



*International Commission on Stratigraphy*

## **SUBCOMMISSION ON CRETACEOUS STRATIGRAPHY**

**ANNUAL REPORT 2014**

### **TITLE OF CONSTITUENT BODY and NAME OF REPORTER**

International Subcommission on Cretaceous Stratigraphy (SCS)

#### *SUBMITTED BY*

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### **OVERALL OBJECTIVES, AND FIT WITHIN IUGS SCIENCE POLICY**

- *To facilitate international communication in all aspects of Cretaceous stratigraphy and correlation*
- *To establish a standard global stratigraphic subdivision and nomenclature for the Cretaceous, as part of the ICS standard global stratigraphic scale;*
- *To produce a stratigraphic table displaying agreed subdivision to substage level and intervals of disagreement, marking boundaries that are defined by a GSSP.*

### **ORGANIZATION**

SCS is a Subcommission of the International Commission on Stratigraphy.

*Membership:* Chair: Prof. Malcolm Hart, UK  
Vice Chairs: Dr James Haggart, Canada  
Dr Brian Huber, USA  
Secretary: Prof. Bruno Granier, France

In addition, there are **18** Voting Members of the Subcommission, from most continents. Over 130 Cretaceous scientists from all over the world and in many different disciplines belong to one or more of the 9 Stage Working Groups of the SCS still active, or to the Kilian Group. All WG members are treated as Corresponding Members of the Subcommission. Effectively, anyone with interest and expertise that can contribute to our objectives is welcome to do so. ***The great bulk of the Subcommission's work is carried out by these Working Groups.***

## Officers for 2013-2016:

Chair:	Prof. Malcolm Hart (Plymouth, UK)
Vice-Chairs:	Dr James Haggart (Canada) Dr Brian Huber (Washington D.C., USA)
Secretary:	Prof. Bruno Granier (Brest, France)

Thanks to Silvia Gardin, former SCS secretary for her work with the website. The SCS website is now relocated at <http://paleopolis.rediris.es/ISCS/>

## INTERFACES WITH OTHER INTERNATIONAL PROJECTS

The Subcommittee has liaised with successive meetings of the *International Cretaceous Symposium*, which until 2004 have been promoted by the German *Subkommission für Kreide-Stratigraphie*. The SCS has since taken over the responsibility for selection of future venues, though the successful applicants will organize individual congresses. The 8<sup>th</sup> *International Symposium on the Cretaceous System* was held in Plymouth during September 2009, and the 9<sup>th</sup> *International Symposium on the Cretaceous System* was held in Ankara (Turkey) during September 2013. This Symposium was held from the 1<sup>st</sup> to 7<sup>th</sup> September 2013 at the Middle East Technical University in Ankara. The local organisation was managed by Ass. Prof. Dr. Ismail Omer Yilmaz, who will also act as an Editor of a special volume of *Cretaceous Research*. The 10<sup>th</sup> *International Symposium on the Cretaceous System* is planned for July or September 2017 and will be held in Austria (Vienna or Salzburg) organised by Prof. M. Wagreich.

The Subcommittee also liaises closely with the Subcommittee on Jurassic Stratigraphy over the definition of the Jurassic/Cretaceous boundary.

The Subcommittee had strong links with IGCP projects: IGCP 507 – “Cretaceous paleoclimatology”, IGCP Project 506 - Marine and Non-marine Jurassic: Global correlation and major geological events (Project Co-Leader W. Wimbledon) and IGCP Project 608 “Asia – Pacific Cretaceous Ecosystems”. The 1<sup>st</sup> Meeting of IGCP 608 was held at the Birbal Sahni Institute of Paleobotany over the Christmas period in December 2012.

IGCP 609 “Climate-environmental deteriorations during greenhouse phases: Causes and Consequences of short-term sea-level change” involves many Cretaceous workers and has had its 1<sup>st</sup> meeting in Ankara (2013) and a 2<sup>nd</sup> meeting in Bucharest (2014) and another planned in Nanjing (2015).

SCS has always been directly or indirectly linked to important international Projects such as IODP, IGCP, CHRONOS (Mesozoic Planktonic Foraminifera Working Group, MPFWG), EARTH TIME EUROPE (ESF-European Science Foundation), and ICDP (International Continental Scientific Drilling Project).

## CHIEF ACCOMPLISHMENTS IN 2013 and 2014

### Highlight

One of the most important highlights for 2014 was the inscription of the Stevns Peninsula (Denmark) on the UNESCO World Heritage List. The Stevns Peninsula was ‘inaugurated’ at a reception on the 22<sup>nd</sup> October 2014, graced by Her Royal Highness Princess Marie of Denmark. The Cretaceous Subcommittee applauds the work of Tove Damholt and Finn Surlyk in achieving this international

recognition for an important Cretaceous succession. Reference to the nomination document is given below.

Damholt, T. & Surlyk, F. 2012. *Nomination of Stevns Klint for inclusion in the World Heritage List*. Østsjælands Museum, St. Heddinge, Denmark

### General Activities

A wealth of data on various aspects of Cretaceous stratigraphy has continued to be published during 2013 and 2014 providing a continuous stream of new data that spans the whole Cretaceous in increasingly higher resolution. This is particularly true in the fields of stable isotopes and the astronomical tuning of sedimentary sequences.

- Battenberg, S.J., Sprovieri, M., Gale, A.S., Hilgen, F.J., Hüsing, S., Laskar, J., Liebrand, D., Lirer, F., Orue-Extrebarria, X., Pelosi, N., and Smit, J., 2012, Cyclostratigraphy and astronomical tuning of the Late Maastrichtian at Zumaia (Basque country, Northern Spain): *Earth and Planetary Science Letters*, v. 359–360, p. 264–278.
- N. Thibault, D. Husson, R. Harlou, S. Gardin, B. Galbrun, E. Huret, F. Minoletti, 2012. Astronomical calibration of upper Campanian–Maastrichtian carbon isotope events and calcareous plankton biostratigraphy in the Indian Ocean (ODP Hole 762C): Implication for the age of the Campanian–Maastrichtian boundary. *Palaeogeography, Palaeoclimatology, Palaeoecology*, **337–338**, 52–71.

Important Cretaceous issues have been considered by the ICDP, within which coring was undertaken in the Cretaceous Songliao Basin (northeastern China) with the aim to recover a nearly complete Cretaceous terrestrial sedimentary record. The first results of this multidisciplinary study are now published.

