

SUBCOMMISSION ON TRIASSIC STRATIGRAPHY

ANNUAL REPORT 2009

1. TITLE OF CONSTITUENT BODY and NAME OF REPORTER

International Subcommittee on Triassic Stratigraphy

SUBMITTED BY

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2. OVERALL OBJECTIVES, AND FIT WITHIN IUGS SCIENCE POLICY

Rationalization of global chronostratigraphical classification.
Intercalibration of fossil biostratigraphies, integrated zonations, and recognition of global data.
Establishment of magneto- and chemo-stratigraphic scales.
Definition of Stage boundaries and selection of global stratotype sections.
Correlation of Triassic rock successions and events, including marine to non-marine.
Climatic evolution and modeling.

The objectives satisfy the IUGS mandate of fostering international agreement on nomenclature and classification in stratigraphy; facilitating international co-operation in geological research; improving publication, dissemination, and use of geological information internationally; encouraging new relationships between and among disciplines of science that relate to Triassic geology world-wide; attracting competent students and research workers to the discipline; and fostering an increased awareness among individual scientists world-wide of what related programs are being undertaken.

3. ORGANIZATION

STS is a Subcommittee of the International Commission on Stratigraphy. Officers (chairman, two vice-chairmen, secretary), Editor/ Webmaster of newsletter *Albertiana*, voting members (25), and corresponding members (~100). The Secretary hosts a web site for STS announcements and task group discussions.

Subcommittee members represent a broad spectrum of specialized stratigraphical disciplines from those countries or regions where Triassic rocks are extensively studied in relation to fundamental and/or applied geological research. Current research activities and future plans are communicated through publication of the bi-annual STS newsletter *Albertiana* as both hardcopy and web release.

3a. Officers for 2004-2008:

Chair: Dr. Michael J. Orchard, Canada
Vice-Chair: Prof. Marco Balini, Italy
Vice-Chair: Prof. Yin Hongfu, China
Secretary: Prof. Christopher R. McRoberts, USA

3b. Officers for 2008-2012:

Chair: Prof. Marco Balini, Italy
Vice-Chair: Dr. Mark Hounslow, UK
Vice-Chair: Prof. Jinnan Tong, China
Secretary: Prof. Christopher R. McRoberts, USA

The official newsletter of the STS is *Albertiana*, printed twice in the year in Utrecht (The Netherlands) and downloadable at the website:
<http://www3.bio.uu.nl/palaeo/Albertiana/Albertiana01.htm>

The web site of the STS is hosted at SUNY – Cortland, where all the information on the Subcommittee activities are available: <http://paleo.cortland.edu/sts/>

4. INTERFACES WITH OTHER INTERNATIONAL PROJECTS

IGCP Project 572: Restoration of marine ecosystems following the Permian-Triassic mass extinction: Lessons for the present (2008-2012).

5. CHIEF ACCOMPLISHMENTS AND PRODUCTS IN 2009**Publications**

“The Triassic Timescale” S.G. Lucas (ed.), Geological Society of London Special publications. The volume includes 15 contributions. The final version of the volume, including all the peer reviewed manuscripts, has been submitted to the GSL in September 2009. The book reviews the state-of-the-art of the Triassic time-scale and includes comprehensive analyses of Triassic radioisotopic ages, magnetostratigraphy, isotope-based and cyclostratigraphic correlations and timescale relevant marine and nonmarine biostratigraphy.

Proceedings of “The Triassic climate” workshop, Bolzano/Bozen, 2008

Special Issue of *Palaeogeography, Palaeoclimatology, Palaeoecology*, The peer review of the manuscripts submitted at the end of 2008 is over, and the volume will be printed in the first half of 2010.

Two volumes of *Albertiana* are scheduled for this year:

#37. Formerly scheduled for December 2008, but published in March, about 90 pages.

#38. Scheduled for the end of September, with editing in progress.

The primary aim of *Albertiana* is to promote the interdisciplinary collaboration and understanding among members of the Subcommittee and within this scope serves as a platform for announcements, meeting reports, business minutes, reviews, and Triassic literature compilations as well as preliminary notes, progress reports, and articles on Triassic research.

Electronic versions are also available in PDF format at:

<http://www3.bio.uu.nl/palaeo/Albertiana/Albertiana01.htm>

Meetings:

8-11 May 2009. Albuquerque, New Mexico, USA. Colorado Plateau Coring Project Workshop 2. The workshop consisted of two days of talks focused on nonmarine Upper Triassic stratigraphy and correlation followed by a fieldtrip to the Petrified Forest National Park in Arizona to examine nonmarine Upper Triassic strata. 35 scientists from 9 countries participated. http://www.ldeo.columbia.edu/~polsen/cpcp/CPCP_09_workshop.html

21-26 June 2009. Cincinnati, USA. IGCP 572 Session at the 2009 North American Paleontological Convention (NAPC 2009).

