First Workshop of IGCP 463: Upper Cretaceous Oceanic Red Beds

Ancona, Italy, September 21–22, 2002

The first workshop of the IGCP Project 463 "Upper Cretaceous Oceanic Red Beds: Response to Ocean/Climate Global Change" was held 21–22 September 2002 in Hotel La Fonte, Ancona, Italy (Project website see http://www.igcp463.cdut.edu.cn). This workshop was organized by University of Ancona, Italy and Chengdu University of Technology, China with sponsorship of IGCP 463 (UNESCO-IUGS) and the Chinese National Committee of IGCP. This workshop was followed by a one-week field trip across the Apennine, Alpine, and Carpathian Mountains. Twenty-six participants from thirteen countries, Austria, Bulgaria, Canada, China, Czech, Germany, Italy, Poland, Romania, Russia, Turkey, U.K., and U.S.A., attended the first IGCP 463 Workshop. IGCP provided partial funding towards travel and subsistence costs mainly to participants from undeveloped and eastern European and Asian countries. The primary objective of the workshop was to organise the project, for participants to prepare a detailed work-plan, and to select key methodologies.

In first session, participants presented eighteen oral talks related to Cretaceous Oceanic Red Beds (CORBs). Amongst the exciting new developments was confirmation that CORBs are distributed in the Alps, Carpathians, Apennines, North Atlantic, Himalayas, Caucasus, Turkey, and Iran. The red beds in southern Tibet, the Chuangde Formation, were documented in detail including biostratigraphy (**Wan and Li**), lithostragraphy (**Li et al.**), sedimentology (**Hu et al.**), inorganic geochemistry (**Hu et al., Huang et al.**), and organic geochemistry (**Zou Peng et al.**). Sedimentation of red facies of the Santonian to early Campanian Chuangde Formation took place under highly oxygenated conditions at the sea floor, which is confirmed by the red color, high content of iron trioxide, negative cerium anomaly at the bottom of the red sequence, and very low total organic carbon (**Hu et al.**).

In the Austrian Eastern Alps distinct CORBs are known from the Helvetic/Ultrahelvetic realm (Turonian to Campanian/ Maastrichtian red marl and limestone), Penninic realm (?Cenomanian, Coniacian and upper Campanian red shales), Austroalpine realm (Santonian-Campanian red marls and marly limestones) (**Wagreich**).

K. Bak reported that red calcareous facies, mainly brick-red marl and marly limestones, are the most widespread Upper Cretaceous facies in the Pieniny Klippen Belt. The lower and upper boundaries of CORB's in the Pieniny Klippen Belt are diachronic, beginning in early Cenomanian on the northern ridge, and in early Turonian on the slopes of the ridge and in the central furrow. Deposition lasted through the late Campanian on the northern ridge, and finished earlier on its slope (during Coniacian-Santonian), and in the central furrow (early Campanian). Highly oxygenated conditions at the sea floor were interpreted for the sedimentation of the red facies in Poland, similar to the result from southern Tibet, which was confirmed by the colour of the deposits, intense burrowing, trace fossil ichnofacies, and diversified foraminiferal assemblage (**K. Bak**). Radiolarian assemblages support these conclusions (**M. Bak**).

Melinte noted that CORBs are widespread in the southern end of the East Carpathians in the Gura Beliei Formation, which is mainly red calcareous marl associated with white and green calcareous marl having a Campanian-Maastrichtian age.

In the Pontides, Turkey, a thinly-bedded red pelagic limestone of upper Cenomanian to lower Campanian age can be followed all along the Black Sea coast as a marker horizon that separates two episodes of magmatism. These episodes have significant tectonic implications regarding the opening of the Black Sea (**Tüysüz**).

