International Commission on Stratigraphy

SUBCOMMISSION ON CRETACEOUS STRATIGRAPHY

ANNUAL REPORT **2013**

1. TITLE OF CONSTITUENT BODY and NAME OF REPORTER

International Subcommission on Cretaceous Stratigraphy (SCS)

SUBMITTED BY
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2. 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.*

3. 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***.

3a. 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://www.univ-brest.fr/geosciences/ISCS/

4. INTERFACES WITH OTHER INTERNATIONAL PROJECTS

The Subcommission 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 responsability for selection of future venues, though the successful applicants will organize individual congresses. The *8th International Symposium on the Cretaceous System* was held in Plymouth during September 2009, and the *9th International Symposium on the Cretaceous System* was held in Ankara (Turkey) during September 2013. This Symposium was held from the 1st to 7th 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 Subcommission also liaises closely with the Subcommission on Jurassic Stratigraphy, especially over the definition of the Jurassic/Cretaceous boundary.

The Subcommission 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 1st Meeting of IGCP 608 was held at the Birbal Sahni Institute of Paleobotany over the Christmas period in December 2012. As a result, Western European and American attendance was limited! The 2nd Meeting of the project is scheduled for 4th to 11th September 2013, which – unfortunately – clashes with the cephalopod meeting in Zurich and is close to the IPA conference in Argentina.

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 Fundation), and ICDP (International Continental Scientific Drilling Project).

5. CHIEF ACCOMPLISHMENTS IN 2012 and 2013

General Activities

The chair of the Cretaceous Subcommission called for the election of its chair and vice-chair(s) in fall 2011. As several nominations were received, the election process was completed by the end of 2011 and the results forwarded to the ICS Executive for approval in January 2012. In addition, the former Chair (I. Premoli Silva) called for the election of new Voting Members of the Subcommission for the 2012-2016 period**.** After having received thirteen nominations, the current Voting Members have been elected with 8 new members (see below).

A wealth of data on various aspects of Cretaceous stratigraphy has continued to be published during 2012 and 2013 providing a continuous stream of new data that spans the whole Cretaceous in increasing higher resolution. This is particularly true in the fields of stable isotopes and the astronomical tuning of sedimentary sequences.

Increasing knowledge on carbon isotope stratigraphic patterns and magnetostratigraphy from continuous pelagic successions, especially deep-sea, through the Cretaceous, stimulated the revision of earlier datasets. In particular, the Cretaceous Subcommission members have been very active in revising ammonite taxonomy and stratigraphic distribution of key taxa; and field trips to solve specific topics have been organized visiting some key sections (*i.e.*, Albian, Berriasian type-area, *etc.*). In addition, the Berriasian Working Group called two official meetings in Spring (Biserte, Tunisia) and Autumn (Prague), and its chair organized a field trip to Iraq in September 2012 plus an additional visit to Ukrainian sections. 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 the multidisciplinary study are now on-line (see below).

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. Jammet, 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. F**ő**zy, N.M.M. Janssen, J. Pálfy, 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-Papaioannou, 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 9th 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.

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.

MEETINGS

The spring meeting (May 2012) in Tunis was hosted by Mabrouk Boughdiri and colleagues, from the University of Bizerte, and was an opportunity to see sites on the southern side of Tethys. For the first time we also had first-hand discussion of developments in both north Africa and Argentina.

An excellent autumn meeting was held in Prague (25-29 October 2012), hosted by the Charles University and Geological Institute of the Czech Academy of Sciences. Thanks to Petr Pruner, Martin Kostak, Petr Schnabl, Stanislav Slechta and Kristyna Cizkova and their colleagues. WG members from as far away as Mexico and Novosibirsk made the long journey to Prague and we had a diverse discussion on Tethyan, Gondwanan, non-marine and boreal correlations, with twenty-five talks and posters presented.

