paleooceanic, and geochemical change also occurred during this interval.

To analyze biodiversity changes during this nine-million year period, a database of acritarch and prasinophyte occurrences was developed. The data were derived from published and unpublished stratigraphic sections where independent age control was well established. From this data, the regional trends in the organic-walled phytoplankton biodiversity for low latitude warm water areas (Avalonia, Baltica, and Laurentia) and the high latitude cool water parts of northern Gondwana were established.

In order to make meaningful comparisons between areas, and to determine compositional changes, the late Silurian-earliest Devonian phytoplankton was divided into three major categories: marine chlorophytes and prasinophytes, marine acritarchs, and nonmarine types, including coenobial forms. These groupings are based on gross morphology, and are sufficiently detailed to mark critical changes in paleoenvironment and phytoplankton biodiversity.

In the Welsh Borderland and Basin, a part of Avalonia, the highest phytoplankton diversity occurred during the late Homerian and early and late Gorstian, with a decline in diversity in the Ludfordian. The lower diversity assemblages in the

Ludfordian may have resulted from the decline in sea-level that occurred during this interval. The data from Gotland mirrors that from the Welsh area, except for the early-middle Ludfordian, where diversity is higher. The data from Podolia shows phytoplankton diversity declined during the Wenlock and Ludlow, and the significantly lower values in the late Ludfordian may be a result of very shallow marine conditions. The early Lochkovian from Laurentia, represented by the Haragan Formation of Oklahoma, U.S.A., indicates an upward decline in phytoplankton diversity.

In northern Gondwana, data from northern Spain and northwest Libya, indicate phytoplankton diversity increased from the Gorstian to the late Ludfordian and early Pridoli, before declining in the late Pridoli and early Lochkovian.

Low latitude and high latitude regions show opposing diversity trends in the Gorstian and Ludfordian, but both appear to show a decling phytoplankton diversity in the early Lochkovian.

ACRITARCH CLASSIFICATION WORKING GROUP REPORT FOR 2005

Ken J. Dorning,
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As part of the phytoPal project, I visited Alain Le Herisse In Brest during the spring of 2005, together with Gary Mullins and Reed Wicander.
Among the discusions, we considered the affinities of acritarch and prasinophyte groups, focussing on the late Silurian to early Devonian interval. The resultant paper will be hopefully published during the next year or so. At this meeting, the acritarch clusters proposed in the Acritarch Newsletter last year were considered, in particular forms that excyst with a straight split into two halves, including *Ammonidium*, *Salopidium*, *Helospheridium* and *Percultisphaera*. The conclusion was that though *Percultisphaera* Lister 1970 shares a common excystment mechanism, the vesicle wall surface ultrastructure suggests significant differences with *Ammonidium* and *Salopidium*. Any comments on this, or contributions on other phytoplankton groupings, will be most welcome. Ken J. Dorning, Sheffield.

Specimen of *Ammonidium microcladum* (Downie) Lister 1970;
photo from:
www.le.ac.uk/geology/glm2/acritarchs.html.

NEWS FROM ACRITARCH WORKERS

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I visited Gotland as part of the Silurian Subcommission meeting in August 2005. As part of this, a number of sections were sampled in detail, with the aim that samples can be processed for acritarchs, chitinozoans and prasinophytes, together with isotopes. I am looking at refining the cyclicity in the Silurian in the Welsh Borderland of England and Gotland, Sweden, in relation to the palynological assemblages. Work continues on other Cambrian, Ordovician, Silurian, Devonian and Carboniferous sections worldwide.

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I am currently working on my Ph.D Thesis: "Global reformations of microorganism communities at the Late Riphean-Vendian of Siberia". I am working on organic-walled microfossils, their morphology, systematics, palaeoecology, palaeobiology and biostratigraphy. My current research focuses on the Vendian microbiotas from the Nepa-Botuoba anticlise and adjacent areas of Siberia.
In cooperation with my colleagues I also do research on the Late Precambrian – Early Palaeozoic microphytofossils from the high Arctic of Russia.

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This year I have finally gotten around to writing up my thesis, 'Acritarch colour as a thermal maturity indicator', supervised by Prof. Geoff Clayton. As some of you know I have concentrated on *Veryhachium*, calibrating its RGB (Red, Green, Blue) colour value with vitrinite reflectance data. With all the data collected and plotted up I am really pleased with the results, and I hope to write a paper for publication within the next few months. Now that the project is drawing to an end, I would like to take this opportunity to thank everyone who has helped me get this far. Essential to the study was gathering a range of samples containing both *Veryhachium* and vitrinite from different levels of thermal maturity. This simply would not have been possible without the support of many people who were generous with both their time and their collections. So, thanks to: Clive Burrett, Ken Dorning, Ian Graham, Craig Harvey, Ken Higgs, Mike Howe (British Geological Survey), John Marshall, John McKellar, Dave Naylor, Aideen McNestry, Bernard Owens, Geoff Playford, Ron Rea (Geological Survey, Ohio), Claudia Rubinstein, Thomas Servais, Reed Wicander and Ann Wilson (Ontario Geological Survey). Your assistance was much appreciated. Following a well deserved holiday this summer, I hope to start a post-doc in October.