Important occurrences of CORBs are in the southern part of the NE Peri-Tethys from the Carpathians to Central Asia (**Shcherbinina**). In the western part of the Ukrainian Carpathians red-coloured facies of the Pukhov Formation range in age from Turonian to Campanian. In the Crimea Coniacian sedimentary rocks are pink-colored. In Cis-Caucasia CORBs are widespread consisting of upper Turonian to Santonian limestone and marl that range in colour from white and pink to reddish brown. On the south slope of the Greater Caucasus in Central Georgia, red, pink, and white limestone deposits (up to 90 m) are upper Turonian, and intercalated red and green marls are Coniacian to lower Campanian (**Shcherbinina; Gambashidze**). In the western Caucasus the Cenomanian to Santonian flysch succession contains pink to brick-red carbonates, and Campanian to Maastrichtian sedimentary rocks are dominantly white and, less commonly, pink-coloured limestones. In the Lesser Caucasus of Armenia the CORBs occur mostly in upper Turonian, upper Coniacian, and lower Santonian strata. In Central Asia, CORBs are found in western Kopetdagh, where upper Turonian to Santonian, alternating red and green marls (40–180 m thick) give way eastward to gray marls and limestones. The Campanian green marls include hard, red marl at the base (~10 m thick) (**Shcherbinina**).

In the North Caucasus and West Turkmenia region pink and red coloured strata are present in several levels in the Upper Turonian to Lower Maastrichtian succession and are most common in the Coniacian-Santonian interval (**Tur**). In the Pre-Caucasus, reddish and grey marl and limestone form an 80-m thick sequence that spans from lower Coniacian to Campanian. In the Tuarkyr Basin in NW Turkmenia, reddish marls and limestone span from Coniacian to Campanian. On the north slope of the NW Caucasus red marl beds are developed in the upper Turonian (?) flysch. Pink limestone and red to brown marl beds occur in the Maastrichtian succession. In the West Kopeth-Dag basin, southwestern Turkmenia, red marl beds appear in the lower Coniacian in the deepest

Photo taken in the Contessa Quarry section near Gubbio during field excursion of the first workshop of IGCP 463. In the background, the central is the Bonarelli black shales (Cenomanian-Turonian boundary oceanic anoxic event). In the left side, the strata goes into reddish Scaglia Rossa limestone from whitish marly lime.

part of the basin and then continue into the lower Maastrichtian over the entire area.

Based on correlative study of the CORBs, **Hu et al.** summarized several characteristics of the red beds as follows: (1) CORBs have very low TOC < 0.3%; (2) pelagic and hemipelagic deposition ranged from oceanic basin, to slope/rise, to outer shelf; commonly in the slope environment red beds are intercalated with turbidite beds, e.g, the Scaglia Rossa and Nietrental formations; 3) red mudstone is common in oceanic basins, and red shale, red marlstone, red limestone, and red radiolarian chert characterize the slope and outer shelf; and 4) in most areas deposition of Upper Cretaceous pelagic red beds commenced soon after the Cenomanian-Turonian boundary and OAE2 event, and may extend into Paleocene.

The second session was a planning meeting with all participants. The participants agreed that the object of study is Upper Cretaceous Oceanic Red Beds, CORBs. "Oceanic" is a more accurate descriptor than "marine" or "pelagic" because it includes all types of marine red beds and excludes continental red beds. The key objective of the project is to apply interdisciplinary methodologies to understand the oceanic processes that resulted in change from anoxic to oxic deep marine sedimentation.

The understanding of CORBs requires interdisciplinary study, including stratigraphy, mineralogy, sedimentology, geochemistry, palaeoceanography, palaeogeography, palaeoclimotology, ocean/climate modeling, etc. It was agreed that the first step for the project is to set up a database of CORBs. The database will include the following items: (1) location of CORBs (longitude and latitude, country); (2) geological setting including regional tectonics; (3) stratigraphic position, such as, biozone, stage, and absolute age, chemostratigraphy, lithostratigraphy, sequence stratigraphic framework, sediment accumulation rates, etc.; (4) composition including lithology, mineralogy, sedimentary facies, geochemistry (organic, inorganic, isotopic, REEs); (5) biostratigraphic data including taxonomy, sample check lists, abundance, diversity, etc.; (6) palaeogeographic position/setting including palaeomagnetic intensity and orientation. All data must have author attribution to indicate the responsibility for data generation.

To better understand CORBs, the project needs the following information as well: (1) cyclic stratigraphy of red beds including the process, timing, and correlation; (2) depositional environment including transport process, water depth, dissolved oxygen content, bio-productivity, transport directions, etc.; and (3) palaeoceanography including oceanic and palaeoclimate modelling, palaeoclimate, and oceanic circulation.

