nanoscale diffusion 'channels' during solid reaction Pl+Bt=Grt+Pheng+Qtz (Keller et al.).

Plans

A UHPM special session entitled "Ultrahigh-pressure Metamorphism: Multidisciplinary Approaches and Where to Go" was held in San-Francisco at the American Geophysical Union Meeting from December 5–10, 2005. The next International Eclogite Conference will be held in the United Kingdom in 2007.

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Cretaceous Oceanic Red Beds (CORB), response to paleoclimatic/paleoceanographic global changes and regional tectonics — Workshop of IGCP 463 & 494

Neuchâtel, Switzerland, September 1–2, 2005

Members of IGCP 463, Cretaceous Oceanic Red Beds (CORBs), held their fourth workshop in Switzerland, and members of IGCP Project 494, Dysoxic to oxic change in mid-Cretaceous Tethyan oceanic sedimentation, held their third workshop. The joint workshops consisted of a day and a half of presentations of current scientific results and a half-day planning the next year's work flow. Afterwards many participants joined the one-day field trip "Aptian, Albian, and Cenomanian sedimentation in the Swiss Prealps" led by Michèl Caron, Luc Braillard, André Strasser, and Corinne Saudan, which preceded the 7th International Symposium on the Cretaceous, 5–9 September, 2005. Projects 463 & 494 also sponsored oral and poster sessions at the Symposium entitled, "Cretaceous Oceanic Red Beds".

The IGCP 463 & 494 workshops were hosted by the Institut de Géologie, Université de Neuchâtel arranged by Karl B. Föllmi. Project leaders Chengshan Wang (China), Luba Jansa (Canada), Robert Scott (USA), and Xiumian Hu (China) chaired the respective workshops. Twenty-six participants from twelve nations attended the meeting: Austria, Canada, China, Czech Republic, Germany, India, Poland, Romania, Slovakia, Switzerland, Turkey, and the USA.

The main goals of the workshop were to review progress and data on the study of Cretaceous Oceanic Red Beds, and to evaluate the relationship of these data to paleoclimatic and paleoceanographic models.

Meeting brief

The year's data and results were summarized in twenty-one presentations. On the first day Chengshan Wang (China) presented an overview of the project to bring new participants up to date. The duration of IGCP 463 is from 2001 to 2006. The objective is to investigate and understand conditions that resulted in the change from anoxic to oxic deposition in the Late Cretaceous world oceans. The time frame of the Young Scientist Project IGCP 494 is from 2003–2005. Complementary funding for these projects has been obtained from the Austrian Academy of Sciences (IGCP Council of Austria), the German Science Foundation, the Czech Science Foundation, Turkey (TÜBİTAK), the Italian Ministry of Foreign Affairs, the Romanian Academy (CNCSIS), and the Natural Science Foundation of China. IGCP 463 has consistently received very good annual assessments and has produced numerous scientific publications including a special issue of Cretaceous Research (2005, No. 1). Principal findings are: (1) that CORBs are distributed globally in Late Cretaceous basins within 60 degrees north and south paleolatitudes, (2) that they indicate well oxygenated deep ocean water masses, and (3) that CORBs are clues to ocean-atmosphere-lithosphere interaction. Deposition of oceanic red beds began at least in the late Aptian following oceanic anoxic event 1a and was repeated throughout all succeeding Cretaceous stages even recurring in the Paleogene. The red color is the result of finely disseminated ferric iron in both clay and carbonate sedimentary rocks. CORB deposition indicates a decrease in oceanic organic carbon burial; and in many basins marine productivity generally was low as indicated by the very low or absent organic carbon. Sediment accumulation rates in the North Atlantic were generally less than 2 cm/kyr except where turbidites are intercalated. Late Cretaceous oceanic circulation during CORB deposition was well ventilated. CORB deposition may be linked to the complex cycle of large oceanic volcanic provinces, climatic change, changes in terrigenous runoff and nutrient input, biological productivity, and oceanic circulation.