WORKING GROUP ACTIVITY

A range of activities is listed below, geographically. At present activities are focussed on better documentation and improved calibration of stratigraphically useful markers and datums in the Tithonian/Berriasian boundary interval. The group's horizons broaden and we consider new geographical areas for multidisciplinary treatment. This means bringing integrated paleomagnetic and/or calpionellid/nannofossil studies to some areas for the very first time: e.g., North Africa, Iraq and Mexico.

Mexico - Riccardo Baraggan presented the latest results at Prague on the 'new' J/K Apulco site, and a publication on the locality, near to the formerly described site of Mazatapec, is in press (Barragan, Lopez, Rehakova). New ammonite and calpionellid evidence was discussed at Sofia and Prague. Nannofossils are being processed, and new ammonite finds assessed.

Spain - Rio Argos: new work on nannofossil and calpionellids (Casellato, Rehakova, Jamrichova) has been undertaken on samples from the *Jacobi* Subzone collected by Philip Hoedemaeker in past years. Some of the early calpionellid results were discussed in Prague: they are rather surprising.

Italy - In recent months Gloria Andreini has undertaken a revision of the calpionellid distribution and zonation at Torre de Busi.

France - Documentation of "template" sites for the *jacobi* and *grandis* subzones continues.

Le Chouet, Drome: completion of the first paper on Le Chouet (Reháková, Casellato, Halásová, Frau, Bulot, Grabowski, Sobien, Pruner, Schnabl, Čížková , Tchoumatchenco, Wimbledon) is imminent, describing the *Chitinoidella* – B, *jacobi* subzone interval, its nannofossil, calpionellid and ammonite biostratigraphy and magnetostratigraphy. More focussed publications are intended, including one to name several new ammonite taxa.

St Bertrands Spring, Drome: initial logging and sampling for paleomagnetism (Pruner, Schnabl, Slechta, Grabowski); calponellids, nannofossils, ammonites (Frau, Bulot, Wimbledon) focussing on the nominal P. *grandis* subzone were carried out in May 2012. Preliminary determinations of paleomagnetism are currently in progress. The next step is a second phase of logging and micropaleontological collecting of the lowermost Berriasian and topmost Tithonian.

Tunisia - Beni Kleb was the subject of a first J/K paleomagnetic sampling in May 2012 (by Petr Schnabl). These samples are currently being studied (Petr Pruner talk at Prague)**.** Initial reconnaissance sampling for nannofossils was undertaken in March 2012 at Jebel Rheouis, Beni Kleb and in central Tunisia at Sidi Kralif, near Sidi Bousid

Silvia Gardin has just reported that the Sidi Kralif samples have produced the first (and rich) Berriasian nannofossils to be found locally. This step forward was discussed at Prague. Work continues on Sidi Kralif and the other two sections. Kamel Maaloui is completing is study of the Sidi Kralif ammonites.

Slovakia - Further study continues on the Strapkova section (examined droning our Slovakia excursion), its micropaleontology and magnetostratigraphy (Michalik, Grabowski, Rehakova, Lintnerova, Halasova)

Bulgaria - The SW Bulgaria sites at Berende and Kopanitsa, with their marly successions, have been intensively studied for ammonites and calcareous nannofossils (Ivanov, Vyara Idakieva, Stoykova). First results were presented in Prague, with obvious correlations possible to both Crimea and Mediterranean Tethys.

Burlya, in NW Bulgaria, a carbonate succession (visited by the WG in 2011) is undergoing new paleomagnetic sampling on its Berriasian part (Grabowski, Schnabl, Sobien) in collaboration with Platon Tchoumatchenco and Iskra Lakova. Marin Ivanov and Vyara Idakieva have also been making fresh collections of ammonites.

Ukraine - Vladimir Arkad'ev has just published a substantial book on the "Mountain Crimea" Jurassic/Cretaceous, a very large accumulation of data. He and Andrey Guzhikov presented new data at Prague, plus tintinnid results by E. Platonov.