- Z. Feng, C. Wang, S. Graham, C. Koeberl, H. Dong, Y. Huang, Y. Gao, 2013. Continental Scientific Drilling Project of Cretaceous Songliao Basin: Scientific objectives and drilling technology *Palaeogeography, Palaeoclimatology, Palaeoecology*, **385**, 6-16.
- C.P. Chamberlain, X. Wan, S.A. Graham, A.R. Carroll, A.C. Doebbert, B.B. Sageman, P. Blisniuk, M.L. Kent-Corson, Z. Wang, C. Wang, 2013. Stable isotopic evidence for climate and basin evolution of the Late Cretaceous Songliao basin, China. *Palaeogeography, Palaeoclimatology, Palaeoecology*, **385**, 106-124.
- C.L. Deng, H.Y. He, Y.X. Pan, R.X. Zhu, 2012. Chronology of the terrestrial Upper Cretaceous in the Songliao Basin, northeast Asia. *Palaeogeography, Palaeoclimatology, Palaeoecology*, **385**, 44-54.
- C. Wang, Z. Feng, L. Zhang, Y. Huang, K. Cao, P. Wang, B. Zhao, 2013. Cretaceous paleogeography and paleoclimate and the setting of SKI borehole sites in Songliao Basin, northeast China. *Palaeogeography, Palaeoclimatology, Palaeoecology*, **385**, 17-30.
- H. Wu, S. Zhang, G. Jiang, L. Hinnov, T. Yang, H. Li, X. Wan, C. Wang, 2013. Astrochronology of the Early Turonian–Early Campanian terrestrial succession in the Songliao Basin, northeastern China and its implication for long-period behavior of the Solar System. *Palaeogeography, Palaeoclimatology, Palaeoecology*, **385**, 55-70.

Note: there are a range of other papers in this Special Issue of *Palaeogeography, Palaeoclimatology, Palaeoecology*, Volume 385, pages 1-228 (published in September 2013).

### *Of general interest:*

- Fernando A.G.S., Nishi H., Tanabe K., Moriya K., Iba Y., Kodama K., Murphy M.A., Hokada H., 2011. Calcareous nannofossil biostratigraphic study of forearc basin sediments: Lower to Upper Cretaceous Budden Canyon Formation (Great Valley Group), northern California, USA. *Island Arc*, **20**, 346–370.
- K. B. Foellmi, M. Bole, N. Jammot, P. Froidevaux, A. Godet, S. Bodin, T. Adatte, V. Matera, D. Fleitmann, J. E. Spangenberg, 2012. Bridging the Faraoni and Selli oceanic anoxic events: late Hauterivian to early Aptian dysaerobic to anaerobic phases in the Tethys. *Climate of the Past*, **8**, 171–189.
- O. Friedrich, R.D. Norris, J. Erbacher, 2012. Evolution of middle to Late Cretaceous oceans—A 55 m.y. record of Earth's temperature and carbon cycle. *Geology*, **40/2**, 107-110.

- Y. Huang, G. Yang, C. Wang, H. Wu, 2012. The stabilisation of the long-term Cretaceous greenhouse climate: Contribution from the semi-periodical burial of phosphorus in the ocean. *Cretaceous Research*, **38**, 7-15.
- G.D. Price, I. Főzy, N.M.M. Janssen, J. Pálffy, 2011. Late Valanginian–Barremian (Early Cretaceous) palaeotemperatures inferred from belemnite stable isotope and Mg/Ca ratios from Bersek Quarry (Gerecse Mountains, Transdanubian Range, Hungary). *Palaeogeography, Palaeoclimatology, Palaeoecology*, **305**, 1–9.
- G.D. Price, T. Williamson, R.A. Henderson, M.K. Gagan, 2012. Barremian–Cenomanian palaeotemperatures for Australian seas based on new oxygen-isotope data from belemnite rostra. *Palaeogeography, Palaeoclimatology, Palaeoecology*, **358–360**, 27–39.
- S. Reboulet, F. Giraud, C. Colombié, A. Carpentier, 2013. Integrated stratigraphy of the Lower and Middle Cenomanian in a Tethyan section (Blieux, southeast France) and correlations with Boreal basins. *Cretaceous Research*, **40**, 170-189.
- L. Simone, S. Bravi, G. Carannante, I. Masucci, F. Pomoni-Papaoiannou, 2012. Arid versus wet climatic evidence in the “middle Cretaceous” calcareous successions of the Southern Apennines (Italy). *Cretaceous Research*, **36**, 6-23.

### **The Kilian Group (Lower Cretaceous Ammonite Working Group).**

The Kilian Group met in September 2013 at the 9<sup>th</sup> International Symposium on the Cretaceous System in Ankara (Turkey). The Kilian Group has focussed on the Berriasian, Valanginian and Hauterivian stages, attempting to calibrate different ammonite zonations of the Tethyan, Boreal and Austral realms with the “standard” Mediterranean region zonation.

Reboulet, S. & 18 others, 2014, Report on the 5<sup>th</sup> International Meeting of the IUGS Lower Cretaceous Ammonite Working Group, the Kilian Group (Ankara, Turkey, 31<sup>st</sup> August 2013). *Cretaceous Research*, v. 50, p. 126–137.

### **The Berriasian GSSP and the J/K boundary.**

This is a summary of progress for the Berriasian WG, written by the chair, W.A.P. Wimbledon.

The year has been most productive, with new fieldwork areas investigated and the launching of new projects. Andrea Svobodova joined the team already working on integrated studies of the St Bertrands Spring, Le Chouet, Charens and Beaume sites (Drome). Ammonite studies at Charens (led by Camille Frau) have yielded plentiful faunas from the uppermost Tithonian to basal Berriasian. Thus four overlapping local J/K sections have been collected for ammonites, nannofossils and calpionellids, two of them with magnetostratigraphy (Pruner, Schnabl, Grabowski). A paper has been published on Le Chouet ammonites (Bulot, Frau, Wimbledon), and a second on himalayitid ammonites is in press (Frau, Bulot).

Work of microfossil samples from Fiume Bosso continues (Gardin, Rehakova). The study of magnetostratigraphy, calpionellids and nannofossils at Strapkova (Slovakia) continues (Michalik et al) as well as preliminary results published on the bio- and magnetostratigraphy of the Barlya section (Bulgaria) (Grabowski, Lakova, Schnabl, Sobień, Petrova). A review of calpionellids zonations from the Tithonian to the Valanginian of Tethys has also been published (Lakova, Petrova). First discussed at our Marseille meeting, a complete revision of Rio Argos J/K ammonites, calpionellids and nannofossils has been undertaken (Hoedemaeker, Rehakova, Gardin, Casellato) and a publication is imminent. Work on analysing the 2013 sampling for conchostracans and ostracods from the Purbeck Formation (Cao, Li) of Dorset continues.

On the Russian Platform, Vasily Mitta has published on the lithostratigraphic divisions of the Upper Berriasian (Ryazanian). In the Caucasus, in October, the Uruk River section (central Caucasus) was restudied (Vuks) with other sections on the rivers Bezeps, Shebsh, and Tuapse (Western Caucasus).

Rogov has published three papers in 2014: on an ammonite zonal scheme for Russian boreal Tithonian-Berriasian (Volgian), on the genus *Khetoceras* from the lower Berriasian (Upper Volgian), and on the ammonite site of Koroshevo (Moscow). A paper on palaeoenvironments and palaeoecology at Nordvik (Siberia) has been published (Zakharov, Rogov, Dzyuba, Kostak, Pruner). And another paper on Nordvik, discussing magnetostratigraphy and biostratigraphic constraints, is in press (Schnabl, Pruner, Wimbledon).