14-17 October, 2009, Nanjing, China. IGCP 572 workshop 4: Ecosystem evolution over the Permian-Triassic transition, 10th Paleontological Society of China Congress & 25th CPC, This symposium aims to update the studies on ecosystem collapse and re-building over the Permian-Triassic transition based on sedimentary and fossil records from South China. There is a growing number of new P/Tr boundary and Lower-Middle Triassic sections studied in South China in recent years. The IGCP 572 symposium hopes to offer opportunities for various Chinese working groups to communicate their new discoveries obtained from the newly found P/Tr boundary and Triassic sections. The IGCP 572 session also provides unique opportunity for non-Chinese working groups to communicate directly with various Chinese researchers, and thus bridge their collaborations in short future.

Progress on outstanding Triassic GSSPs:

Induan-Olenekian

At the end of 2007 after very lively discussions and two rounds of votes, the Task Group selected as best GSSP candidate the Mud section (Spiti, India), with the proposed base of the Olenekian at the FAD of the conodont *Neospathodus waageni sensu latu* at level MO4-13A3 of Mud O4 section. In 2008 further research aimed at refining the taxonomic variability of *N. waageni* leads to discover some specimens possibly belonging to morphotypes of the group of *N. waageni* also below the level MO4-13A3. In order to come to a stable conclusion one year of time was given to the research group working on Mud section, with dead line the ICOS 2009 (Calgary, July, 12-17). Two conodont specialists (M. J. Orchard and N. Goudemand) were involved in the study

and they both confirm the conclusion that *N. waageni sensu lato* first appears about 1 m below the level MO4-13A3. In October 2009 the Task Group is reactivated, with a suggested schedule to fix another session of vote by the end of 2010.

Olenekian-Anisian:

Two boundary proposals were presented in 2007 (Albertiana #36). The first proposal was based on the FAD of the conodont *Chiosella timorensis* supported by multidisciplinary data at Desli Caira (Gradinaru et al.). The second proposal suggested the base of the magnetozone MT1n at the same section (Hounslow et al.). During the Bad Goisern meeting in September, 2008 the conodont specialists unanimously supported the FAD of *C. timorensis* as the best marker event for the O-A boundary, as already stated by Gradinaru et al., 2006 (Albertiana #34). In 2009 the research focused on the ammonoid calibration of the boundary interval, to test the isochrony of the first occurrence of *C. timorensis*. Such a test is very difficult because often the Olenekian-Anisian sections show reduced sedimentation rate and poor and/or not continuous ammonoid record. H. Bucher expressed some concerns on the completeness of the uppermost Olenekian at Desli Caira because some faunas correlative with part of the Haugi Zone of north America have not yet been found. This part of the section was sampled again in late summer by Gradinaru together with the latest Anisian, showing rather impoverished ammonoid faunas. The possibilities of gaps at the top of the Olenekian at Desli Caira leads some authors to reconsider other sections as Guandao (China), characterized by good conodont record accompanied by stable isotope variations and paleomag record, or Nevada, where all the late Olenekian to early Anisian ammonoid faunas are present but not in succession in the same section.

Ladinian-Carnian

The GSSP for the base of the Carnian stage has been defined in 2008 at level SW4 of the Prati di Stuoeres/Stuoeres Wiesen (Dolomites, Italy) with the first occurrence of the ammonoid *Daxatina canadensis*. The GSSP has been ratified in June, 2008 and the final paper for Episodes is in progress.

Carnian-Norian

After the proposal of two candidate sections Black Bear Ridge (Williston Lake, British Columbia, Canada) and Pizzo Mondello (western Sicily, Italy), the work of the Task Group is now focusing on the selection of the primary and additional marker events. This implies refinement on conodont and halobiid taxonomy and correlations. The research teams studying the two sections work in very close cooperation, making the Task Group a really collaborative and stimulating environment.

This year Zonneveld et al. have submitted to Stratigraphy the description of the stratigraphic and sedimentologic framework of BBR section and have presented a second contribution on the Upper Triassic of Williston Lake to the GSA. The monograph on halobiid and monotid bivalves from Black Bear Ridge and other sections in the Williston Lake area by C. McRoberts is near to the completion. The conodont monograph by M.Orchard is also close to the end.

The progress on Pizzo Mondello section is mostly due to the two PhD thesis of M.Levera and M. Mazza (Milano University) and to M. Rigo (Padova University). Two contributions on conodonts have been presented at the ICOS 2009 (Mazza et al.; Rigo et al.). Moreover a paper on the turnover of conodont genera at the C/N boundary (Mazza et al.) is in press in the special volume of *Paleo3* dedicated to the Proceedings of the Bolzano Triassic Climate symposium. M. Mazza, M. Rigo, A. Nicora and M. Orchard have discussed and compared the conodonts from both the candidate sections during a post ICOS informal meeting at Vancouver (end of July). M. Levera is ending his PhD on the C/N halobiids. This year he discussed his collections with L. Krystyn, P. De Capoa and C. McRoberts and compared his collections with type material in Vienna and C. McRoberts collections from North America. Next year two field trips to BBR (May) and PM (September) sections are planned. The Triassic workshop held in Sicily in September will be a crucial opportunity for the Task Group to try to come to a conclusion.