Vladimir Bakhmutov has been at the Feodosia Tithonian/Berriasian sections in October collecting new paleomagnetic data. Preliminary results were presented by him at the Sofia meeting, and these are currently being improved and updated. New results on the nannofossils of the Feodosia sections were also presented in Prague by Eva Halasova. This data will be integrated with already collated information on lithostratigraphy, nannofossils (Casellato), foraminifers (Daria Ivanova), calpionellids (Rehakova), ammonites (WAPW) and magnetostratigraphy, and a publication is anticipated in 2013.

Iran - Mohamed Bezaggagh presented important new data at Prague on typical Tethyan calpionellid biotas in the Shal and Kolur sequences of the Alborz chain of Iran.

Caucasus - Valery Vuks has been making a reconnaissance of prospective sections near the J/K boundary in the western Caucasus, collecting samples for micropaleontology.

India - Samples collected from limestones in Kutch (by Dr Pandey) are being processed in the hope of finding microfossils.

Tibet - Work continues, including efforts at trying to integrate past results (?Tith/?Berr.ammonites, Liu et al.) with more modern collecting for palynology (Li) and nannofossils and ammonites (Wan).

Russian Platform and Siberia - Important new work has been undertaken on the Nordvik section with a revision of paleomagnetic zonation. This work (by Bragin, Kazansky, Shurygin and Dzyuba) has M17r commencing in the *Chataetes chetae* Zone instead of the *Hecteroceras kochi* Zone.

In addition, Zanin, Zamirailova and Eder have just published an interesting new paper on presumed J/K calcareous nannofossils from the Bezhanov Formation (2012, Open Geology Journal 6, 25-31).

Vasily Mitta continues with his important work on ammonite biostratigraphy, notably on links from the Russian Platform to Tethys during the Berriasian, and happily was able to contribute to the Prague discussions.

Kurdistan - After a gap in research of 64 years, reconnaisance fieldwork in northern Iraq in July 2012 focussed on Tithonian/Berriasian Chia Gara limestone/marl successions in the Gara Anticline and at Banik, but examination of accessory sequences at Sargelu and Barzanja was also carried out. Logging of the two major sections was undertaken as the first requirement. Samples from Gara and Banik are currently under investigation by: Ibrahim Mohyaldin (geochemistry), Daniela Rehako-

va and Gloria Andreini (calpionellids), Kristalina Stoykova (calc. nannofossils), and Jim Riding and Ian Harding (palynomorphs).

Argentina - Hector Leanza and Alberto Riccardi are considering new possibilities for J/K profile studies. And, in the University of Buenos Aires, ammonite and nannoplankton biostratigraphy are being applied to the new site of Las Loicas, where there are possibilities for geochronological results from interbedded tuffs (using TIMS, SHRIMP and Laser Ablation U/Pb on zircons). The team consists of Beatriz Aguirre-Urreta, Veronica Vennari (ammonites), Andra Concheyro, Marina Lescano (nannofossils), Victor Ramos (field geology/tectonics), and Marcio Pimentel (geochronology; Universidade Federal do Rio Grande do Soul, Brazil).

South Primorye - A new team undertook its first fieldwork near Vladivostok in early October 2012 (Valentina Markevich, Eugenia Bugdaeva, Viktor Nechaev, Sha Jingeng, Li Jianguo, and WAPW). Preliminary fieldwork on the coast of Ussuri Bay and adjacent sections was for the purposes of testing the usefulness of published local lithostratigraphy and of trying to locate fossiliferous horizons, notably those identified by Sey and Kalacheva and Konovalov and Konovalova. In particular, the intention was to localise examples of Tethyan berriasellids in a section with multiple *Buchia* horizons. The reputedly 600m-thick predominantly sandstone Chigan Formation is affected by a number of major faults which disrupt the sequence, as well as gabbroic intrusions. Work has been initiated on recording all stratigraphically significant past fossil finds and then it will be necessary to integrate these records with new observations made in the field.