Two regions where security questions have slowed progress may be suitable for renewed fieldwork in 2015. The second stage of fieldwork in central Tunisia (Sidi Khalif - Gardin) and Kurdistan (Garagu and Banik sites - Andreini, Stoykova, Rehakova) is being planned. More sampling of rich nannofossil levels at the first is a priority, and amplification of a clear *C. alpina* zonal boundary at Banik needs to be duplicated at Garagu (Chia Gara).

One paper has been published on calpionellids from southern Ukraine (Platonov, Arkad'ev et al.) Another publication on Theodosia, Crimea is almost completed, with new results for nannofossils (Halasova, Casellato) and magnetostratigraphy (Bakhmutov), as well as some amendment of foraminiferan ranges (Ivanova). Study of anomalous calpionellid and ammonite records continues (Reháková, Wimbledon). An english-language version of the magnetostratigraphy of the Boissieri Zone of the Zavodskaya Balka near Theodosia has been published (Guzhikov, Arkad'ev).

Li Gang has been studying Morrison formation conchostracans, as well as continuing with work on the Jehol Biota, northern China. In Mexico, a precise modern analysis of calpionellid and calc. dinoflagellates biostratigraphy results has been published (Apulco and Iturbite sites) and another is in press (Tamazunchale) (López-Martínez, Barragán, Rehakova). More fieldwork in the Mazatapec area is due in 2014. Prospects for palaeomagnetism are to be assessed. Work commenced in May on new sampling the Great Valley Sequence of California (Hull Road, Elder Creek, Grindstone, Thomes and Wilson creeks), with collecting for *Buchia*, belemnites (Dzyuba) nannofossils (Erba, Casellato) and palynology (Galloway, Riding, Harding, Lucas-Clark) -fieldwork was enlivened by some rifle fire at Grindstone Creek). A review of ammonite evidence, particularly, in the New World (Andes, Mexico, California) relative to other biostratigraphy and radiometric dating is in preparation for publication by Alberto Riccardi.

Work continues on Berriasian palaeogeography, and Terry Poulton should be thanked for his stirring efforts on north American seaways.

Up-coming meetings include Southern France (April 2015) and at Samara on the River Volga (September 2015).

Y-Q. Liu, Q. Ji, X-J. Jiang, H-W. Kuang, S. Ji, L-F. Gao, Z-G. Zhang, N. Peng, C-Xi Yuan, Xu-Ri Wang, H. Xu, 2013. UePb Zircon Ages of Early Cretaceous Volcanic Rocks in the Tethyan Himalaya at Yangzuoyong Co Lake, Nagarze, Southern Tibet, and Implications for the Jurassic/Cretaceous Boundary. *Cretaceous Research*, 40, 90-101.

### **Base Valanginian GSSP.**

In the absence of magnetic signals in the Montbrun-les-Bains section, so far the primary candidate for the Valanginian GSSP, and in general in all the southern France successions, scientists from Spain suggest that the alternate sections near Caravaca (SE Spain) should be reconsidered by the WG. The detail synthesis of the biostratigraphic and magnetic events provided by Aguado et al. (2000) shows that the Spanish sections, especially the Caneda Luega, are the only ones in the world

where a direct correlation could be made between magnetic chrons and ammonite-nannos-calcipionellid zones at this level. Meanwhile, Stephane Reboulet and colleagues are currently gathering new data at Montbrun-les-Bains (S. France) and, in addition, and undertaken the study with a multidisciplinary approach of the Vergol section, which has the advantage of including also the base of the Upper Valanginian.

Barbarin, N., Bonin, A., Mattioli, E., Pucéat, E., Cappetta, H., Gréselle, B., Pittet, B., Vennin, E. & Joachimski, M. 2012. Evidence for a complex Valanginian nannoconid decline in the Vocontian basin (South East France). *Marine Micropaleontology*, **84-85**, 37–53.

### **Base Hauterivian GSSP.**

Since October 2010 when Luc Bulot (chair of the WG) and I. Premoli Silva (SCS chair) started to assembling the data available so far on La Charce section (Drome, France), the major candidate for the Hauterivian GSSP, the draft of the proposal did not make any progress due to new problems, such as the need of new sampling for up-dating the nannofossil and planktonic foraminiferal distributions across the Valanginian/Hauterivian boundary. Moreover, the chair Luc Bulot was deeply involved on collecting and studying Berriasian ammonites from Le Chouet. Hopefully the Hauterivian GSSP proposal will be completed in 2013.

There will be an ‘event’ on the 5<sup>th</sup> December 2014) at Serre de l'Ane near La Charce in the Department of Drôme (France). This is at the site of the proposed GSSP for the Valanginian-Hauterivian boundary, and accepted by the Hauterivian Working Group. Luc Bulot and Stephane Reboulet have indicated that the formal proposal will be submitted to the ICS in early 2015. Once this is done there should soon be an agreement on the proposal and the GSSP can proceed to official ratification.

J. Mutterlose, M. Malkoc, S. Schouten, J.S. Sinninghe Damsté, 2012. Reconstruction of vertical temperature gradients in past oceans — Proxy data from the Hauterivian–early Barremian (Early Cretaceous) of the Boreal Realm. *Palaeogeography, Palaeoclimatology, Palaeoecology*, **363–364**, 135–143

### **Base Barremian GSSP.**

This report, prepared by Peter Rawson (Chairman of the WG) and Miguel Company (Vice-Chair), is a summary of the formal proposal of the Río Argos section as GSSP of the Barremian stage, which will be submitted shortly to the Sub-commission for approval.

#### 1. Geographical and geological setting:

The candidate section is located on the right bank of the River Argos, some 8 km west of Caravaca (SE Spain). From a geological point of view it belongs to the Subbetic Domain, which corresponds to the pelagic domain of the southern passive margin of the Iberian plate during the Alpine cycle (Triassic-Miocene). The analyzed interval of the section (beds 144 to 193) is 40 m thick and encompasses the uppermost Hauterivian (*Pseudothurmannia ohmi* Zone, with the *Ps. ohmi*, *Ps. mortilleti* and *Ps. picteti* Subzones) and the lowermost Barremian (*Taveraidiscus hugii* Zone, with the *T. hugii* and *Psilotissotia colombiana* Subzones). The lithological succession consists of a monotonous alternation of marls and marly limestones, belonging to the Miravetes Formation, only broken by the occurrence of a thin laminated black shale interval near the base of the section (bed 148), which represents the local equivalent of the Faraoni Level, a well-known organic-rich horizon

that has been recognized within the uppermost Hauterivian sediments in several basins of the western Mediterranean Tethys.

Textural (mudstones mainly composed of calcareous nannofossil remains), macropalaeontological (assemblages largely dominated by ammonites), taphonomic (absence of reworking evidence) and paleoichnological (intense bioturbation dominated by *Zoophycos*, *Chondrites* and *Planolites*) features indicate that the Río Argos succession was deposited in a stable, distal, low-energy, deep-water sedimentary environment. Sedimentation seems to have been continuous throughout the studied interval, since no evidence of interruption or condensation has been detected.