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During the year 2005 I have been working on:

1) Acritarch biostratigraphy of Middle-Late Cambrian and Early Ordovician strata in the Zagros Basin, southern Iran.

2) Acritarch biostratigraphy of Late Ordovician strata in the Khoshyeilagh area, eastern Alborz Range, Iran.

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CIMP readers may be interested in aspects of my recently completed PhD thesis that, in part, deals with Middle Cambrian acritarchs (see abstract at p. 30). The thesis was completed at the University of Toronto, Canada, under the supervision of Geoff Norris and Desmond Collins; committee members Andrew Miall and Grace Parsons.
I am currently a term Assistant Professor at the University of Alaska Fairbanks and considering post-doc opportunities dealing with palynology and sedimentology as well as tenure-track positions.

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My Ediacaran acritarch monograph was finally published mid-year (Grey, 2005a), and is the first comprehensive attempt to apply standard Phanerozoic biostratigraphic methods (including detailed range charts) to the Proterozoic. The interval covered extends from below the newly defined Ediacaran System (c.600 Ma) to the first Ediacaran fauna in Australia (c.550 Ma) and includes samples from continuously cored drillholes in the Officer, Amadeus, and Georgina Basins and the Adelaide Rift Complex. Despite a patchy record in some areas, five assemblage zones have been identified. The oldest zone contains few diagnostic taxa, but is succeeded by a rapidly diversifying assemblage of large acanthomorphs. There are no obvious lithological or facies changes associated with the diversification, but in most drillholes it lies well above glacigenic sediments and follows the Acraman impact event (Grey et al., 2003, 2005b; Hill et al., 2004). The tantalising evidence for an association between the diversification and impact requires further evaluation, both by further studies of the Australian succession and by similar analyses of global successions. Sebastian Willman, supervised by Malgosia Moczydlowska, of Uppsala University is currently studying Officer Basin drillholes not covered in the initial study and so far is obtaining results consistent with the preliminary study. I hope to visit Sweden in mid-2006 to continue our collaborative studies and Sebastian will probably visit Australia later in the year for a further round of sampling and to look at type material.

In the meantime, I continue working on the Officer Basin Cryogenian succession in Western Australia. Two Geological Survey drillholes, Empress 1/1A and Lancer 1, can be correlated using a combination of lithostratigraphy, palynology, stromatolite biostratigraphy (Grey, 2005c), and stable isotopes (Hill, 2005). The drillholes, about 260 km apart, are surprisingly uniform both stratigraphically and in fossil distributions. Furthermore, the same association of acritarchs and stromatolites are present in Wallara 1 drillhole in the Northern Territory,

and can be matched to successions in the Adelaide Rift Complex. This confirms earlier proposed correlations that were supported by the stable isotope curves (Hill et al., 2000). By applying combined techniques in this way, my colleagues and I constructed a basic framework for the Australian stratigraphic succession (Grey et al., 2005).

The data from both of these studies are beginning to show some significant results for the interpretation of Neoproterozoic successions, in particular in relation to the age, number and correlation of glacial events in Australia. At least three, possibly four, glaciations appear to be present and sparse geochronological data, mainly from detrital zircons, is indicating that the glaciations may not be the same age as glaciations on other continents. Detailed documentation continues.

I continue to work on other parts of the Proterozoic and Archaean. Most of my current interests are based on stromatolites, but papers on Mesoproterozoic filaments and acritarchs and some probable early Archaean microfossils are in late stages of preparation.

References: (other than those listed at p. 27).

HILL, A. C., 2005, Stable isotope stratigraphy, GSWA Lancer 1, Officer Basin, Western Australia: in MORY, A. J. and HAINES, P. W. (editors), Lancer 1 well completion report (interpretive papers), Officer and Gunbarrel Basins, Western Australia: contribution to Western Australia Geological Survey, Record 2005/4, 81p. http://www.doir.wa.gov.au/documents/gswa/gsdRec_2005_04.pdf

HILL, A. C., GREY, K., GOSTIN, V. A .and WEBSTER, L. J., 2004, New records of late Neoproterozoic Acraman ejecta in the Officer Basin: Australian Journal of Earth Sciences, v. 51, p. 47–51.

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I have been continuing research on acritarchs from different periods of time : the Middle Ordovician of Saudi Arabia (collaboration with Mansour Al-Ruwaili and Marco Vecoli , paper submitted) ; the acritarchs from southern and southeastern Turkey, for the revision of the lithostratigraphy with Florentin Paris as coordinator and others collaborators (paper submitted); the upper Ordovician in relation to the impact of the glaciation on the phytoplankton stays a very active project , and several papers on the subject are in preapration (e.g the upper Ordovician of the northern Tchad with F. Paris, Ph. Steemans and D. Massa); the Silurian in general and particularly the preparation of a synthesis on North African material from Algeria, Libya and Tunisia ; the Upper Silurian and Lower Devonian with a contribution in preparation for the Phytopal project issued from a collaboration with Reed Wicander, Gary Mullins and Ken Dorning (« the 3 Mousquetaires »), that spent two weeks in Brest in April 2005 ; the Devonian and particularly the Devonian of north Africa (Libya, Tunisia) and South America (Brazil and Bolivia, collaboration with J.H Melo from PETROBRAS, Claudia Rubinstein and Philippe Steemans, stay to Rio in December), with a first monograph in preparation on the Upper devonian Acritarchs of the Amazon Basin, Brazil, that I hope should be published this year.
Work with Emmanuelle Javaux of Liege and Craig Marshall from Sydney on biomarkers , and collaboration with Edwige Masure from Paris, give me opportunity to