North Primorye - The team from Novosibirsk (B.N. Shurygin, O.S. Urman & O.S. Dzyuba) have been extending their extensive studies in Siberia and making new studies on sites in the Russian far east in the Komsomolsk area, on sequences with common *Buchia* and very rare Tethyan ammonites.

California - A new team has been formed for field and laboratory study for the sections of the northern Great Valley of California, as follows: Melissa Grey (Canada) *Buchia*, Jennifer Galloway (Canada) palynology, Oksana Dzyuba (Russia) belemnites, and from USA Alex Barnard mapping/lithostratigraphy, Emile Pessagno radiolarians, and Kathleen Surpless (radiometric dating). Nannofossils have not yet been assigned. It is some decades since the nannofossil work of Bralower at Grindstone Creek and even longer since the work of Jones on *Buchia* in the Paskenta-Grindstone area. First fieldwork is scheduled for May 2013.

Greenland - Work continues on the east Greenland sequences. Peter Alsen and Stefan Piasecki talked at Prague about new results from sections in the Wollaston Forland and other areas, and improved palynomorph/ammonite correlation from there to other boreal regions, notably, for the first time, to the *S. primitivus* Zone of England. Consideration is being given to a next step of magnetostratigraphic sampling of cores on which an ammonite and palynological study has already been performed.

United Kingdom - Paleomagnetic sampling of the non-marine Purbeck Formation (Tithonian-Valanginian) of Dorset was discussed at Prague. The work in summer 2011 (Pruner, Slechta, Schnabl) is on the putative M19-M18 interval, an interval previously sampled for magnetostatigraphy (by Ogg et al.) but not conclusively and with much much less resolution. 300 samples were collected and are in the process of study.

RECENT MEETINGS

Perugia – May 25-28, 2013 [report awaited]

Warsaw – October, 2013 [report awaited]

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*, 4**0**, 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-calpionellid 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.

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 Subcommission 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), *Discoidellia 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 $\delta^{13}C$ 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 declara-

tion 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 (2011-2013)

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., Főzy, 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 collegues on the stratotype sections of the Bedoulian and Gargasian substages including revised biostratigraphies, $\delta^{13}C$ 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:1 0.1344/105.000001752

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 previuos 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 not adequate for such critical interval and 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‰ $\delta^{13}C$ 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. The formal proposal dealing with the new criteria for identifying the base Albian is in preparation and is expected to be circulated during 2014.

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.

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. For the time being all

replies, received so far, support the proposal of having a composite section as a base Coniacian GSSP. Although it is not an ideal choice, there is not a 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 Subcommission is in advanced preparation by the WG chair.

I. Walaszczyk, C. J. Wood, J. A. Lees, D. Peryt, S. Voigt & F. Wiese, 2010. Salzgitter-Salder Quarry (Lower Saxony, Germany) – Slupia Nadbrzena 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.

Base Santonian GSSP.

The final proposal for the base Santonian at Olazagutia (Spain), prepared by the chair Marcos Lamolda, was distributed for approval and/or comments to the Voting Members of the Subcommission three times since 2008, and finally reached the quorum of positive votes in 2010. On October 1, 2010 the proposal was returned to the WG chair for an up-date and few corrections. The final GSSP proposal was submitted to the ICS on 20 December 2010. On 29 May 2011 the Santonian GSSP proposal was circulated to the Commission Voting Members for comments. The proposal along with the comments was sent back to M. Lamolda on 8 July 2011 for corrections and editing. The final version was returned to ICS on 3 October 2011. The proposal for the base Santonian at Olazagutia (Spain) was approved by the ICS on 9th April 2012. Meanwhile, the quarry, in which the GSSP is located, has changed the ownership and the new owner in April 2012 denied the access even to the inactive part of the quarry, a fact that prevented to forward the proposal to IUGS for ratification. After several actions by ICS Chair, S. Finney, and the proponent, M. Lamolda, the owner changed his/her mind allowing the access at the inactive part of the quarry to scientists who have to fill and sign an application form for the visit. After having clarified the problem of access, the proposal has now been submitted to IUGS and approved. The article for *Episodes* is expected in 2014.