Norian-Rhaetian

The study of the GSSP candidate Steinbergkogel (Austria) has been finished with a complementary high-resolution palaeomagnetic sampling of the late Norian part for a still more detailed correlation with other Tethyan sections. The distinct and sudden frequency change from *Epigondolella* to *Misikella* conodont dominance identified in 2008 in the Steinbergkogel section, has been investigated and proven for contemporaneity in 20 sections from various Tethyan regions between Austria and Indonesia. This easily detectable event can now be used as the most important proxy for identifying the Norian–Rhaetian boundary in marine sediments of the Tethys Realm. Additional conodont studies further have demonstrated the widespread occurrence of the *Epigondolella mosheri* group in the Tethys. Some morphotypes of this group may allow a cross-correlation of the boundary into the Panthalassa Realm of North America.

6. CHIEF PROBLEMS ENCOUNTERED IN 2009

The slackening of the activities experienced in 2008 unfortunately is still continuing in 2009. The lack of IGCP support with the end of IGCP 467 is only one of the reasons, being the most important the reduction of research funding related to the general economic crisis started with the second half of 2008. In several countries the budget for the research is notably reduced and the allocation of funds delayed. This affects the field work, data analysis and, most dramatically lead to a reduction of research contracts for PhD students and post-doc young scientists. The IGCP 572 still provide some support for investigations on the Early Triassic.

7. SUMMARY OF EXPENDITURES IN 2009 (in US\$)

ICS FUNDING

Subcommission allocation	\$ 2500
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STS EXPENDITURES

Albertiana	\$ 800
Contribution to Officer's travel expenses	\$ 800

Preliminary test of Sicily 2010 field trip*	\$ 900
TOTAL	\$ 2500
*2 day excursion for 3 people (September 14-17, 2009)	

8. WORK PLAN, CRITICAL MILESTONES, ANTICIPATED RESULTS AND COMMUNICATIONS TO BE ACHIEVED NEXT YEAR (2010):

Meeting/field workshop schedule

February 20-26, 2010. IGCP 572, 5th workshop. Recovery of ecosystems after the P-Tr mass extinction: Field workshop in Oman, Gutech of Muscat, Oman. The field workshop aims to investigate the recovery of ecosystems following the end-Permian mass extinction through analyses of the rock and fossil records via studies of biostratigraphy, paleontology, paleoecology, sedimentology, geochemistry and biogeochemistry in Oman, which was situated at the northern margins of the Gondwana during the P/Tr transition. Scientific Committee for the Fieldworkshop: Michaela Bernecker (Gutech, Muscat), Sylvie Crasquin (Paris), Alda Nicora (Milano), Aymon Baud (Lausanne), Charles Henderson (Calgary), Leopold Krystyn (Vienna) and Oliver Weidlich (Kassel).

May, 21-24, 2010. Field trip to Black Bear Ridge, Williston Lake (British Columbia, Canada). The field trip is organized by J.P. Zonneveld (Univ. Alberta, Edmonton) and will allow the visit of one of the two GSSP candidate section.

June, 3-6, 2010. Wuhan, China, IGCP 572, 6th workshop. Meeting and Field Workshop in South China, International Conference of Geobiology, China University of Geosciences, Wuhan. IGCP 572 is one of major sponsors of the ICG2010 and will organize three sessions: Permian/Triassic (P/Tr) mass extinction, Triassic restoration of marine ecosystems and Global distribution of Early Triassic microbialites at the IGC, Wuhan in the summer of 2010. The symposium aims to update the studies on the P/Tr mass extinction and possible causes, investigate the restoration mechanisms and processes of marine ecosystems following the P/Tr mass extinction through studies of biostratigraphy, palaeontology, palaeoecology, sedimentology, geochemistry and biogeochemistry, and elucidate the growing mechanisms and environmental significance of the Early Triassic microbialites. Three potential field excursions are also organized before and after the symposium: 1) Meishan-Chaohu excursion route: examining the P/Tr mass extinction and its aftermath from platform ramp to basin setting; 2) Guizhou excursion route: assessing recovery pattern and processes of palaeo-communities in various facies settings; 3) Southern Tibet excursion route: collapse and re-building of marine ecosystems in Gondwana margins.