finish a contribution dealing with « Evolution of the marine phytoplankton : from acritarchs to dinocysts » (submitted to RPP).
A substantial part of my activity was also devoided this year to the applied palynology, in contact with different Oil companies (2 internal reports in 2005), and to supervise two PHD projects : Miguel Perez-Leyton on the Palynostratigraphy of the Siluro-Devonian of Southern Bolivia and Benson M. Modié on the Permian Ecca-Dwyka Group of Botswana (see details in the newsletter). They are on the way to finish.

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I am currently working on the morphology, systematics and palaeobiology of Late Riphean microfossils from Siberia.
For the next future, I plan to continue my investigations of the rich and exceptionally preserved microbiotas from the Upper Riphean Lakhanda and Miroedikha Formations of Eastern Siberia in order to define a structure of biocenosis, its biological diversity and its relation to the paleoenvironmental conditions.

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I continue working on Ordovician acritarchs from China. In June, I participated in the annual meeting of IGCP 503 in Milwaukee, USA where I gave a talk and attended the pre-conference excursion in Cincinati. In August, I participated in the 6th Baltic Conference in St. Petersburg, Russia and gave a talk there as well. Apart from own busy research, with my colleague's help I have started organizing the 10th ISOS, 3rd ISSS and IGCP 503 conference 2007, to be held in Nanjing. The first circular of the conference has been sent to colleagues via email. If any colleagues have not received the circular, please contact me, or download it from the following websites:
http://www.ordovician.cn/home.asp;
http://www.silurian.cn/home.asp;
http://sarv.gi.ee/igcp503/

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My current research project is entitled "Neoproterozoic microbial diversification - a prelude to the Phanerozoic world".

The objective of the project is to study new fossil materials and geological data in order to recognize and interpret the origin and diversification of photosynthetic microbiota, their adaptation and survival of severe environmental disturbances and their impact on global biogeochemical cycles, and environmental feedback during Neoproterozoic and Cambrian times. Existing collections and new materials obtained through planned extensive fieldwork are from sedimentary successions located in various palaeogeographic settings in Australia, China, Siberia, Poland and Sweden.

The project involves research by the doctoral student Sebastian Willman. His

Ph.D. project is on "Origins of Neoproterozoic-Early Palaeozoic phytoplankton". This project is focused on patterns of origination, extinction and diversity of early marine phytoplankton and it falls within the disciplines of Palaeobiology, Evolution and Earth Sciences. The objectives are to better recognize the patterns of biodiversity change at taxonomic and temporal scales and to assess the environmental impacts on the development of more complex marine ecosystems by studying new and diverse microfossil materials.

My former Ph.D. student, Martin Stockfors, defended his thesis on April, 29, 2005, at Uppsala University, and was awarded a degree of Doctor of Philosophy. The thesis title is "Cambro-Ordovician microorganisms: acritarchs and endoliths", published in Sweden by Geotryckeriet, Uppsala 2005, ISBN 91-506-1798-2.

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Gary Mullins is continuing to work on the phytoPal Project, which has entered its final year. A database of all of the known Palaeozoic microphytoplankton (and many pre- and post-Palaeozoic species as well) has been constructed. Gary, along with the other partners in the project, is engaged in the final assessment of the stratigraphical ranges of each of the taxa in the database. The fluctuations in the diversity of the Palaeozoic acritarchs and related forms will then be evaluated and compared with changes in the global climate and extinction/origination events. In particular, Gary is working with Malgosia Moczydlowska-Vidal, with Reed Wicander, Ken Dorning and Alain Le Herisse, and with Thomas Servais, on assessing the diversity of the microphytoplankton in the Cambrian, Late Silurian-early Devonian and Carboniferous respectively.

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In 2005 I continued to study the palynology from metamorphic formations of the Eastern Carpathians, Romania. A study of Arenigian age chitinozoans from the Tulghes Group, Balan Zone, Eastern Carpathians resulted in the following publication: Leonard Olaru & Laviniu Apostoaie, "Arenigian chitinozoans from the Tulghes Group, Upper Formation (Tg.4) from Balan Zone,Eastern Carpathians,Romania" published in Acta Palaeontologica Romaniae, 4: 299-314, Cluj-Napoca, 2004.
I have communicated in 2005 to the 5th National Symposium of Romanian Paleontologists, Bucharest, a new study titled: Leonard Olaru "Some problems in biostratigraphy and palynological correlation of the Upper Formation (Tg.4) of the Tulghes Group from Eastern Carpathians(Romania)" which will be published in Acta Palaeontologica Romaniae ,5, Bucharest in 2006. This later study comes after my other study that is in press, titled: Olaru L., Lazar A. (2005) Acritarchs characteristic assemblage from the Upper Formation (Tg.4) of the Tulghes Group, Balan Zone (Eastern Carpathians, Romania) Analele Universitatii "Al. I. Cuza" Iasi, Geologie.
Finally, I wish to correlate acritarch assemblages with chitinozoan assemblages, that come from the same samples of the same formation Tg.4, from the Tulghes Group. I have observed that there is a small difference of interpretation

between the acritarch age and chitinozoan one. This study is very important for understanding the structure and tectonics of this formation, its initial sedimentary formation, and later transformation in the metamorphic formation (as today) by the dynamic and hydrothermal metamorphism, accompanied by tectonic events