## 2. Fossil Record

**2.1. Ammonites** - The Río Argos section has provided a rich and diverse ammonite fauna, which has been the subject of several studies. We have collected more than one thousand specimens from the studied interval. All of them belong to Mediterranean taxa.

The primary marker event of the base of the Barremian stage (first occurrence of *Taveraidiscus hugii*) has been recorded in bed 171 (23 m above the base of the studied interval). Other significant bioevents that take place in this interval are the first occurrences of *Pseudothurmannia ohmi* (bed 144), *Pseudothurmannia mortilleti* and *Pseudothurmannia sarasini* (148), *Discoideilia favrei* (149), *Ps. picteti* (156), *Barremites* spp. (160), *Taveraidiscus intermedius* (170), *Psilotissotia chalmasi* (174), *Psilotissotia colombiana* (183), and *Kotetishvilia nicklesi* (193).

**2.2. Foraminifera** - Although foraminifera are present in all the samples studied, their abundance and degree of preservation varies throughout the section. The diversity of planktonic foraminifers is, in general, relatively low, whereas the benthic ones are more abundant and diverse.

Only few events have been recorded in the Río Argos section. Concerning the planktonic foraminifers, *Hedbergella roblesae* and *Hedbergella semielongata* appear in bed 138, and *Hedbergella similis* in bed 195. Among the benthic foraminifers, the first occurrences of *Dorothia praeoxycona*, *Gavelinella barremiana* and *Conorotalites aptiensis* have been recorded, respectively, in beds 130, 175 and 195.

**2.3. Calcareous nannofossils** - The calcareous nannofossils assemblages are mostly composed of cosmopolitan and Tethyan taxa, the dominant genera being *Watznaueria*, *Nannoconus* and *Micrantholitus*. All the interval studied corresponds to the Zone NC5. The most significant events recognized in the section are: the last occurrence of *Lithraphidites bollii* (which marks the base of Subzone NC5C, in bed 148), the first occurrence of typical forms of *Nannoconus circularis* (154) and the first occurrence of *Micrantholitus* sp 1 (194). The last occurrence of *Calcicalathina oblongata*, which defines the base of Subzone NC5D, takes place somewhat above the interval studied, within the *Kotetishvilia nicklesi* Zone.

## 3. Stable isotopes and organic matter

The  $\delta^{13}\text{C}$  values vary between 0 and 1.75‰ throughout the section, reaching their maximum in a small positive excursion, preceded by a negative peak, at the base of the *Ps. mortilleti* Zone, coinciding with the aforementioned Faraoni Level. The values remain more or less stable, around 1‰, in the *Ps. picteti* Subzone and show a negative trend throughout the *T. hugii* Zone.

The total organic matter content is, in general, very low (0.13% on average). However, the dark laminated sediments of the Faraoni Level show significantly higher values, reaching 3.8%.

#### 4. Cyclostratigraphy

A high-resolution cyclostratigraphic analysis from magnetic susceptibility signal has been performed in the Río Argos section. Its results allow us to assign a duration of 0.78 myr to the *Ps. ohmi* Zone and 0.57 myr to the *T. hugii* Zone. The duration of the Faraoni event is estimated as 100-150 kyr, and the base of the Barremian stage would be located 0.7 myr after the onset of this event. Similar results were obtained from the cyclostratigraphic analysis of clay mineralogy.

#### 5. Magnetostratigraphy

The Cretaceous sediments of the Ríos Argos area are affected by a Neogene remagnetization that prevents any magnetostratigraphic analysis. Nevertheless, correlation by ammonite and isotope stratigraphy with the Gorgo a Cerbara section (central Italy) allows us to correlate the Hauterivian/Barremian boundary with the upper part of chron CM5n.

#### 6. Protection

The Cretaceous outcrops of the Río Argos area are catalogued as a Site of Geological Interest in the General Urban Development Plan of the municipality of Caravaca. We expect the next declaration of the Río Argos section as Palaeontological Zone, with the category of Heritage of Cultural Interest, according to the Law of Cultural Heritage of the Region of Murcia.

#### **Publications relevant to the Hauterivian/Barremian boundary:**

- Archuby, F.M., Wilmsen, M., Leanza, H.A., 2011. Integrated stratigraphy of the Upper Hauterivian to Lower Barremian Agua de la Mula Member of the Agrio Formation, Neuquen Basin, Argentina. *Acta Geologica Polonica*, **61**, 1-26.
- Company, M., Aguado, R., Baudin, F., Coccioni, R., Deconinck, J.F., Frontalini, F., Giusberti, L., Martinez, M., Moiroud, M., O'Dogherty, L., Pellenard, P., Rawson, P.F., Romero, G., Sandoval, J., Tavera, J.M., Weissert, H., 2011. La sección de río Argos (Caravaca, Murcia), candidata a GSSP del límite Hauteriviense-Barremiense (Cretácico inferior). XXVII Jornadas de la Sociedad Española de Paleontología (Sabadell, 2011). *Paleontologia i Evolució, memòria especial*, **5**, 75-78.
- Fernando, A.G.S., Nishi, H., Tanabe, K., Moriya, K., Iba, Y., Kodama, K., Murphy, M.A., Okada, H., 2011. Calcareous nannofossil biostratigraphic study of forearc basin sediments: Lower to Upper Cretaceous Budden Canyon Formation (Great Valley Group), northern California, USA. *Island Arc*, **20**, 346-370.
- Föllmi, K.B., Bôle, M., Jammet, N., Froidevaux, P., Godet, A., Bodin, S., Adatte, T., Matera, V., Fleitmann, D., Spangenberg, J.E., 2012. Bridging the Faraoni and Selli oceanic anoxic events: late Hauterivian to early Aptian dysaerobic to anaerobic phases in the Tethys. *Climate of the Past*, **8**, 171-189.
- Lukeneder, A., 2012. New biostratigraphic data on an Upper Hauterivian-Upper Barremian ammonite assemblage from the Dolomites (Southern Alps, Italy). *Cretaceous Research*, **35**, 1-21.
- Martinez, M., Pellenard, P., Deconinck, J.F., Monna, F., Riquier, L., Boulila, S., Moiroud, M., Company, M., 2012. An orbital floating time scale of the Hauterivian/Barremian GSSP from a magnetic susceptibility signal (Rio Argos, Spain). *Cretaceous Research*, **36**, 106-115.
- Price, G.D., Fözy, I., Janssen, N.M.M., Pálfy, J., 2011. Late Valanginian-Barremian (Early Cretaceous) palaeotemperatures inferred from belemnite stable isotope and Mg/Ca ratios from Bersek Quarry (Gerecse Mountains, Transdanubian Range, Hungary). *Palaeogeography Palaeoclimatology Palaeoecology*, **305**, 1-9.