June 28 to July 3, 2010. London, UK, IGCP 572, 7th workshop. Permo-Triassic ecosystems session and workshop; 3rd International Palaeontological Congress (IPC 3), London; 2010. IGCP 572 is organizing a thematic session addressing the Permian-Triassic mass extinction and subsequent recovery and a half-day workshop on the microbial ecosystem following the end-Permian mass extinction.

More information on IGCP activities can be found at the following link: <http://www.ipc3.org>, <<http://www.igcp572.org>>.

September, 5-10, 2010. Dolomites (Italy). 7th International Field Workshop on Triassic. Triassic of the Dolomites. This excursion is a great opportunity to visit the best Triassic sections of the Dolomites, that are recently been recognized as World Heritage Site for the superb Triassic successions by the UNESCO. The excursion is organized by G. Bachmann (Halle University) and P. Gianolla (Ferrara University).

September, 12-16, 2010. Palermo. Triassic workshop in western Sicily. The workshop includes 2 days of presentations at the Museo Geologico Gemellaro and 2 days of field excursions in western Sicily and immediately follows the International Field Workshop in the Dolomites. The field excursion program includes the historical Permian of the Sosio Valley, some significant Upper Triassic sections in platform and basinal settings, including the Pizzo Mondello section, candidate for the definition of the GSSP of the Norian Stage. Correspondence: M. Balini, University of Milano and P. Di Stefano, University of Palermo.

GSSP deliberations

The I-O Boundary: A new vote is scheduled for the end of 2010.

The O-A Boundary: Two competing GSSP proposals based on fossils and on magnetozone on the same Desli Caira section (Romania) have been submitted to the Task Group. Concerns on the time significance of the first occurrence of the conodont *Chiosella timorensis* lead to a new sampling of ammonoids at Desli Caira section and re-opened the discussions. In such a situation it is difficult to schedule a vote.

The L-C Boundary: The GSSP has been ratified by IUGS in June, 2008. The final presentation of the GSSP on Episodes is in progress.

The C-N Boundary: The search for the primary and additional marker events in progress and several new data are in press. For this reason the final proposals, expected for the end of 2009, have been delayed to the end of 2010, after the visit of the two candidate sections by the Task Group scheduled for May and September 2010.

The N-R Boundary: The primary marker event and the candidates section was designated in 2008. The final proposal for the Steinbergkogel section, Austria is expected by few months.

9. BUDGET AND ICS COMPONENT FOR 2010 (in US\$)

Albertiana - STS Newsletter production	\$ 800
Support for Black Bear Ridge excursion (May 2010) and Sicily Workshop (September 2010)	\$3500
TOTAL	\$4300

Potential funding sources outside IUGS

Dept. of Geosciences, University of Utrecht provides facilities for the production of *Albertiana* and hosts its web-site.

Dept. of Geosciences, Cortland, New York hosts the STS website.

National research and travel grants provide support to individuals, and host institutions provide in-kind support to the executive and task group chairs.

Because of lack of IGCP financial cover, in 2009 no funding are available for the organization of meetings of the Middle and Upper Triassic Task Groups.

10. REVIEW CHIEF ACCOMPLISHMENTS OVER PAST FIVE YEARS (2003-2008)

Organization

Renewal of STS voting and corresponding membership in 2001. Voting membership was reduced from 31 to 26, and a broader geographical and disciplinary base established. This was the first significant turnover of voting members since the inception of the STS. A summary of all members' research interests was published in *Albertiana* 26. Four new GSSP Task Group chairs were appointed. A second renewal took place in the Fall of 2004 with 11 new voting members amongst 25: this addressed the ICS recommended limit for terms served as well as lapsed members. A second web site was created to supplement that of *Albertiana* and host discussion groups.

Meetings/ workshops

1. Extinction events, faunal turnovers, and natural boundaries within and around the Late Triassic. Vancouver, Canada. May 25th -28th, 2003. Conodont workshop on the Carnian-Norian boundary.
2. Triassic geochronology and cyclostratigraphy a field symposium, September 11th -15th 2003. Focus on Secada core research and Middle Triassic time scales. Conodont workshop on the Olenekian-Anisian boundary.
3. Field workshop in Spiti, India, 26th June-6th July 2004. Conodont workshop on the Ladinian-Carnian boundary.
4. International Geological Congress, Florence, Italy, August 20-28, 2004. G22-06: Triassic in Tethys Realm; DWO-09: Upper Triassic boundaries.
5. Meeting on Triassic Chronostratigraphy and Biotic Recovery. Chaohu, China, May 23-25, 2005. Focus on I-O boundary
6. Symposium on Circum-Panthalassa Triassic Faunas and Sequences, at INTERRAD conference. Te Papa Tongarewa, Museum of New Zealand, in Wellington, Wellington, New Zealand. March 19-24, 2006.
7. Symposium on Triassic Conodonts: Taxonomy and Time Scales, at the First International Conodont Symposium (ICOS1), in Leicester, England, July 17-21, 2006.