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During January-April 2005, Prof. Geoff Playford was collaborating with Dr. Felipe González and Dra. Carmen Moreno at the University of Huelva (Andalucia, Spain) as part of his association with them in a three-year Spanish Government/Univ. Huelva-funded project on the biostratigraphy of the Iberian Pyrite Belt, based on miospore and acritarch assemblages. Geoff continued joint research on North American Ordovician acritarchs with Prof. Reed Wicander (Central Michigan University), specifically on Upper Ordovician assemblages from Oklahoma and Michigan's Upper Peninsula. Ongoing research, with John Rigby (Queensland University of Technology) is on Permian palaeobotany and palynology of West Papua (including a nonmarine acritarch component). Marco Quintavalle, one of Geoff's research students at The University of Queensland, submitted his PhD thesis on Ordovician palynostratigraphy (acritarchs and chitinozoans) of the Canning Basin, Western Australia, towards the end of 2004; following the thesis examination, Marco was awarded the degree early in 2005. Marco and Geoff subsequently prepared the bulk of the thesis for publication (three papers currently in press). Two other PhD candidates at UQ, Daniel Mantle and Emma Msaky, are working on Mesozoic projects based respectively in the Timor Sea and coastal and offshore Tanzania.

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I continue to work on Ordovician acritarchs from Siberia and Baltica. Thus, several studies are in progress. However, since a new research group of palaeobiology and biostratigraphy of the Precambrian and the Early Palaeozoic had been created last year in the Institute of the Precambrian Geology and Geochronology, I together with my closest colleagues (T. Hermann, E. Golubkova and V. Podkovyrov) began to work for join research of biosphere evolution through the Proterozoic to the Early Palaeozoic. My personal study now focuses on the Late Vendian – Cambrian microphytoplankton of Siberia. Everything related to its biodiversity, ecology, systematics and biostratigraphical implication is in a field of my interest. In collaboration with Siberian Research Institute of Geology, Geophysics and Mineral Resources (SNIIGG&MS), Novosibirsk, I am working on acritarch biostratigraphy of the Cambrian of the Siberian Platform.
In addition, a series of palynological studies is planned to be prolonged on the high Arctic of Russia (Severnaya Zemlya, Novaya Zemlya and Kolguev Island) in the next future.

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At the end of February I will finish a one year NFSR post-doctoral grant at the University of Liège. In this year, together with Philippe Steemans, we have focused our work on Silurian and Devonian miospores and acritarchs from Argentina and Brazil. We have submitted a paper with new palynological data from the Devonian of the Mendoza Precordillera. We have also progressed with Silurian and Lower Devonian palynomorph assemblages form the Central Precordillera Basin of San Juan and Upper Silurian assemblages from the Amazonas Basin, northern Brazil. During this periode I have continued my studies on Ordovician and Silurian acritachs and miospores from the Central Andean Basin , northwestern Argentina, as a part of a multidisciplinary approach (sedimentology, palynology, graptolites and trilobites). Two papers are now in press, one of them dealing with lower Silurian acritarchs and graptolites from the Cordillera Oriental (in Geobios) and the other dealing with the refinement of the Upper Tremadoc biostratigraphy and faunas of the Cordillera Oriental (in Ameghiniana). I have been continuing to supervise the PhD project on Ordovician chitinozoans from northwestern Argentina, carried on by Susana de la Puente in the Paleopalynology Unit of Mendoza. I have also finished and submitted for publication a paper on acritarchs and chitinozoans from the Famatina System, northwestern Argentina, a peri-Gondwana active volcanic arc during Ordovician times, in collaboration with Aicha Achab.

For the next future, I will continue research on marine and terrestrial palynomorphs of the Ordovician and Silurian from western Argentina, especially focused on biodiversification patterns, biostratigraphy, paleobiogeography and paleoenvironments. I will also start studies on, almost palynologically unknown, Silurian-Devonian basins of the San Rafael Block (Mendoza), Sierra de la Ventana (Buenos Aires) and north Patagonia. Finantial support for these projects is provided by the CONICET and the National Agency of Scientific Research, Argentina.
In 2006, together with Thomas Servais, we will start with a new project entitled "Evolution of the Ordovician palynomorph biodiversity in the Gondwana margin: biofacies vs. paleogeography and paleoclimate", in the framework of the scientific cooperation programme between Argentina and France (SECyt-ECOS). This joint project also includes Florentin Paris and Marco Vecoli as participants.
Last but not least, a book entitled " Pre-Quaternary palynostratigraphy of South America" is planned to be published probably in 2007 by the AASP, with. Mercedes Di pasquo (Buenos Aires, Argentina) as Editor in Chief. I will be the coordinator for Cambrian, Ordovician and Silurian chapters.