#### **Base Aptian GSSP.**

A wealth of data have been collected and published on the Aptian stage in the last years by our French colleagues on the stratotype sections of the Bedoulian and Gargasian substages including revised biostratigraphies,  $\delta^{13}\text{C}$  curve and cyclostratigraphy. Although magnetic signature in the French stratotype sections cannot be detected, carbon isotope data allowed a precise correlation between the base of magnetic chron M0, recommended at the 1995 Brussels Meeting for identifying



the base of the Aptian, and the Aptian basal ammonite *Deshayesites oglanlensis* Zone. The formal proposal of the Aptian GSSP at Gorgo a Cerbara (central Italy) is still pending.

- A. Cherchi, R. Schroeder, 2013. The Praeorbitolina/Palorbitolinoides Association: an Aptian biostratigraphic key-interval at the southern margin of the Neo-Tethys. *Cretaceous Research*, **39**, 70-77.
- M. Ivanov, V. Idakieva, 2013. Lower Aptian ammonite biostratigraphy and potential for further studies of OAE 1a in Bulgaria. *Cretaceous Research*, **39**, 47-69.
- M.V. Kakabadze, I.M. Kakabadze, 2012. Biostratigraphy and interrelationship of the Lower and Middle Aptian (Cretaceous) sedimentary sequences in Georgia and adjacent regions of the Caucasus. *Revue de Paléobiologie, Vol. spéc.*, **11**, 103-111.
- J-P. Masse, M. Fenerci-Masse, 2013. Stratigraphic updating and correlation of Late Barremian-Early Aptian Urgonian successions and their marly cover, in their type region (Orgon-Apt, SE France). *Cretaceous Research*, **39**, 17-28.
- J.A. Moreno-Bedmar, M. Company, J. Sandoval, J.M. Tavera, T. Bover-Arnal, R. Salas, G. Delanoy, F.J.-M.R. Maurasse, R. Martinez, 2012. Lower Aptian ammonite and carbon isotope stratigraphy in the eastern Prebetic Domain (Betic Cordillera, southeastern Spain). *Geologica Acta*, 10/4, 1-12 DOI:10.1344/105.000001752
- Moullade M., Tronchetti G., Balme C., Mauroux P., 2012. A new upper Bedoulian section in the Aptian stratotypic area: Croagnes (5 km NW of Gargas, Vaucluse, SE France). *Carnets de Géologie* [Notebooks on Geology], Brest, Letter 2012/03 (CG2012\_L03), p. 193-199.
- M.L. Quijano, J-M. Castro, R.D. Pancost, G.A. de Gea, M. Najarro, R. Aguado, I. Rosales, J. Martín-Chivelet, 2012. Organic geochemistry, stable isotopes, and facies analysis of the Early Aptian OAE—New records from Spain (Western Tethys). *Palaeogeography, Palaeoclimatology, Palaeoecology*, **365–366**, 276–293.
- B. Granier, R. Busnardo, 2013. New stratigraphic data on the Aptian of the Persian Gulf. *Cretaceous Research*, **39**, 170-182.
- J. Moreno, R. Barragan, M. Company, L.G. Bulot, 2013. Aptian (lower Cretaceous) ammonite biostratigraphy of the Francisco Zarco Dam stratigraphic section (Durango State, north-east Mexico). *Journal of South American Earth Sciences*, **42**, 150-158.

### **Base Albian GSSP.**

As indicated in previous reports, the formal proposal for the base Albian at Tartonne (SE France), prepared by J. Kennedy, never reached the quorum. Voting Members against the proposal commented on the change of lithofacies at the critical level (from marl to organic-rich laminated black shale), the regional/provincial distribution of the index-species *Leymeriella (L.) tardefurcata*, and the low stratigraphic value of ancillary markers (few, poorly diagnostic planktonic foraminifera; *Predicosphaera* taxonomic problems, etc.), made the Tartonne section unsuitable as the base Albian GSSP. In addition, the sampling across the Aptian/Albian boundary was considered at too low resolution and inadequate for such a critical interval. The proposed event (FO of *L. tardefurcata*) is poorly applicable to other sections, especially outside SE France.

In Spring 2010 members of the new Working Group, set up at Plymouth in 2009 (Paul Bown, coordinator), re-sampled – at high resolution – the Col de Pré-Guittard section, Kennedy’s ancillary section near Tartonne. A multidisciplinary study of the new sample set was carried out during 2011 (work is still in progress) by members of the WG. One of the most important results concerns the planktonic foraminifera which display a major turnover across the Niveau Kilian, in parallel with a 1‰  $\delta^{13}\text{C}$  excursion. Petrizzo *et al.* (2012) reported that (1) the latest Aptian assemblage, dominated by few long-ranging *Hedbergella* and large-sized *Paraticinella* completely disappear near the base of the Niveau Kilian organic-rich level, (2) planktonic foraminiferal assemblages from across the Niveau Kilian to the top of the studied section are composed of minute, but very distinctive smooth-surfaced species of *Microhedbergella miniglobularis* and *Mi. renilaevis*, (3) the appearance of *Mi. renilaevis* in the middle part of the Niveau Kilian represents a major step in the evolution and diversification of the Albian planktonic fauna. The same sequence of events was reported from several deep-sea sites in the Atlantic and Indian Oceans (Huber & Leckie, 2011). Therefore, documentation of the planktonic foraminiferal turnover, combined with the carbon-isotope

stratigraphy in the Col de Pré-Guittard section, provide new criteria, replacing the FO of the unsuitable *L. tardefurcata*, for defining the GSSP for base Albian in a stratigraphically complete succession. A multi-disciplinary paper dealing with the new criteria for identifying the base Albian is now published and being voted on by the working group before being presented to the SCS.

Huber B.T., Leckie R. M. 2011. Planktic foraminiferal species turnover across deep-sea Aptian/Albian boundary sections. *Journal of Foraminiferal Research*, **41**, 53–95

Petrizzo M.R., Huber B.T., Gale A.S., Barchetta A., Jenkyns H.C. 2012. Abrupt planktic foraminiferal turnover across the Niveau Kilian at Col de Pré-Guittard (Vocontian Basin, southeast France): new criteria for defining the Aptian/Albian boundary. *Newsletter on Stratigraphy*, **45/1**, 55-74.

C. Peybernes, F. Giraud, E. Jaillard, E. Robert, M. Masrour, M. Aoutem, N. Içame, 2013. Stratigraphic framework and calcareous nannofossil productivity of the Essaouira-Agadir Basin (Morocco) during the Aptian-Early Albian: Comparison with the north-Tethyan margin. *Cretaceous Research*, **39**, 149-169.

Kennedy, W.J., Gale, A.S., Huber, B.T., Petrizzo, M.R., Bown, P., Barchetta, A. & Jenkyns, H.C. 2014. **Integrated stratigraphy across the Aptian/Albian boundary at Col de Pré-Guittard (Southeast France): A candidate Global Boundary Stratotype Section.** *Cretaceous Research*, **51**, 248-259.