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 (Petrizzo *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. Petrizzo, 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 $\delta^{13}C$ 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 dynocyst 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 form 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-magnetochronology 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. Stemmerik, F. Surlyk, 2012. Upper Campanian-Maastrichtian nannofossil biostratigraphy and high-resolution carbon-isotope stratigraphy of the Danish Basin: Towards a standard $\delta^{13}C$ 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 startigraphy: 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.

6. CHIEF PROBLEMS ENCOUNTERED IN 2013

The need, today, for a high-resolution stratigraphical framework that is applicable worlwide 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.

7. SUMMARY OF EXPENDITURES IN 2013 (ANTICIPATED THROUGH MARCH 2014):

I. INCOME

ICS subvention for 2013	£ 3513.70
Other income	£ 0.00
Total income	**£ 3513.70**

II. EXPENDITURE

Attendance at STRATI 2013 in Lisbon	£ 1187.68
Attendance at ISCS 2013 in Ankara	£ 1482.40
Contribution to J/K meetings in 2013 still under discussion	£ 0.00
Total expenditure (to date)	**£ 2670.08**

8. WORK PLAN, CRITICAL MILESTONES, ANTICIPATED RESULTS AND COMMUNICATIONS TO BE ACHIEVED IN 2013 and 2014:

Membership of Cretaceous Subcommission.

Several Voting Members of the Cretaceous Subcommission had terminated their mandate with the 34th Geological Congress, August 2012. The call for nominations was completed in September 2012 and the new membership was elected by the end of October 2012.

Meetings

- The 10th meeting of the Berriasian and J/K boundary WG was held in Perugia (Italy), May 2013.
- The 1st International Congress on Stratigraphy (STRATI) was held in Lisbon from the 1st to 7th July 2013.
- The official meeting of the Cretaceous Subcommission was held at the 9th International Symposium on the Cretaceous System in Ankara, Turkey, 1st to 7th September 2013.
- The 5th Workshp of the Kilian Group was held during the 9th International Symposium on the Cretaceous System, Ankara, September 2013.
- The 11th 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 25th), 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 (27th April to 2nd May 2014).
- The 2nd Meeting of IGCP 608, 4th – 11th September, 2014, Waseda University, Tokyo, Japan.
- The 2nd International Congress on Stratigraphy (STRATI) which is to be held in Graz, Austria, during July 2015.
- The International Geological Congress (IGC) which will be held in Cape Town (South Africa), 27th August to 4th September 2016.
- The 10th International Symposium on the Cretaceous System will be held in 2017. There are possible offers of a location in Saltzburg, Vienna, Lausanne and Heidelberg.

Work Plan and anticipated Results

- To bring recommendations for the remaining GSSPs to ICS as soon as possible.
- Submission of the *Episodes* article on the base of the Santonian Stage.
- Votes on the Coniacian GSSP and submission to ICS after Subcommission approval.
- Votes on the Hauterivian GSSP and submission to ICS after Subcommission approval.
- Preparation of the first draft for the Aptian GSSP.
- To complete the study of the Col de Pré-Guittard section for the Albian GSSP, preparation of the formal proposal and submission to ICS after Subcommission approval.
- Identification of the criteria for recognition of the base of the Berriasian and the (important) J/K boundary.
- Choose the appropriate section for the Campanian GSSP.