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During year 2005 the main focus of research was concentrated on study of the Lower Riphean (early Mesoproterozoic) silicified Kotuikan microbiota, Anabar Uplift, northern Siberia, from a new occurrence (the Fomich River Valley). Earlier the microbiotas which are among the most diverse silicified early Mesoproterozoic assemblages have been detected in the cherts of the Kotuikan and Yusmastakh formations from the Kotuikan River Valley (Sergeev et al., 1995). However, these microbiotas were described only from one

locality and new finds were necessary to trace the possible variation in composition of these unique assemblages across the Anabar Uplift. It turned out that the composition of the Kotuikan microbiota from the new locality (the Yusmastakh Formation is truncated by pre-Vendian unconformity in the Fomich River Valley area) is the same and comprising the ellipsoidal akinetes of Archaeoellipoides, spheroids of Myxococcoides grandis, short trichomes (germinated akinetes ?) as well as entophysalidacean and other chroococcacean cyanobacteria. This similarity in the microbiota composition from the distant localities (about 300-400 km) supports the earlier inherited from the lithological data idea about expanding over all Anabar Uplift area of the carbonate ramp in early Mesoproterozoic time. This environment is the key element in hypothesis explaining similarity of the Mesoproterozoic Archaeoellipsoidal-dominated microbiotas from the various continents and new finds support this idea.

The monograph about the Precambrian silicified microfossils from northern Eurasia finally has been prepared during 2005. The book should be published during the first quarter of year 2006 (unfortunately, in Russian) and contains information about the silicified microfossils successions from the southern Ural Mountains, Middle Asia and Siberia ranging in age from Early Riphean (early Mesoproterozoic) to Vendian (Ediacarian). The combined succession of these studied microfossil assemblages from the northern Eurasia were used as the type one for comparison to various Proterozoic microbiotas of different age described from other regions. As a result of all available data integration, the model of vertical distribution of various microfossils taxa in Archean and Proterozoic has been created and seven informal microphytological units or "Proterohorizons" have been established ranging in age from 2.0 to 0.535 Ga. These subdivisions are named as follows: the Labradorian (2.0-1.65 Ga), Anabarian (1.65-1.2 Ga), Turukhanian (1.2-1.03 Ga), Uchuromayan (1.03-0.85 Ga), Yuznouralian (0.85-0.65 Ga), Amadeusian (0.65-0.55 Ga) and Belomoryan (0.55-0.535 Ga) proterohorizons. The results of the microphytological investigations and the proposed preliminary subdivision of the upper Paleoproterozoic and Meso-Neoproterozioc based on the microfossil successions have been presented to the XI All-Russian Palynological and XIII Russian Micropaleontological conferences which were held to Moscow during the fall of 2005.

Sergeev V.N. Recent appreciation of Precambrian microfossils biostratigraphic usefulness // XI All-Russian Palynological Conference: "Palynology: Theory and Applications". M.: PIN RAS, 2005. P. 236-237 (in Russian).

Sergeev V.N. The biostratigraphic opportunity of Precambrian microfossils: current status // Proceedings of XIII Russian Micropaleontological Conference: "Micropaleontology in Russia on a boundary of centuries" . M.: Geos, 2005, P. 158-160 (in Russian).

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I changed from deputy head (2002-2005) to head of department (2006-2009) of the UMR 8014 CNRS unit at Lille. This will bring some more administration on the desk. Research is focused on leading the IGCP 503 project (Ordovician Palaeogeography and Palaeclimate, 2004-2008) and the organisation of related meetings. The main scientifical question of the ongoing research is to understand the

relation between phytoplankton biodiversity changes and the Ordovician Biodiversification Event. At a larger scale, I participate in the PhytoPal project, to understand the phytoplancton diversity during the Phanerozoic (http://www.le.ac.uk/geology/glm2/phytopal.html). In 2005, a revision of the Late Cambrian genus Nellia was published (Stricanne et al.), and a comparison of the palaeogeographical distribution of the Ordovician acritarchs with other groups (graptolites, chitinozoa, etc.) with the main aim to declare that planktonic groups may be as important as benthic fossils. Projects in collaboration with Marco Vecoli (Lille), Li Jun (Nanjing) and Lena Raevskaya (St. Petersburg) continue. A new collaboration project with C. Rubinstein (Mendoza) has just been accepted and will run from 2006 to 2008.