### **Base Coniacian GSSP.**

The main paper describing the criteria for identifying the base Coniacian and the proposal of a candidate composite GSSP section was published in *Acta Geologica Polonica* at the end of 2010. Besides multiple up-dated biostratigraphies, the paper also includes the isotope curves for both the Salzgitter-Salder (northern Germany) and Slupia Nadbrze~na (central Poland) sections. It is confirmed that the inoceramid-based lower Coniacian boundary (= first appearance of *C. deformis erectus*), slightly post-dates the traditional ammonite (FAD of *Forresteria petrocoriensis*) position of the boundary.

In September 2011 the chair of the WG, Irek Walaszczyk, circulated the published proposal to the Working Group members asking for comments and eventual approval. All comments received indicated support for a composite GSSP, although the Working Group has been advised that a single GSSP (with a subsidiary location providing additional information) is the preferred option. Although this is not an ideal choice, there is no single, perfect, section which satisfies the GSSP for the base of the Coniacian. The formal proposal to be submitted to the Voting Members of the Subcommittee is in advanced preparation by the WG chair.

In 2013-2014 there were works done on the Turonian/Coniacian sections in the US and Canadian Western Interior, northern Mexico, and in Mangyshlak Mountains, Kazakhstan. It seems that neither of the US and Canadian western interior sections is promising. The sections are either quite condensed or the boundary succession is with gaps (Walaszczyk et al. 2014). A potential has the Rosario section in MEXico studied and described by Ifrim et al. (2014); the sections still needs further works, and moreover, there are some safety issues in this part of the country; in January, together with Roger and Dee Ann Coopers, Houston, I am going to Big Bed National Park in SW Texas, which is a part of the same basin to check the succession there. The Big Bend area is in a National Park and if the succession appears complete and with good potential for the basal Coniacian stratotype, it could easily be accessible and studied.

In 2013, together with Russian colleagues, I finished also the study of selected sections from NW part of the Mangyshlak Mountains, in Kazakhstan, including the Shakh-Bogota section, which was once proposed as a candidate stratotype section for the base of the Coniacian stage (Walaszczyk et al. 2013). Although the succession seems to be complete right at the boundary, the rest of the succession, particularly the Turonian part is quite condensed.

Walaszczyk, I., Wood, C.J., Lees, J.A., Peryt, D., Voigt, S. & Wiese, F., 2010. Salzgitter-Salder Quarry (Lower Saxony, Germany) – Slupia Nadbrzema river cliff section (central Poland): a proposed candidate composite Global Boundary Stratotype Section and Point for the Coniacian Stage (Upper Cretaceous). *Acta Geologica Polonica*, **60/3**, 445-477.

Ifrim, C., Wiese, F. & Stinnesbeck, W., 2014. Inoceramids and biozonation across the Turonian - Coniacian boundary (Upper Cretaceous) at El Rosario, Coahuila, northeastern Mexico. *Newsletters on Stratigraphy*, **47** (2), 211–246.

Walaszczyk, I., Shank, J.A., Plint, A.G., & Cobban, W.A., 2014. Interregional correlation of disconformities in Upper Cretaceous strata, Western Interior Seaway: Biostratigraphic and sequence-stratigraphic evidence for eustatic change. *Geological Society of America Bulletin*, in press.

Walaszczyk, I., Kopaevich, L.F. & Beniamovski, V.N., 2013. Inoceramid and foraminiferal record and biozonation of the Turonian and Coniacian (Upper Cretaceous) of the Mangyshlak Mts., western Kazakhstan. *Acta Geologica Polonica*, **63** (4), 469–487.

### **Base Santonian GSSP.**

This is now approved and a proposal to hold an inaugural event at the site is awaited. The article in *Episodes* was published in 2014.

Lamolda, M.A., Paul, C.R.C., Peryt, D. & Pons, J.M. 2014. The Global Boundary Stratotype Section and Point (GSSP) for the base of the Santonian Stage, “Cantera de Margas”, Olazagutia, northern Spain. *Episodes*, v. **37/1**, p. 2–13.

### **Base Campanian GSSP.**

Members of the WG have been searching for a new section across the Santonian/Campanian boundary to be proposed as base Campanian GSSP. So far, the only section not affected by hiatus and/or major dissolution is the Bottaccione section (Gubbio, central Italy), in which the calcareous plankton bioevents are calibrated to magnetostratigraphy. The distribution of planktonic Foraminifera across the Santonian-Campanian interval at Bottaccione was recently revised and up-dated (Petritto *et al.*, 2011). Moreover, as the available carbon isotope stratigraphy was considered at too low a resolution for reliable supra-regional correlation, a new set of carbon isotope analyses across the critical interval has been undertaken by Silke Voigt on the original samples (Premoli Silva & Sliter 1995), calibrated to paleomagnetic scale, and on new samples collected at higher resolution along the same road section and on the opposite side of the valley by Gale and Voigt. A paper with the new carbon isotope curves correlated to that from Lägerdorf (Northern Germany) is ready to be submitted for publication. The main bias of the Bottaccione section is that planktonic foraminifera across the critical interval could not be properly disaggregated from the hard limestones, using cold acetolysis method, and are poorly preserved.

M.R. Petritto, F. Falzoni & I. Premoli Silva, 2011. Identification of the base of the lower-to-middle Campanian *Globotruncana ventricosa* Zone: Comments on reliability and global correlations. *Cretaceous Research*, **32**, 387-405.

S. Bey, J. Kussa, I. Premoli Silva, M.H. Negrab, S. Gardin, 2012. Fault-controlled stratigraphy of the Late Cretaceous Abiod Formation at Ain Medheker (Northeast Tunisia). *Cretaceous Research*, **34**, 10-25.

### **Base Maastrichtian GSSP.**

To overcome the problem of correlation between the ratified GSSP and coeval sections, stable isotopes were measured in high resolution from Tercis-les-Bains GSSP (Thibault *et al.*, 2012). In this

paper the Tercis  $\delta^{13}\text{C}$  isotope curve was successfully correlated to the isotope curves from two Danish Basin cores (DK) that could represent the standard carbon isotope curve for the Boreal Realm, being calibrated to the nannofossil and dyncocyst biostratigraphies. Moreover, Gardin *et al.* (2012) revised the biostratigraphy of the Bottaccione section, already calibrated to magnetostratigraphy, and gathered new calcareous plankton biostratigraphic and magnetostratigraphic data of the upper Campanian-Maastrichtian interval from the nearby Contessa section (Gubbio, central Italy). In addition, both the Contessa and Bottaccione sections have been analysed for stable isotopes by Voigt (2012) who reconstructed carbon isotope curves for both sections and correlated them to her new isotope curve from the Tercis GSSP.