8. Conference, The Boreal Triassic. Longyearbyen, Svalbard, Arctic Norway, August 16-20, 2006.
9. International meeting on The Global Triassic. Albuquerque, New Mexico, USA. May (19-)23-25, 2007.
10. Field workshop on the Carnian-Norian boundary, Williston Lake, NE BC, Canada. May 27-31, 2007.
11. Symposium, The Triassic climate, Bolzano/Bozen, Italy, June 3-6, 2008.
12. Symposium and field workshop, Upper Triassic subdivisions, zonations and events, Bad Gaisern, Austria, September 28-October 2, 2008.

Publications

14 issues of *Albertiana* (#24-37) were published in 2000 thru 2008. Each of these issues was made available for download from the web.

Abstract volumes/ field guides prepared for meetings in Romania, Oman, Stuores, Felsoors, Vancouver, St Cristina, Spiti, Chaohu, Wellington, Leicester, Longyearbyen, Albuquerque, Bolzano and Bad Gaisern.

Task groups

Base-Induan

The Permian-Triassic boundary Task group ended the activities in 2001, with the ratification of the GSSP at the first appearance of the conodont *Hindeodus parvus* at the base of bed 27c, within the Yinkeng Formation at Meishan, Changxing County, Zhejiang Province, South China.

Induan-Olenekian

The Induan-Olenekian boundary Task Group, formed in 1997, reviewed the options for a GSSP in the Russian Far East but found them lacking because of strong remagnetization of Triassic rocks and poor recovery of I/O conodont assemblages. A section in Chaohu, Anhui Province, China subsequently became the focus of intensive study. Ammonoid and conodont biostratigraphy, magnetostratigraphy, and chemostratigraphy were undertaken. The FAD of the conodont *Neospathodus waageni* was identified as a potential GSSP datum: it lies 26 cm below the FAD of the flemingitid ammonoids, and is located slightly prior to the top of the second Triassic normal magnetozone, and prior to the peak of the first Triassic positive excursion of $\delta^{13}C$. A preliminary conodont biostratigraphy for Chaohu was summarized in *Albertiana* #29 (2004), and the ammonoids described in *Albertiana* #31. This boundary and proposed GSSP was the focus of a meeting held in China during June 2005, at which time many members of the task group were able to examine the section. Several publications on Chaohu appeared in 2006 (see

Albertiana #33 and 34), including an account of the conodont succession, and papers on the bivalves, ammonoids and palynomorphs.

After 2004 field work carried out in Mud, Spiti, an evaluation of the Mikin Fm. for establishing an Induan-Olenekian boundary GSSP candidate began (see Albertiana #35). The rocks include top *Gyronites*, complete *Flemingites*, and basal *Euflemingites* ammonoid intervals. Three boundary options based in ammonoids were suggested and provisionally tied to the FAD of *Neospathodus waageni* subspp. Initial conodont studies identified useful taxa common to Chaohu. The ammonoid record appears superior to that at Chaohu but the section lacks a magnetostratigraphy. Both the proposal and studies on the conodonts and C-isotopes from Spiti appeared in Albertiana #36, as did an account of the considerable discussion on this boundary that took place during and after the Svalbard meeting.

Two ballots were organized in 2007, based on the FAD of *Neospathodus waageni sensu lato* at Mud and at Chaohu. Mud got the majority of votes at the end of 2007, with proposed GSSP at the base of level MO4-13A3 of Mud section 4. In 2008 further research on Mud samples, aimed at refining the taxonomic variability of *N. waageni*, leads to discover some specimens possibly belonging to morphotypes of the group of *N. waageni* also below the level MO4-13A3. In order to come to a stable conclusion one year of time was given to the research group working on Mud section, with dead line the ICOS 2009 (Calgary, July, 12-17). Two conodont specialists (M. J. Orchard and N. Goudemand) were involved in the study and they both come to the conclusion that *N. waageni sensu lato* first appears about 1 m below the level MO4-13A3. In October 2009 the Task Group is reactivated and the discussion re-opened. The mandate of the Task Group is to organise a round of vote by the end of 2010.

Olenekian-Anisian

A field workshop was held at Desli Caira, in Dobrogea, Romania, in June 2000, to view the Olenekian-Anisian boundary candidate. Major work was undertaken on ammonoid, nautiloid, conodont, and foraminiferid biostratigraphy. Both chemo- and magneto-stratigraphic analyses were largely completed. At the 2003 field workshop in St. Christina, a conodont workshop amongst task group members agreed that the appearance of the conodont *Chiosella timorensis* at the base of bed 7 was a suitable datum for GSSP definition. Further geochemical sampling was undertaken in 2004 to fill a perceived gap in the coverage at the principal section. Further work has been undertaken on correlative sections in South China, Spiti, and South Primorye, Russia. In particular, a section at Guandao in the Nanpanjiang Basin of Guizhou Province, South China produced an excellent dataset, including isotopic dates from about this boundary (~247 Ma).