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My acritarch-related research activity includes the following projects:

- The revision of Gondwanan Cambro-Ordovician palynostratigraphy for the establishment of a formal acritarch zonation, and its relations to the existing chitinozoan zonation (collaboration with Thomas Servais, Lille, France; and Florentin Paris and his postdoc Blaise Videt at Rennes, France). For this project, I am going to spend three weeks in 2006 as visiting scientist at the CONICET-IANIGLA in Mendoza (Argentina) working with Claudia Rubinstein, a collaboration sponsored by the bilateral program ECOS-SUD.
- The study of acritarch dynamics in response to the end-Ordovician glaciation and extinction event. This study is being conducted in collaboration to the ECLIPSE program of the CNRS: Glaciations and biotic crisis: the end-Ordovician event (coordinator Jean-François Ghienne, Strasbourg, France). Some key-sections around the globe are being re-sampled for detailed palynological (and coupled biogeochemical) analyses.
- Other ongoing collaborations are with Prof. Iginio Dieni, University of Pavia, Italy (revision of palynological material from the South Alpine basement, Italian Alps); Dr. Javier Alvaro, University of Zaragoza, Spain (Cambrian stratigraphy of the Montagne Noire, France); Dr. Enrique Vilas, University of Zaragoza, Spain (Hirnantian of Spain); Dr. Gary Mullins, Leicester, U.K. ("Phytopal project", aiming at investigating the relationships between acritarch evolution and diversity, and palaeoclimate during the Palaeozoic).

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I am continuing my work on Ordovician and Devonian acritarchs from a variety of locations. I am presently finishing a paper on the Ordovician Khabour Formation in Western Iraq with Thamer Al-Ameri, starting a study of Devonian acritarchs from Bolivia with Geoff Clayton, and finishing a PhytoPal project on global implications of organic-walled phytoplankton biodiversity through the Late Silurian to Early Devonian with Alain Le Hérissé, Ken Dorning, and Gary Mullins. The preliminary results of that study were presented at the Paleozoic Microphytoplankton (PhytoPal) Symposium at the American Association of

Stratigraphic Palynologists 38th Annual Meeting in St. Louis, Missouri last September.

ACRITARCH PUBLICATIONS, 2005:

The following are acritarch-related papers published during 2005. As last year, this list results mainly from the communications from the members of our commission, and may be not 100% complete.
Abstracts and other material not officially published in refereed journals are listed separately.

Grey, K., 2005a. Ediacaran Palynology of Australia. Memoirs of the Association of Australasian Palaeontologists 31, 439 p.
(available from the Geological Society of Australia):
http://www.gsa.org.au/publications.html

Grey, K., 2005b. Preliminary report on the Proterozoic biostratigraphy, Lancer 1, Officer Basin, Western Australia, in Mory, A.J. and Haines, P.W. (editors), Lancer 1 well completion report (interpretive papers), Officer and Gunbarrel Basins, Western Australia: contribution to Western Australia Geological Survey, Record 2005/4, 81 p.
http://www.doir.wa.gov.au/documents/gswa/gsdRec_2005_04.pdf

Golubkova, E., Raevskaya, E., 2005. Main changes in microfossil communities through the Upper Proterozoic of Russia. In: Steemans P., Javaux E. (Eds), Pre-Cambrian to Palaeozoic Palaeopalynology and Palaeobotany.- Carnets de Géologie/Notebooks on Geology, Memoir 2005/02 Abstr. 07, 21-25.

González, F., Playford, G., Moreno, C., 2005. Upper Devonian biostratigraphy of the Iberian Pyrite Belt, southwest Spain. Part Two: organic-walled microphytoplankton. Palaeontographica, Abteilung B 273, pp. 53-86.

Grey, K., 2005c. A Baptism of Ice and Fire. Australasian Science April 2005, v. 26, no. 3, p. 24-28.

Grey, K., Hocking, R.M., Stevens, M.K., Bagas, L., Carlsen, G.M., Irimies, F., Pirajno, F., Haines, P.W., Apak, S.N., 2005. Lithostratigraphic nomenclature of the Officer Basin and correlative parts of the Paterson Orogen, Western Australia: Western Australia Geological Survey, Report 93, 89p. http://www.doir.wa.gov.au/documents/gswa/gsdRpt93.pdf

Le Hérissé, A., Robardet, M., 2005. Silurien. In: A. Blieck (coordinator), Special report on Palaeozoic stratigraphy, Ann. Soc. Géol. Du Nord. T. 11 (2ème série), 139-144.

Hermann, T.N, Podkovyrov, V.N., 2005. On the animal nature of the Late Riphean Rugosoopsis. Paleontological Journal 39 (6), 582-589.

Moczydlowska, M., 2005. Taxonomic review of some Ediacaran acritarchs from the Siberian Platform. Precambrian Research 136, 283-307.

Playford, G., Dino, R., 2005. Carboniferous and Permian palynostratigraphy. In: Koutsoukos, E.A.M. (Ed.), Applied stratigraphy, chapter 5, pp. 101-121.

Raevskaya, E., 2005. Diversity and distribution of Cambrian acritarchs from Siberian and East-European Platforms: a generalized scheme. In: Steemans P., Javaux E. (Eds), Pre-Cambrian to Palaeozoic Palaeopalynology and Palaeobotany.- Carnets de Géologie/Notebooks on Geology, Memoir 2005/02 Abstr. 07, 39-44.

Rubinstein, C.V., 2005 Ordovician to Lower Silurian palynomorphs from the Sierras Subandinas (Subandean ranges), northwestern Argentina: a preliminary

report.- Carnets de Géologie - Notebooks on Geology, Brest, Memoir 2005/02, Abstract 09 (CG2005_M02/09), p. 51-56, 1 fig., 1 pl.