- S. Gardin, B. Galbrun, N. Thibault, R. Coccioni, I. Premoli Silva, 2012. Bio-magnetostratigraphy for the upper Campanian – Maastrichtian from the Gubbio area, Italy: new results from the Contessa Highway and Bottaccione sections. *Newsletters on Stratigraphy*, **45/1**, 75–103.
- M. Machalski, 2012. Stratigraphically important ammonites from the Campanian–Maastrichtian boundary interval of the Middle Vistula River section, central Poland. *Acta Geologica Polonica*, **62/1**, 91–116.
- F. Surlyk, S.L. Rasmussen, M. Boussha, P. Schiøler, N.H. Schovsbo, E. Sheldon, L. Stemmerick, N. Thibault, 2013. *Cretaceous Research*, **46**, 232–256.
- N. Thibault, R. Harlou, N. Schovsbo, P. Schiøler, F. Minoletti, B. Galbrun, B.W. Lauridsen, E. Sheldon, L. Stemmerick, F. Surlyk, 2012. Upper Campanian-Maastrichtian nannofossil biostratigraphy and high-resolution carbon-isotope stratigraphy of the Danish Basin: Towards a standard  $\delta^{13}\text{C}$  curve for the Boreal Realm. *Cretaceous Research*, **33**, 72–90.
- N. Thibault, D. Husson, R. Harlou, S. Gardin, B. Galbrun, E. Huret, F. Minoletti, 2012. Astronomical calibration of upper Campanian–Maastrichtian carbon isotope events and calcareous plankton biostratigraphy in the Indian Ocean (ODP Hole 762C): Implication for the age of the Campanian–Maastrichtian boundary. *Palaeogeography, Palaeoclimatology, Palaeoecology*, **337–338**, 52–71.
- S. Voigt, Gale A., Jung C., Jenkyns H., 2012. Global correlation of Upper Campanian - Maastrichtian successions using carbon isotope stratigraphy: development of a new Maastrichtian timescale. *Newsletters on Stratigraphy*, **45/1**, 25–53.
- P.D. Ward, J.W. Haggart, R. Mitchell, J.L. Kirschvink, T. Tobin, 2012. Integration of macrofossil biostratigraphy and magnetostratigraphy for the Pacific Coast Upper Cretaceous (Campanian–Maastrichtian) of North America and implications for correlation with the Western Interior and Tethys. *GSA Bulletin*, **124** (5/6), 957–974.

## CHIEF PROBLEMS ENCOUNTERED IN 2014

The need, today, for a high-resolution stratigraphical framework that is applicable worldwide has resulted in the necessity of re-visiting several candidate sections, already studied paleontologically, by implementing multiple biostratigraphies and stratigraphic tools other than fossils (many of which are profoundly affected by provincialism in several intervals), such as like magnetostratigraphy, stable isotope stratigraphy, etc. In several cases, especially in the Late Cretaceous, the integration of multiple biostratigraphical data, together with physical stratigraphies, has shown that the candidate sections were unsuitable as a potential GSSP. Consequently, new sections have had to be considered and studied from scratch. This has resulted in a delay in submitting some GSSP proposals, also taking into account that scientists from different sub-disciplines do not necessarily work at the same speed.

Another problem is the lack of fundings in most countries for carrying out studies that are strictly stratigraphical in nature as these are often deemed of low priority when compared to other more ‘sexy’ proposals. Funds for just attending workshops and/or conferences are also becoming more limited.

## SUMMARY OF EXPENDITURES IN 2014:

### I. INCOME

ICS subvention for 2014	£ 9000.00
Other income	£ 0.00
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<b>Total income</b>	<b>£ 9000.00</b>

### II. EXPENDITURE

Attendance at GFC 2014 in Paris (costs awaited)	[£000.00]
Berriasian (J/K) autumn meeting in 2014 was cancelled and funding not required	
As there was no discussion of Cretaceous stage boundaries amongst ammonite workers at the Cephalopod meeting In Zurich, MBH did not make a claim for travel	
	-----
<b>Total expenditure (to date)</b>	<b>£ 0000.00</b>

## WORK PLAN, CRITICAL MILESTONES, ANTICIPATED RESULTS AND COMMUNICATIONS TO BE ACHIEVED IN 2015 and 2016:

During 2015 it is hoped that the *Albian GSSP* will be approved by the Working Group and be put before the ISCS – and hopefully approved. It is also expected that proposals for the *Hauterivian GSSP* and the *Coniacian GSSP* will be submitted to ISCS. The *Barremian GSSP* should also be progressed during 2015.

### Meetings

- The 10<sup>th</sup> meeting of the Berriasian and J/K boundary WG was held in Perugia (Italy), May 2013.
- The 1<sup>st</sup> International Congress on Stratigraphy (STRATI) was held in Lisbon from the 1<sup>st</sup> to 7<sup>th</sup> July 2013.
- The official meeting of the Cretaceous Subcommittee was held at the 9<sup>th</sup> International Symposium on the Cretaceous System in Ankara, Turkey, 1<sup>st</sup> to 7<sup>th</sup> September 2013.
- The 5<sup>th</sup> Workshp of the Kilian Group was held during the 9<sup>th</sup> International Symposium on the Cretaceous System, Ankara, September 2013.
- The 1<sup>st</sup> meeting of IGCP 609 was held during the 9<sup>th</sup> International Symposium on the Cretaceous System, Ankara, September 2013.
- The 11<sup>th</sup> meeting of the Berriasian and J/K boundary WG was held in Warsaw, October 2013.
- As a part of the Annual Meeting of the Geological Society of America (October 25<sup>th</sup>), a ceremony was held at Pueblo, Colorado, marking the inauguration of the GSSP ‘spike’ for the base of the Turonian Stage.
- A number of sessions on Cretaceous stratigraphy and the K/Pg boundary are being

arranged as part of the Annual Meeting of the European Geosciences Union in Vienna, Austria (27<sup>th</sup> April to 2<sup>nd</sup> May 2014).

- The 2<sup>nd</sup> meeting of IGCP 609 was held in Bucharest, Romania, jointly with the Earthtime – EU Sequence Stratigraphy Workshop, August 2014.
- The 2<sup>nd</sup> Meeting of IGCP 608, 4<sup>th</sup> – 11<sup>th</sup> September, 2014, Waseda University, Tokyo, Japan.
- The 2<sup>nd</sup> International Congress on Stratigraphy (STRATI) which is to be held in Graz, Austria, during July 2015.
- The 3<sup>rd</sup> meeting of IGCP 609 will be held in Nanjing, China, 5<sup>th</sup> – 11<sup>th</sup> September 2015.
- The International Geological Congress (IGC) which will be held in Cape Town (South Africa), 27<sup>th</sup> August to 4<sup>th</sup> September 2016.
- The 10<sup>th</sup> International Symposium on the Cretaceous System will be held in 2017 in either Salzburg or Vienna.