At Desli Caira, the FAD of the conodont *Chiosella timorensis* corresponds to a significant change in the ammonoid fauna, and a little below a peak of a positive C isotope excursion; it falls within a short reversed polarity interval situated between two short normal intervals that follow the longer reversed interval in the upper Spathian. The Guandao section lacks rich ammonoid faunas but it is relatively expanded and has an excellent conodont succession and numerous dated ash beds that place the O-A boundary at 247.2 Ma. At the Svalbard meeting, E. Grădinaru presented data on the ammonoids and nautiloids of Desli Caira: the boundary is placed between beds with *Deslicairites simionescui* n.g. n.sp., *Procarnites kokeni* and other upper Spathian ammonoids below and the *Paracrochordiceras-Japonites* Beds of basal Anisian age

above. Especially important for correlation with the Boreal Realm is the outstanding occurrence of olenekitids (*Deslicairites*, ?*Svalbardiceras*) in the topmost Olenekian of the Tethys and of ?*Karangatites* at the very base of the Anisian at Desli Caira. *Karangatites* is the zonal marker for the base of the Anisian in Arctic Siberia. The use of the FAD of the conodont *Chiosella timorensis* as a datum for the O-A boundary was challenged due to variation in its taxonomic treatment and evolution in our understanding of the group leading to historical records of the species occurring within Olenekian strata. A study of *Chiosella* based on the collections from both Desli Caira and Guandao was undertaken in order to clarify its taxonomy and demonstrate its utility as a global index. A paper on this topic was published in *Albertiana* #34.

The proposal for the GSSP at Desli Caira on the first occurrence of *C. timorensis* at the base of the level GR7 was published in *Albertiana* #36 (Gradinaru et al.) that included also the report of ammonoid faunas. In the same issue of *Albertiana* a second GSSP proposal was presented by Hounslow et al. They suggested the base of the magnetozone MT1n at Desli Caira section to bypass bio-chronostratigraphic problem. This proposal is supported by an extremely interesting and detailed magnetostratigraphic correlation schemes including South China, Kcira, Desli Caira, Spitzbergen, Spain, UK, Germany and Poland.

In 2009 the discussion in the Task Group stalled on test of the isochrony of the first occurrence of *C. timorensis*. Such a test is necessary to demonstrate the significance of this bioevent as primary marker for the GSSP, but on the other hand it is very difficult because the ammonoid record of the best O-A sections is poor or discontinuous. H. Bucher expressed some concerns on the completeness of the uppermost Olenekian at Desli Caira because some faunas correlative with part of the Haugi Zone of north America have not yet been found. For this reasons this part of the section was sampled again in late summer by Gradinaru together with the latest Anisian, showing rather impoverished ammonoid faunas. The possibilities of gaps at the top of the Olenekian at Desli Caira leads some authors to reconsider other sections as Guandao (China), characterized by good conodont record accompanied by stable isotope variations and paleomag record, or Nevada, where all the late Olenekian to early Anisian ammonoid faunas are present but not in the same section. Unfortunately no good ammonoids have been reported so far from Guandao, while the Nevada successions are usually remagnetized. Another interesting section is Atlasov Cape in South Primorye (Russia). However the ammonoid record of this section is endemic and no data on conodonts are available.

Anisian-Ladinian

During the St. Christina meeting (2003) a formal task group was formed in order to finalize the more than 10 year of research and discussions on the Anisian-Ladinian boundary. Three alternate proposals were published in *Albertiana* #28, and the choice was concluded in a series of votes within STS during 2004. The IUGS ratified the choice on 21st March 2005. The GSSP is thus defined at the top of "Chiesense groove", located about 5 m above the base of the Buchenstein Beds at Bagolino, northern Italy; the lower surface of the overlying thick limestone bed has the lowest occurrence of the ammonoid *Eoprotrachyceras curionii*. Secondary global markers in the uppermost Anisian include the lowest occurrence of conodont *Neogondolella praeungarica* and a brief normal-polarity magnetic zone. The GSSP level is bracketed by U-Pb single zircon age data, indicating that the boundary age is within the range 240-242Ma. A

description of the GSSP was published in Episodes. Since summer 2009 the GSSP site is accessible through a geological pathway with explanatory notes and ammonoid casts provided by the local administration of Bagolino and the Natural History Museum of Brescia.

Ladinian-Carnian

A field workshop in the Italian Dolomites during July 1998 focused on the section at Prati di Stuores, the subject of a formal Ladinian-Carnian boundary GSSP proposal. A dedicated Task Group was established in 2001. Subsequently fieldwork was carried out in two other regions: Spiti and Nevada. Studies in Spiti have included four expeditions, with two in Nevada. Crucial biostratigraphic data concerns the distinction between prospective index ammonoids *Daxatina* and *Trachyceras*, the FAD of the prospective conodont *Metapolygnathiformis polygnathiformis*, and the appearance of the bivalve *Halobia*.