The stratigraphic data of eight participants from Austria, the Caucasus, Czech Republic, Poland, Romania, and Tibet as integrated by Robert Scott (USA) shows that CORBs were deposited during each Late Cretaceous epoch before and after OAE2, and during the Coniacian-Santonian when black shale of OAE3 was deposited in the eastern Atlantic. The mean duration of CORB deposition based on this small data set is 5.1 myr, and the mean rate of accumulation is 1.6 cm/kyr. Oceanic red beds span the different systems tracts of sequences, thus appear to be related to climate rather than to sea level and depended on local basin conditions.

Intercalated red and green pelagic, Cenomanian-Turonian strata in the Carpathians of the Czech Republic are a model of CORB deposition as presented by Luba Jansa (Canada) with his colleagues. An initial assumption is that the original color of deep marine sediments was gray, so that

IGCP 463 & 494 workshop members on University of Neuchatel campus. Left to right Robert Scott, Chengshan Wang, Marta Bąk, Bill Hay, Luba Jansa, Xianghui Li, Guobiao Li, and Krzysztof Bąk kneeling.

early diagenetic conditions oxidize ferrous iron to ferric iron resulting in the red color. In modern oceans red sediments are deposited at a rate of less than 1.5 cm/kyr. In the Carpathians Upper Cretaceous red claystone is interbedded with greenish gray claystone, both of which have the same clay mineralogy, so had terrigenous sources. The amounts of ferric oxide and manganese oxide are independent of quartz, so they must have been derived from the sea water under oxic, alkaline conditions. Bottom-water redox conditions resulted either from increased dissolved oxygen or from increased exposure time to oxic bottom waters. Three processes may have acted alone or in some combination: (1) low sedimentation rate, (2) coastal downwelling, and/or (3) changes in bathymetric topography.

In the Outer Western Carpathians of the Czech Republic, intercalated red and green claystones are dated by dinoflagellates and benthic foraminifers as Middle Cenomanian to Lower Campanian by P. Skupien and his colleagues (Czech Republic). Neritic dinoflagellate cysts are more abundant in this unit than either oceanic or littoral forms. The absence of calcareous fossils indicates deposition was below the CCD. Both red and green claystone contain abundant terrigenous minerals and differ mainly in the high percent of hematite. Campanian flysch overlies the CORB unit.

In other sections of the Outer Western Carpathians, Cenomanian–Lower Turonian red brown claystone was deposited at abyssal depths below the CCD and rarely a low diversity nannoflora assemblage was preserved as reported by Lilian Švábenická (Czech Republic).

In the Outer Carpathians of Poland pelagic red beds range from Cenomanian to Campanian age in the Pieniny Klippen Basin described by Krysztof Bąk (Poland). A red, ferromanganese lamina is interbeded with deposits of the Cenomanian-Turonian OAE2 event. This lamina formed in response to increased deep circulation during the latest Cenomanian transgressive event and the opening of the equatorial South Atlantic.

In the Carpathians of Slovakia Lower Albian red beds lay above Aptian marine shale and the Selli bed and contain planktic foraminifers as reported by Jan Sotak and his colleagues (Slovakia). Turonian to Santonian red beds with planktic and calcareous benthic foraminifers lie above black shale of OAE2. These younger red beds are massive claystone with a few thin sandstone beds. The relative abundances of the foraminifers suggest that depths were bathyal, with oxic to dysoxic conditions and low to high nutrient levels. Bottom water paleotemperatures calculated from $\delta^{18}O$ of benthic foraminifers were about 21.7°C and surface water temperatures from planktic foraminifers were about 27.1°C. Because the benthic temperature seems higher than normal, additional study is recommended.

Cretaceous sedimentary rocks of the Eastern Carpathians in Romania record major oceanic fluctuations from oxic to anoxic to oxic conditions according to Mihaela Melinte (Romania). The age of pelagic red beds range from latest Albian to Maastrichtian, and even into the Paleogene. Calcareous nannoplankton and benthic foraminifers are commonly preserved suggesting deposition above the CCD. Quantitative analysis of the nannoflora indicates generally high productivity.