Rubinstein, C.V., Melo, J.H.G., Steemans, P., 2005. Lochkovian (earliest Devonian) miospores from the Solimões Basin, northewestern Brazil. Review of Palaeobotany and Palynology 133, 91-113.

Servais, T., Blieck A., Caridroit, C., Chen, X., Paris, F., Tortello, F., 2005. Use and utility of plankton and nekton for Ordovician palaeogeographical reconstructions. Bulletin de la Société Géologique de France 176, 531-543.

Stricanne, L., Servais, T., Talyzina, N., Vanguestaine, M., 2005. Reevaluation of the Late Cambrian – Early Ordovicia acritarch Nellia acifera Golub & Volkova. Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen 235, 87-112.

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Yan Kui, LI Jun, 2005. Ordovician Biostratigraphy of acritarchs from the Meitan Formation of Honghuayuan Section, Tongzi, Guizhou, Southwest China. Journal of Stratigraphy 29 (3), 236-256. (in Chinese with English abstract).

Yan Kui, LI Jun, Liu Jianbo, 2005. Biodiversity of Early-Middle Ordovician acritarchs and sealevel changes in South China Chinese Science Bulletin 50, 20, 2362-2368.

ABSTRACTS OF CONFERENCE PRESENTATIONS, 2005

This list includes the references to conference presentations dated 2004 which have been communicated by the CIMP members. As always, I prefer to list conference abstracts separately from peer-reviewed papers.

Alvaro, J.J., Ferretti, A., Gonzalez-Gomez, C., Pierre, C., Serpagli, E., Subias, I., Vecoli, M., Vizcaino, D., 2005. An updated Furongian stratigraphic framework for South-Western Europe. In: The Fourth International Symposium on the Cambrian System; Acta Micropalaeontologica Sinica 22(Supplement), pp. 3-5.

Dronov A., Tolmacheva T., Raevskaya E., Nestell M. (Eds.), 2005. Cambrian and Ordovician of St.-Petersburg Region. Guidebook of a field trip of the “6th Baltic Stratigraphical conference”. August 23-35, Saint-Petersburg. 2005. 62 p.

Elming, S.-Å., Moczydlowska, M., 2005. Palaeogeography of Baltica in the Cryogenian-Neoproterozoic: palaeomagnetic and palaeontological constraints. National Conference on the International Geoscience Programme (IGCP), May 20th, 2005, Uppsala.

Golubkova, E., 2005. O vozraste pezskoj svity rifeya mezenskoj sineklizy. Abstract of conference “Struktura, veshestvo, istorija litosfery Timano-severoural’skogo segmenta” Syktyvkar. 2005, 42. (in Russian).

Grey, K., Willman S., Moczydlowska, M., Hill, A.C., 2005. Subdividing the Ediacaran of Australia using biostratigraphy. Central Australian Basins

Symposium, 16-18 August, 2005, Alice Springs. Programme and Abstracts, p. 24-25.

Hermann, T.N, Podkovyrov, V.N., 2005. The Late Riphean is a major stage of evolutionary innovations. Abstr. of the LI session of the All-Russian Palaeontological Society, St.-Petersburg, 2005. 35-36. (in Russian).

Lehnert, O., Vecoli, M., Servais, T., Nützel, A., 2005. Was the "Great Ordovician Biodiversification Event" triggered by an increase in primary production? System Earth Biosphere Coupling International Conference, Erlangen, Germany, 24-27 September 2005, Schriftenreihe der Deutschen Gesellschaft für Geowissenschaften 39, p. 231.

Li Jun, Wicander, R., Yan Kui, Zhu Huaicheng, 2005. The paleobiogeographic significance of an Upper Ordovician organic-walled microphtoplankton assemblage from Dawangou, Xinjiang, northwestern China. Abstracts for the Second International Symposium of IGCP 503 "Ordovician Palaeogeography and Palaeoclimate", June 15-18, 2005, Milwaukee Public Museum in Milwaukee, Wisconsin, Insight 2, 15-16.

Li Jun, Yan Kui, 2005. Radiation of early-middle Ordovician acritarchs in South China. In: Koren, T., Evdokimova, I., Tolmacheva, T. (eds.), The Sixth Baltic Stratigraphical Conference, August 23-25, St. Petersburg, Russian: Abstracts. St. Petersburg, 7-8.

Moczydlowska, M., 2005a. Life cycle and wall ultrastructure of Early Cambrian unicellular green algae (Chlorophyta). 5th Regional Symposium of the International Fossil Algae Association, Ferrara Italy, August 30 - September 3, 2005, Abstracts; Museologia Scientifica e Naturalistica, vol. 1 2005, p. 32.

Moczydlowska, M., 2005b. Early Cambrian acritarchs: morphological disparity, life cycle and biodiversity. American Association of Stratigraphic Palynologists 38th Annual Meeting, St. Louis, Missouri, September 18-21, 2005, p. 40.