Four working groups were set up during the planning session: (1) Himalayas led by Helmut Willems and Chengshan Wang, (2) Mideast including the Caucasus and Iran (RAG, IGS), leadership to be arranged; (3) Europe led by Michael Wagreich, Okan Tüysüz, and Krzysztof Bak; and the Atlantic-Pacific Oceans led by Luba Jansa, Robert Scott, and Paul Sikora. Tasks of the working groups are to coordinate each working group, to communicate, and to set up regional databases

The post-workshop field trip consisted of two consecutive parts: Part A Sept 23–24 was lead by Dr. Massimo Sarti from Ancona to Gubbio, and then to Lago di Garda; Part B Sept. 25–29 continued from northern Italy to the Austrian Alps, and then to the western Carpathians in Slovakia and the Pieniny Klippen Belt in southern Poland; co-leaders were Drs. Michael Wagreich (Austria), Jozef Michalik (Slovakia), and Krzysztof Bak (Poland). An excellent field guidebook, entitled "*Cretaceous Oceanic Red Beds (CORBs) in an Apennines–Alps–Carpathians Transect*" was distributed to participants. This 115-page guidebook provides an introduction to the regional geology of each area, as well as describes stops and the exposed CORBs from Italy, Austria, Slovakia, and Poland. Participants gained first-hand information of the regional geology, composition, and ages of some CORBs in Europe.

The first field trip stop was to see the pink-red Scaglia Rossa, which is famous not only as a beautiful building stone in Italy, but also as an important geological record of the K/T boundary layer with an iridium anomaly. The Scaglia Rossa ranges in age from Turonian to Eocene and was the section that fostered the impact hypothesis of end Cretaceous mass extinction by **Alvarez et al.**.

In Italy five well exposed sections of the Scaglia Rossa were visited including the Fornaci Quarry near Ancona, the Bottaccione Gorge and Contessa Gorge near Gubbio, the Pra da Stua and Torbole sections near Lago di Garda. The Scaglia Rossa in the Fornaci Quarry contains abundant turbidite beds (white bands), but in Gubbio it is almost purely pelagic. These sections provide one of the most complete pelagic intervals in the world, ranging from the Lower Cretaceous Maiolica, the Scisti a Fucoidi, the Scaglia Bianca, the Scaglia Rossa, the Scaglia Variegata, and the Miocene Scaglia Cinerea. Several key red beds are well exposed in the Contessa Quarry, including the lowest Aptian red shales near the bottom of the Scisti a Fucoidi, the middle Cenomanian red marl and shale in the Scaglia Bianca, and the post-Turonian Scaglia Rossa. The contact between the Cretaceous Scaglia Rossa and the Early Tertiary shallow-water limestone is nicely exposed at a number of localities near Nago and Torbole. In the Southern Alps a well documented stratigraphic hiatus spans from Turonian to Ypresian.

The second part of the field trip was along a transect from Salzburg to Vienna, to Bratislava, and then to Krakow. The oceanic red bed facies vary widely from red non-calcareous clay and shale, to red calcareous shale, to red marl, and red marly limestone. In Austria four CORB stops were visited that represent the southern margin of the European Plate, the Penninic Ocean, and the Austroalpine Microplate in the Northern Calcareous Alps. The age of these CORBs is mainly Santonian-Campanian.

In Slovakia, the CORBs are part of the Koöarisk· Formation in the Jablonica Nappe cover and the Púchov Marl in the famous Pieniny Klippen Belt, which was first described and named by **Štúr** (1860). These CORBs are mainly made up of red marlstone and marly limestone that range from Cenomanian to Campanian in age. In Poland, the CORBs are mainly distributed in the Pieniny Klippen Belt and in the Polish Outer Carpathians and have lithologies similar to CORBs in Slovakia. It is interesting to note that Albian-Cenomanian red marlstones in the Carpathians are similar to mid-Cretaceous red beds in the Central Apennines. This means that Aptian-Albian red beds also may be widely distributed, which needs confirmation.

The proceedings of the Ancona workshop of IGCP 463 will be published in a future issue of the Cretaceous Research.

The next workshop of the IGCP 463 will be held in Lhasa, Tibet, China, 25–30 August 2003, including a 4-day field excursion in southern Tibet.

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