Cenomanin to Coniacian pelagic red limestones in northwestern Germany were deposited on a shallow open shelf according to Frank Wiese (Germany). Thin bedded red and white bioclastic wackestone to mudstone are interbedded and sedimentary structures indicate penecontemporaneous erosion. The meter-scale cyclic stacking pattern suggests increasing depositional energy into storm wave base for each cycle. The red beds predominate upon swells and in the intervening depressions; the white beds are interbedded with black shale and are thicker than on the swells.

CORBs range in age from Aptian to Maastrichtain in the Austrian-Bavarian Eastern Alps as summarized by Michael Wagreich (Austria). This area spanned from the southern margin of the European Plate across the Penninic Ocean to the Austroalpine microplate. Uppermost Aptian–lowermost Albian pelagic red foraminiferal packstone comprise a condensed facies below Albian shale. Red mudstone units are also in uppermost Albian to lowermost Cenomanian, in Coniacian– lower Campanian, and in upper Campanian formations. Repeated deposition of CORBs over a long time span suggests that they were the normal background, slow pelagic sediments. Because CORB deposition was possible only during times of low clastic input, tectonism was a major control.

In northwestern Turkey, oceanic red beds occur in Aptian and Santonian-Campanian strata according to İ.Ö. Yilmaz (Turkey). Aptian black shales that underlie CORBs comprise the early transgressive systems tract, and the carbonate red beds are part of the late transgressive interval. Many red beds are capped by drowning disconformities. Santonian-Campanian red beds, on the other hand, are in the drowning facies. These basins were subjected to frequent tectonic and volcanic processes that altered sedimentation.

In the Cauvery Basin of southern India, pelagic red beds were deposited during the Santonian *Dicarinella asymmetrica* Zone as first reported here by Abiraman Govindan (India). During Santonian time the Cauvery Basin was about 45° south latitude. Organic-rich black shales were deposited in Aptian, Albian, and Cenomanian intervals. The biogeographic affinity of the microfauna changed from austral during the Aptian-Albian, to transitional during the later Albian-Turonian, and to Tethyan in the Coniacian-Maastrichtian.

Mainly Turonian-Coniacian CORBs were reported for the first time from New Zealand by D.C.H. Hikuroa and J.A. Crampton (New Zealand). These shales were deposited in the outer shelf to slope at a high rate of sediment accumulation. Current pale-

Top hardground surface inclined toward viewer of the Maastrichtian Forclettes Limestone at Roter Sattel. The ferric iron-manganese hardground surface on top is up to 30 cm thick and grades down into pink to light red carbonates seen in the background.

ogeographic maps place New Zealand at about 60° south latitude, however a comment was made during discussion that ocean models would be difficult to reconcile with this position.

In central Italy pelagic carbonate red beds span intermittently from upper Aptian to Turonian and younger according to Xiumian Hu (China). The lowermost red interval in the Upper Aptian is separated from the Selli organic-rich bed by more than two meters of gray thin-bedded limestone. Intervals of red limestone occur also in the Albian, Cenomanian and Turonian stages. The red color is imparted by finely disseminated hematite particles within the micrite fabric. In single beds the color changes upward from gray to red as goethite changes to hematite. Carbon and oxygen isotopes of gray to red limestones do not change nor do redox-sensitive elements.

Field trip in Prealps

The one-day field trip in the Swiss Prealps east of Fribourg displayed a well exposed Aptian to Maastrichtian section. Three black shale intervals are interbedded with thin-bedded pelagic limestones, some of which had a pinkish color. The black shale intervals represent OAE1a, an Albian event, and OAE2. Pink deep marine limestones are Albian, Cenomanian, Turonian, and Maastrichtian in age based on planktic foraminifers (Strasser et al., 2001). A spectacular ferric iron-manganese hardground surface on top of the Maastrichtian Forclettes Limestone is up to 30 cm thick and underlies the Paleogene Chenaux Rouges Formation.