9. BUDGET AND ICS COMPONENT FOR 2014

Office expenses (Fax, phone, postage, etc)	£ 50.00
Contribution to a J/K boundary Meeting (organization+ participants' support)	£ 1000.00
Contribution to a J/K boundary Meeting (organization+ participants' support)	£ 1000.00
Contribution to a meeting (possibly in France) that will push ahead with Barremian, Hauterivian and Valanginian GSSP proposals (organization + participants' support)	£ 3000.00
Funds to support some of the Killian Group in travel to the Cephalpod meeting in Zurich, at which it is anticipated that further discussion on Lower Cretaceous GSSPs will take place	£ 2000.00
Total estimated expenditure	**£ 7050.00**

10. SUMMARY OF CHIEF ACCOMPLISHMENTS OVER PAST FIVE YEARS (2009-2013)

See Accomplishments in ICS Annual Reports 2007 to 2012 for additional details.

- Renewed research by WG members (resulting in a great number of publications, still ongoing), based on research needs pinpointed by the 1995 Brussels, 2005 Neuchâtel, 2008 Oslo, 2009 Plymouth and Ankara 2013 meetings.
- The 3rd official meeting of the Working Group on the Berriasian GSSP and the J/K boundary, chaired by W.A.W. Wimbledon in Milan (March 2009).
- The 4th official meeting of the Working Group on the Berriasian GSSP and the J/K boundary, chaired by W.A.W. Wimbledon in Plymouth (September 2009).
- The 5th 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 4th Workshop of the Kilian Group on the Aptian and Albian zonation, held in Dijon (August 2010).
- The 6th 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 7th 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 8th 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 9th 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 2nd meeting of the *Berriasian and J/K boundary Working Group*, Marseille, July 2008 SCS Symposium HPS-10 on "Stratigraphic subdivisions of the Cretaceous System: State of the Art". (Co-conveners: I. Premoli Silva, F. Surlik & I. Walaszczyk), at 33rd Geological Congress, August 2008, Oslo.
- The 3rd meeting of the *Berriasian and J/K boundary Working Group*, Milan, March 2009.
- The 4th meeting of the *Berriasian and J/K boundary Working Group*, Plymouth, September 2009.
- The 5th meeting of the *Berriasian and J/K boundary Working Group*, Smolenice, April 2010.
- ICS Meeting, Prague, May 2010.
- The ICS official meeting, at 34th Geological Congress, August 2012, Brisbane.
- The 1st 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 9th 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 10th 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, 25th 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 Sagemen led a geological walk around the site and the various features of the Cenomanian to Turonian succession.
- The Chair (Malcolm Hart) will be attending all the Cretaceous-based sessions at the EGU Annual Meeting in Vienna (27th April to 2nd May, 2014)

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

Meetings

- July 2013 – ICS meeting at the 1st International Congress on Stratigraphy, Lisbon, Portugal
- September 2013 – Subcommission Official Meeting at the 9th International Symposium on the Cretaceous System, Ankara
- September 1-7, 2013 – 9th International Symposium on the Cretaceous System, Middle East Technical University, Ankara, Turkey. Convenor: Ismail Omer Yilmaz
- September 2013 – 5th Workshp of the Kilian Group at the 8th International Symposium on Cretaceous System, Ankara.
- October 2013 – the 11th Workshop of the Berriasian and J/K boundary WG in Warsaw, Poland.
- September 2014 – the 9th International Symposium "Cephalopods Past and Present", University of Zurich, Switzerland.
- July 2015 – 2nd International Congress on Stratigraphy, Graz, Austria.
- August 2016 – International Geological Congress, Cape Town, South Africa.
- September 2017 – 10th International Symposium on the Cretaceous System (location to be finalized).
  Details of other meetings are not yet available.

Objectives

- To submit the proposal of Santonian GSSP to *Episodes* for publication
- To submit the proposal for the Coniacian GSSP to the Cretaceous Subcommission 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 Subcommission 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 Subcommission 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 possibile
- **To propose 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 Subcommission 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
2013 – Finalize proposals for the base of Valanginian, Hauterivian, Barremian, Aptian, Coniacian, and possibly Campanian
2013-2014 – Finalize the proposal for the base of Berriasian (Jurassic/Cretaceous boundary)
2014-2014 – Definition of substages

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

Subcommission officers (with addresses)

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