Moczydlowska, M., Zang, W-L., 2005. The plexus of Cambrian acritarch Skiagia and its significance for global correlation. The Fourth International Symposium on the Cambrian System, 18-24 August, 2005, Nanjing, China., Acta Micropalaeontologica Sinica 22, Supplement, p. 117-118.

Mullins, G.L., Aldridge, R.J., Dorning, K.J., Le Hérissé, A., Moczydlowska, M., Molyneux, S., Servais, T., Wicander, R., 2005. he diversity of the Lower Paleozoic phytoplankton: the PhytoPal Project. American Association of Stratigraphic Palynologists 38th Annual Meeting, St. Louis, Missouri, September 18-21, 2005, p. 43.

Podkovyrov, V.N. Hermann, T.N., 2005. About heteromorphic organisms of the Late Proterozoic. Abstr. of the LI session of the All-Russian Palaeontological Society, St.-Petersburg, 2005. 98-99. (in Russian).

Servais, T., Dzik, J., Fatka, O., Heuse, T., Vecoli, M., Verniers, J., 2005. The Ordovician of central Europe in the new stratigraphical context. System Earth Biosphere Coupling International Conference, Erlangen, Germany, 24-27 September 2005, Schriftenreihe der Deutschen Gesellschaft für Geowissenschaften 39, p. 355.

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Servais, T., Lehnert, O., Mullins, G., Munnecke, A., Nützel, A., Vecoli, M., 2005. The phytoplankton dvelopment in the Palaeozoic: a link to the diversification of marine invertebrates? In: Program and Abstracts: Joint meeting of the APLF-TMS-LSPG, Paris, 3-7 October 2005, p. 102.

Servais, T., Li, J., Mullins, G., Vecoli, M., Wicander., 2005. The Ordovician phytoplankton database in the Palaeozoic context. Abstracts for the Second International Symposium of IGCP 503 "Ordovician Palaeogeography and Palaeoclimate", June 15-18, 2005, Milwaukee Public Museum in Milwaukee, Wisconsin, Insight 2, 29-30.

Vecoli, M., 2005. Biodiversity of the oceanic microphytoplankton in the early Palaeozoic: data and interpretations. In: Program and abstracts, Joint meeting of the APLF-TMS-LSPG, Paris, 3-7 October 2005, p. 107.

Vecoli, M., Lehnert, O., Servais, T., 2005. Did microphytoplankton “explosions” trigger the Ordovician Biodiversification Event? Geophysical Research Abstracts, Vol. 7, N° 08873.

Wicander, R., Le Hérissé, A., Dorning, K. J., and Mullins, G. L. 2005. Acritarch and prasinophyte biodiversity changes through the Late Silurian to earliest Devonian: an overview. American Association of Stratigraphic Palynologists Programs and Abstracts, p. 48.

Willman S., Moczydlowska, M., Grey, K., 2005. Acritarchs in the Ediacaran seas. The Palaeontological Association 49th Annual Meeting, 18- 21 December 2005, Oxford University.

THESIS ABSTRACT

Sedimentology and Palynology of the Burgess Shale

By Kevin Gostlin

Doctoral Thesis, 2006, Department of Geology, University of Toronto

Supervisors, Geoff Norris and Desmond Collins;
committee members, Andrew Miall and Grace Parsons

Analysis of the sedimentology of the Burgess Shale's Greater Phyllopod bed (GPB) as well as palynology of the Burgess Shale and bounding Formations has shed more light on our breadth of understanding of depositional and ecological setting.

High resolution sedimentologic analysis of the GPB was conducted in order to compare the competing depositional models as well as consideration that the biota preserved at the GPB is in situ. The paucity of trace fossils remains the most substantial fact suggesting that the majority of GPB biota is allochthonous. There are, however, some species that appear to be *in situ*. Sediment patterns such as massive beds with high clay content are inconsistent with deposition via turbidity currents, and fluidized mud-flows respectively. The clinoform geometry of the basin is most consistent with transport of sediment off the escarpment perpendicular to the strike of the platform edge. Storm generated backcurrents likely transported the mud and majority of fossils from their original habitat the platform high above the GPB.

Palynologic analysis of a few of the bounding formations in the vicinity of the Burgess Shale fossil beds as well as detailed examination of the GPB has revealed one new genus, *Asperitas*, and several new species of acritarchs including, *Acrum incompostum*, *A. minutum*, *Asperitas anaideia*, *A. burgessensis*, *Dictyotidium acanthodes*, *D. cerionites*, *Dictyotidium? fraudulentum*, *D. microreticulatum*, *D. monogranulum*, *Micrhystridium cylindrum*, *Trachysphaeridium bicircummunum* and *T. reticulatum*.

Palynologic analysis by delicate acid-maceration also permitted the isolation of organic carbon cuticle, and abundant acritarchs directly from the arthropod *Marrella splendens*. The acritarchs are found in higher concentrations in association with the *Marrella* than in the matrix immediately surrounding the organism. It is concluded that *Marrella* was a filter-feeder composing a critical trophic link in this Middle Cambrian ecosystem. The presence of delicate organic carbon structures highlights the fact that organic carbon preservation contributed to the extraordinary preservation of the fossils of the Burgess Shale.