Work in the Dolomites included a very heavy resampling of the Prati di Stuores section which resulted in a single incomplete specimen of *Metapolygnathus polygnathiformis noah* near the bed with the FAD of *Daxatina*. The Padova research group sought new sections in the Eastern Dolomites to better document the interval between the top of *Daxatina* beds and base of *Trachyceras aon*. In Spiti, as in Prati di Stuores, *Daxatina* appears towards the top of the range interval of the genus *Frankites*, and *Trachyceras* overlaps with highest *Daxatina*. However, the FAD of the conodont *M. polygnathiformis* predates the oncoming of *Daxatina* by several meters. Doubtful *Halobia* still appear within the *Frankites* beds but well established occurrences are higher, within the beds with *Trachyceras*. The pros of the Spiti sections are the concurrent record of ammonoids, conodonts and bivalves, which allows the intercalibration of the bioevents. The cons are the remagnetization of the section, the thermally degraded/destroyed palynomorph content, and the accessibility limited to the summer months, due to the altitude.

In the successions in New Pass, Nevada, *Frankites sutherlandi* overlaps the lower part of the range of *Trachyceras* gr. *T. desatoyense*, several meters above the FAD of *T. desatoyense*. *Halobia* appears in the same beds from where *F. sutherlandi* was recovered and possibly is even older. The richest beds in ammonoids of the South Canyon section overlie a sudden facies change, with the drowning of a carbonate platform. South Canyon does not appear to be a possible GSSP candidate mostly because of the facies change and the remagnetization due to the nearby Cenozoic volcanic rocks. The section is, however, of great significance for large-scale correlations of North America with the Tethyan realm

M. Gaetani, the task group chair, distributed a questionnaire in June 2006 concerning the status of the boundary deliberations and the pros and cons of various fossil criteria. An outcome of this was that, in spite of a lack of an ancestor for *Daxatina*, ammonoids were favored for definition of the boundary. M. Balini, the principal worker on the ammonoid faunas of this boundary interval, visited the Smithsonian Museum for comparative studies and then completed his collections in South Canyon, Nevada. He reports a much more detailed view of the lithologic as well as of the faunal succession, with bed-by-bed data from 5 sites: A, B, D, E, F, three of which have yielded conodont fauna.

The Albuquerque Symposium (May 2007) was the most important moment for the discussion of the GSSP options. The third and last possible candidate section, South Canyon (Nevada), was

visited by the Task Group during the pre-congress field trip. Several contributions on British Columbia, Nevada and Prati di Stuares were presented at the symposium and data were published in the New Mexico Museum Bulletin (#40 and #41: Balini et al., Balini & Jenks; Orchard; Orchard & Balini; Mietto et al.). The detailed bed-by-bed study of South Canyon, the most important site to test the correlations of the Tethyan bioevents with North American successions, shows interesting faunal similarity with the Tethyan successions. This locality, that previously was regarded to as representing the basal part of the Carnian in North America actually yields typical Upper Ladinian fossils in the lower part, such as *Frankites sutherlandi*, *Metapolyganthus intermedius* and bivalves of the group of *Daonella elegans*. The stratigraphic position of *Daxatina* is also very similar with respect to the Tethys. The upper part of the range of the overlaps with the lower part of the range of *Trachyceras*.

The significance of the new data and the selection of the marker event for the definition of the GSSP of the Carnian stage was discussed during the Business Meeting of the STS. The FO of *Metapolyganthus polygathiformis*, previously considered as possible marker for the base of the Carnian, was no more supported by the conodont specialists while the FAD of *Daxatina canadensis* achieved the general consensus. A final dossier was published in *Albertiana* #36, and the proposal was voted by 72% of the Task Group members. IUGS ratified the GSSP in June 2008.

Carnian-Norian

The Task Group on the Carnian-Norian boundary was established in 2001. Key sections in Canada, Sicily, Slovakia, Turkey, and Oman have been studied resulting in an integrated bio-, magneto- and chemostratigraphic cross-correlation of key sections in the Tethys. The Pizzo Mondello section in Sicily contributes a magnetostratigraphic profile tied to a preliminary conodont zonation for the C-N boundary interval in Tethys. Alternate views of its correlation with the cyclostratigraphically calibrated Newark non-marine successions, place the base of the Norian at about 214 Ma or 228 Ma. A preliminary new conodont zonation from a potential GSSP at Black Bear Ridge, Western Canada was presented during a formal Workshop on Upper Triassic boundaries at the IGC in Florence in 2004.