Future programme

Delegates decided to meet in September 3–4, 2006 in Beijing, China, for the final workshop of IGCP 463 and 494. Following the meeting a five-day field trip will traverse Tibet east to west to view Cretaceous CORB stratigraphy.

Project participants will submit biostratigraphic data in one of three formats: (1) species/sample meters checklist; (2) checklist of taxa in a composite of stratigraphically superposed, closely spaced sections in meters; or (3) composite section of a region in zones not in meters. The final data will be a product of the project and available to all. A publication of individual reports will present the results of the project. Participants favored publication by a geoscience society such as SEPM rather than a for-profit publisher. Such contacts will be explored in the next six months.

Reference

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The IV International Symposium ProGEO on the Conservation of the Geological Heritage

Braga, Portugal, September 13–16, 2005

The IV International Symposium ProGEO on the Conservation of the Geological Heritage was held between 13–16 September 2005 at Braga organised by ProGEO (European Association for the Conservation of the Geological Heritage) and by the Earth Sciences Department of the University of Minho. The Braga symposium builds on the earlier International Symposia, at Digne (1991), Roma (1996), and Madrid (1999), and at ProGEO conferences hosted in countries and regions, too numerous to list—as well as workshops at the Beijing and Firenze International Geological Congresses. These meetings have set the agenda for geoheritage (geosite, geo(morph)ological site) protection in the last ten years and introduced the ideas of comparative geosite inventories for countries and regions, of National Geoparks (with nested, protected geosite groups), promoted the integration of geoconservation in strong national nature conservation, as well as links to landscape (Dublin 2002 conference) and geoarchaeological conservation.

The IV International Symposium, which received the sponsorship of the IUGS and the Portuguese Foundation for Science and Technology, and the support of the UNESCO World Heritage Centre, had an organising committee of José Brilha, Diamantino Pereira, Maria Isabel C. Alves, Mário Cachão, Miguel Ramalho, Paulo Pereira and Renato Henriques. They created, supported by a scientific committee chaired by Francesco Zarlenga and Graciete Dias, the best surroundings and atmosphere for a creative (and sometimes energetic) exchange of views, for sharing of experience and initiating collaborations: and many congratulations came from the participants.

Nationals of more than thirty countries from four continents contributed to the symposium's activity and products. Several international and national institutions were represented at the Opening Ceremony, namely: the IUGS (Prof. A. Brambati), the IUCN— The World Conservation Union (T. Badman), the European Federation of Geologists (Fernando Noronha), the Portuguese Nature Conservation Institute (Luis Macedo), the National Institute of Engineering, Technology and Innovation—Portuguese Geological Survey (Teresa Ponce de Leão), the National Natural History Museum (Fernando Barriga), the Portuguese Geologists Association (Fernando Noronha), the National Association of Portuguese Municipalities (Joaquim Barreto), and the School of Science of the University of Minho (João Ferreira), as well as the many national committees, national agencies, geological surveys, and institutes, NGOs and academies of science which make up the ProGEO network.

One hundred and sixty participants presented about one hundred and fifty oral and poster contributions, in these themes: 1) Methodologies to characterise geological heritage; 2) Management of geological heritage; 3) Integrating geoconservation in nature conservation policies; 4) Geoconservation and education for sustainable development; and 5) Portuguese frameworks of international relevance. An Abstracts Volume was published and the Proceedings Volume is in preparation.

The programme included three Plenary Lectures. Common approaches to geoconservation in Europe, and the considerable differences by W.A.P. Wimbledon presented a survey of the state of the art of geoconservation in Europe (a full compilation of information on geoconservation in Europe by ProGEO is to be published in book form in 2006, with reports from 35 European countries). A general overview of Geoconservation in Portugal by J. Brilha gave to all participants a summary of the beginnings of geoconservation in Portugal as the host