## BUDGET AND ICS COMPONENT FOR 2015

Office expenses (Fax, phone, postage, etc)	£ 50.00
Contribution to a J/K boundary Meeting (organization+ participants' support), April 2015	£ 2000.00
Contribution to a J/K boundary Meeting (organization+ participants' support), October 2015	£ 1500.00
A number of requests for support for the STRATI 2015 Meeting are being received	£ 5000.00
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<b>Total estimated expenditure in 2015</b>	<b>£ 8550.00</b>

## 10. SUMMARY OF CHIEF ACCOMPLISHMENTS OVER PAST FIVE YEARS (2010–2014)

*See Accomplishments in ICS Annual Reports 2007 to 2013 for additional details.*

- Renewed research by WG members (resulting in a great number of publications, still ongoing), based on research needs pinpointed by the Brussels (1995), Neuchâtel (2005), Oslo (2008), Plymouth (2009) and Ankara (2013) meetings.
- The 5<sup>th</sup> official meeting of the Working Group on the Berriasian GSSP and the J/K boundary, chaired by W.A.W. Wimbledon in Smolenice (Slovakia) (April 2010).
- The 4<sup>th</sup> Workshop of the Kilian Group on the Aptian and Albian zonation, held in Dijon (August 2010).
- The 6<sup>th</sup> official meeting of the Working Group on the Berriasian GSSP and the J/K boundary, chaired by W.A.W. Wimbledon in Paris (November 2010).
- The 7<sup>th</sup> official meeting of the Working Group on the Berriasian GSSP and the J/K boundary, chaired by W.A.W. Wimbledon in Sofia (October 2011).
- The 8<sup>th</sup> official meeting of the Working Group on the Berriasian GSSP and the J/K boundary, chaired by W.A.W. Wimbledon in Bizerte, Tunisia (May 2012).
- The 9<sup>th</sup> official meeting of the Working Group on the Berriasian GSSP and the J/K boundary, chaired by W.A.W. Wimbledon in Prague (October 2012).

The Chair and/or Vice Chair represented the SCS at:

- The 5<sup>th</sup> meeting of the *Berriasian and J/K boundary Working Group*, Smolenice, April 2010.
- ICS Meeting, Prague, May 2010.
- The ICS official meeting, at 34<sup>th</sup> Geological Congress, August 2012, Brisbane.
- The 1<sup>st</sup> International Congress on Stratigraphy, Lisbon, July 2013. This was a well-attended and well-organised congress, building on the two STRATI meetings previously held in Paris. It is planned that this series of meetings will be held every two years: Graz, Austria, is to host the 2015 congress. Papers on the Cretaceous were well-represented in the programme and some of the field excursions (led by Jacques Rey) looked at the Cretaceous sections both north and south of Lisbon.
- The 9<sup>th</sup> International Symposium on the Cretaceous System, Ankara, September 2013. This major meeting at the Middle East Technical University, Ankara, Turkey was organised by Ass. Prof. Ismail Omer Yilmaz. Though less well attended than comparable meetings in Western Europe, there was a full programme of lectures, although the number of posters was down on the symposium held in Plymouth. There were informative mid-symposium and post-symposium field trips. Prof. Bruno Granier was accepted as the new SCS Secretary and there were thanks to the past Chair (Isabella Premoli Silva) and Secretary (Sylvie Gardin). There were updates on outstanding GSSP definitions. The 10<sup>th</sup> International Symposium on the Cretaceous System will be held in 2017 (though this could clash with the two-yearly STRATI meeting), though a venue was not decided. Possible locations include Saltzburg, Vienna, Lausanne and Heidelberg.
- The inauguration of the Turonian GSSP at Pueblo, Colorado, 25<sup>th</sup> October 2013. At an event organised by Rangers at the Pueblo State park, the GSSP ‘marker’ was ceremonially placed in the succession. Within the park there is now a comprehensive display board, static binoculars that can be used by visitors to view the ‘marker’ and a programme of outreach events to involve the community (especially schools). Dr Brad Sageman was thanked for preparing the information boards and choreographing the event. There were speeches by Stan Finney (Chair, ICS), Malcolm Hart (Chair, SCS), Suzanne Mahlburg Kay (President, Geological Society of America) and Brad Sageman. All the speakers and guests were thanked for their attendance and support by the Park Ranger responsible for education and outreach. Later, Brad Sageman led a geological walk around the site and the various features of the Cenomanian to Turonian succession.
- The Chair (Malcolm Hart) attended the 9<sup>th</sup> International Symposium “Cephalopods Past and Present”, University of Zurich, Switzerland (7<sup>th</sup> to 10<sup>th</sup> September, 2014).
- The Chair (Malcolm Hart) attended all the Cretaceous-based sessions at the EGU Annual Meeting in Vienna (27<sup>th</sup> April to 2<sup>nd</sup> May, 2014), GCAGS Annual Meeting (5<sup>th</sup> to 7<sup>th</sup> October, 2014) and the GSA meeting in Vancouver (18<sup>th</sup> to 22<sup>nd</sup> October, 2014).
- The Secretary (Bruno Granier) and the Chair (Malcolm Hart) were scheduled to attend the GFC meeting in Paris (1<sup>st</sup> to 2<sup>nd</sup> December, 2014), but the Chair was unable to travel at the last minute.

## OBJECTIVES AND WORK PLAN FOR NEXT 4 YEARS (2013-2017)

### Future Meetings

- July 2015 – 2<sup>nd</sup> International Congress on Stratigraphy, Graz, Austria.
- IGCP 609, September, Nanjing, China
- August 2016 – International Geological Congress, Cape Town, South Africa.
- September 2017 – 10<sup>th</sup> International Symposium on the Cretaceous System (Vienna or Salzburg, Austria).

Details of other meetings are not yet available.

### Objectives

- To submit the proposal for the **Coniacian GSSP** to the Cretaceous Subcommittee Voting Members, then submit it to ICS, and possibly to *Episodes* for publication;
- To submit a revised proposal for the **Albian GSSP** to the Cretaceous Subcommittee Voting Members, then to submit it to ICS, and possibly to *Episodes* for publication;
- To submit the proposal for the **Barremian GSSP** to the Cretaceous Subcommittee Voting Members, then to submit it to ICS, and possibly to *Episodes* for publication;
- To bring recommendations for the remaining GSSPs to ICS as soon as possible;
- **To prepare the definition of the criteria for the recognition of the base of the Berriasian and the J/K boundary. This is deemed as ‘High Priority’ and the Working Group have been informed of this, with the expectation that this will be resolved as soon as possible.**
- To communicate the results as widely as possible
- To develop new directions for the Subcommittee as GSSP proposals are completed. This specifically concerns the subdivision of stages, with the definition of substages and related GSSPs.

### Work Plan

2014 – Finalize the proposal for the base of the Albian (achieved)

2015 – Finalize proposals for the base of Hauterivian, Barremian, Aptian, and Coniacian Stages, and to continue with work on the Valanginian and Campanian.

2015–2016 – Finalize the proposal for the base of Berriasian (Jurassic/Cretaceous boundary)

2015–2017 – Definition of substages for discussion at the ISCS in 2017.



## APPENDIX [Names and Full Addresses of Current Officers and Voting Members]

### Subcommission officers (with addresses)

**Chair:** Prof. Malcom Hart  
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### *List of Voting Members*

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