Discussions during ICOS1 centered on the suitability of key CNB conodont taxa for intercontinental correlation. It was agreed amongst those present that the FAD of *Epigondolella quadrata*, a higher level than those previously considered, might be a suitable index but this was not widely supported. New work in both Canada and Sicily was planned.

New integrated biostratigraphic investigations at Pizzo Mondello started at the end of 2006 in connections with three PhD thesis of Milano and Padova Universities. Two of them focus on conodonts and halobiids. Preliminary results were presented at the Albuquerque meeting (May 2007) and a more advanced report was printed in *Albertiana* #36 (Nicora et al.). The biostratigraphic record of Pizzo Mondello is more complete than reported in literature. Besides conodonts, new ammonoids, halobiids and radiolaria were documented. Ammonoids document the last two chronozones of the Carnian and the first zone of the Norian. Halobiids also document the Upper Carnian and the Lower Norian. The radiolarian faunas although found in relatively few samples are very rich with more than 45 taxa.

In 2009 some data from the two sections have been submitted for publications. These include stratigraphic and sedimentologic description of Black Bear Ridge section and conodont data from Pizzo Mondello section. At the end of July the conodont specialists working on the two sections (M. Mazza, A. Nicora, M. Orchard and M. Rigo) met in Vancouver and discussed taxonomy and correlations. Nearly at the same time the bivalve specialists C. McRoberts and M. Levera compared faunas and discussed taxonomy in a meeting at SUNY Cortland. In September Pizzo Mondello section was visited by J.P. Zonneveld and Milano team in the framework of preparation of the field excursion for the Triassic Workshop Sicily 2010.

Norian-Rhaetian

A Norian-Rhaetian boundary Task Group was formed in 2001. Sections in western Canada, USA, and Austria were studied and produced important ammonoid, bivalve, and conodont data. Magnetostratigraphic and chemostratigraphic studies were undertaken in Queen Charlotte Islands, Canada. Rock magnetism carried a Cretaceous overprint. A carbon isotopic anomaly was identified at a potential boundary where radiolarians show distinctive faunal change and which is the FAD of the conodont *Epigondolella mosheri*, which approximates the Amoenum Zone in North America. A field workshop in the Gabbs Valley Range of Nevada in March 2005 included sampling of both N/R and T/J boundary strata. Palynology results were disappointing, but the presence of the 'Tethyan' conodont *Misikella* was confirmed - a first for the North American autochthon.

In Austria, a section in the Hallstatt and Zlambach Formation produced good ammonoids, pelagic bivalves, conodonts, rare radiolarians, and palynomorphs, as well as a magnetostratigraphy. A distinctive dinoflagellate change occurs midway through the Zlambach section with the FO of *Rhaetogonyaulax rhaetica*, a datum that may have potential in correlation with shallow marine and/or high latitude basins.

At Steinbergkogel, Austria, a potential GSSP candidate, the FAD of the conodont *Misikella posthernsteini* was proven to be isochronous with the FO of the ammonoid *Cochloceras*. This well-constrained bioevent is closely above the FO of the conodont *Misikella hernsteini* and a magnetic polarity change from a long normal to a well developed reversed interval. The distinctive dinoflagellate change, which occurs with the FO of *Rhaetogonyaulax rhaetica* in the Zlambach section, is stratigraphically higher than the other two options and corresponds to another ammonoid change with the FO of the widely distributed genera *Cycloceltites* and *Vandaites*. A formal presentation of Steinbergkogel as candidate section was done for the Albuquerque Symposium (Krystyn et al., New Mexico Museum Bulletin 41) and updated with magnetostratigraphy in Albertiana #36. Steinbergkogel section was visited during the Bad Goisern meeting in 2008 and impressed the participants for the amount of work done by the group led by L. Krystyn. The thickness of the boundary succession is unfortunately rather thin, and the facies is not constant. However the section is of great interest because the Norian-Rhaetian boundary is commonly very poorly documented all over the world. The last problem to be solved in order to come to the final vote of the Task Group consists in the demonstration of the significance of events recorded at Steinbergkogel by their correlations with other sections. This rather complex task engaged L. Krystyn team for most of 2009. At the present a correlation

chart for sections in the Tethyan Realm is almost ready and some possibilities of direct correlations with North America, based on conotons of the group of *Epigondolella mosheri* is under evaluation.

11. OBJECTIVES AND WORK PLAN BEYOND 2009.

The slowing down of the research activities in 2009, unfortunately forces a revision of the work plan scheduled last year. Realistically the objective of the STS, i.e, the completion of the definition of the GSSP of the Triassic System (I-O, O-A, C-N and N-R) can be achieved by 2012. The schedule is strictly depending on the end of the economic crisis.

Work plan:

2010: vote of the I/O and N/R boundary Task Groups. Possibly also for the O/A and C/N T.G.

2011: further ballots, if necessary

2012: start of work on the substages, but only if the primary goals of the STS are accomplished.

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