

IAS NEWSLETTER

Nº 106 December 1989



Carbonate conglomerate
loaded into turbidites

Silurian

North Greenland

4th International Symposium on Fluvial Sedimentology

2-4 October 1989

The 4th meeting of fluvial sedimentologists, engineers and geomorphologists took place in the small fishing and touristic Village of Sitges, just south of Barcelona, Spain. The meeting, which was preceded and followed by field excursions, was sponsored by the Geological Survey of Catalonia, the University of Barcelona and the International Association of Sedimentologists, and was organised by Cai Puigdefabregas (Catalonian Survey) and Mariano Marzo (Barcelona University)

Three hundred participants attended the meeting. There were 55 oral papers and 135 posters. The meeting was divided into six sessions as follows:-

- (1) Sediment Transport and Bedforms
- (2) Fluvial Geomorphology and Modern River Systems
- (3) Concepts and Facies Models
- (4) Alluvial Stratigraphy
- (5) Fluvial Basins and Tectonics
- (6) Applied Fluvial Sedimentology (Gold, Coal, Hydrocarbons and Reservoir Modelling)

In this report, I have chosen to pick out from the talks and posters aspects which were of particular interest to me. This is an entirely personal matter and I make no attempt to disguise the fact!

Sediment Transport and Bedforms

Why should we be concerned with sediment transport and fluid mechanics? The answer is that it underpins the relation between bedform - bar type and fluid flow, and thereby provides the means of interpreting sedimentary structures of various scales in terms of process.

Much work continues to be devoted to gravels. A number of problems or areas of study stood out as being important.

- (i) the bed armouring process and the related process of gravel overpassing on depth-limited bars. *Carling* showed how these processes provide insight into the occurrence of open-work and closed-work gravel fabrics. The fining-up (normal grading) in gravel beds can also be explained by the selective rejection or acceptance of mobile pebbles into the bed rather than by a decreasing discharge with time. Remaining questions are whether gravel overpassing and size segregation work on bars with avalanche fronts, rather than the shallow bar fronts described by *Carling*, and what controls the grading of individual foresets rather than the entire bedform?
- (ii) the effects of microform bed roughness, that is, plane beds, ribs and clusters of pebbles. *Reid* and *James* showed how these clast arrangements exerted different resistance on the overlying flow, thereby influencing the threshold of movement and the bedload transport rate.

The study of present day rivers is a prerequisite for the estimation of palaeohydrology. A key question, therefore, is whether there is any relation between discharge and bedload transport in modern rivers. Certainly, the situation looks bleak. In the gravel-bed rivers of the northern Negev and Judean desert *Hassan* showed that there was no relation between discharge of ephemeral floods and bedload transport. *Clarke's* study of high energy streams, floored by boulders as large as 2 m in diameter, in a Californian desert area indicated that the largest clasts were moved only during the exceptional high-magnitude flood, perhaps of recurrence time of about 100 years. *Todd* postulated longer recurrence times of c. 1000 years for the high magnitude floods transporting his Devonian conglomerates. This is a theme taken up by *Castelltort, Balasch & Clotetperamau* who, working in the Vallcebre Basin near Gerona (northern Spain) were able to identify inactive, semi-active and active bedload stocks which correlate with different magnitude and frequency flows.

An influential paper on gravelly braided streams was *Doeglas' (1962)* study of the River Durance in SE France. *Dawson's* study of the nearby River Bleone provides further insights into the development of gravelly barforms. Simple unit bars representing a single sediment transport event develop into complex bars representing both in-channel

accumulation and secondary suprabar deposition. *Bluck & Haughton* identified "families" or "tiers" of gravel bars which fine downstream. The downstream migration of each bar produces a coarsening-up bed as the riffle head supercedes the tail, and downstream migration of a whole family of bars in turn produces a larger scale upward-coarsening.

In the sand-bed streams of Northern Australia, *Roberts* found anomalously low (and as yet unexplained) suspended sediment concentrations. *Buchanan* contrasted the ephemeral and perennial sand-bed rivers of the Great Plains, USA, noting that ephemeral rivers were controlled by the peak annual flood and by the duration of mean flows from year to year. Perennial rivers, however, inherited their characteristics from the previous years, so that contemporary flows had little effect on channel form for that year.

Concepts and Facies Models

The facies model based on the vertical sequence has died a death and few people will mourn the demise of these hugely oversimplified and outrageously optimistic devices. Three aspects of sedimentary facies attracted widespread attention:

- i) The importance of overbank sediments, especially their cyclicity and pedogenesis, as exemplified by *Behrensmeyer's* study of the Chinji Formation of the Potwar Plateau, Pakistan
- ii) point bar geometry and interpretation : *Willis* presented models of a meander bend and showed the great variation in 2-dimensional geometry of the point bar dependent on the line of section and on the method of downstream/across stream translation, expansion or rotation of the bend. The stepped point bar profiles described by *Hirst* were related to erosional cutting of benches at lower discharges. Exhumed meanderbelts such as that of the Reirsvlei palaeoriver, South Africa discussed by *Smith* provide exceptional opportunities for the investigation of the planform geometry and palaeohydraulics of an ancient river.
- iii) Anastomosing rivers were described par excellence from North America and Colombia.

The key mechanism that characterizes them appears to be the efficacy of avulsion rather than simply high rates of sedimentation or low slope. The classical Columbia River

represents a confined anastomosing system (*Derald Smith*), whereas in the unconfined Cumberland Marshes the successive stages in an avulsion were documented by *Norm Smith & Derald Smith*. The search for a convincing ancient analogue continues. Maybe *Bersier* saw it back in 1959 in the freshwater Molasse of western Switzerland! The Gilbert River system entering the Gulf of Carpentaria, northern Australia described by *Jones* is another example of an extremely low-gradient (1 : 2000) alluvial system.

Alluvial Stratigraphy

You either love hierarchical systems of classifying architectural elements or you hate them. Two systems were presented : that of *Miall* is highly descriptive and is ranked on the time scale of operation of the processes responsible, ascending in number from short term to long term. *Bristow's* scheme is based on the importance of micro, meso, macro and megaforms in the construction of the architectural elements, ascending in the reverse order to *Miall*, and using as a precedent the widely used aeolian system of *Brookfield* (1977). The real question is not the order of the labelling system, but whether any system of this type helps to guide observation/interpretation, and whether it is useful as a means of communication. I thought at one point that the answer was in the affirmative, until half an hour later I heard a field description implementing one of the schemes and was utterly confused!

The main contributions to the understanding of geological sequences must surely now come from the field of geomorphology. This was impressively demonstrated by a number of talks and posters. *Friend* based his interpretation of the Siwaliks on shuttle photographs and maps of the present drainage systems contributing to the Indo-Gangetic molasse. The bedrock geology, size and relief of the headwaters of rivers is of profound importance in determining fluvial style. Changes in "hinterland parameters" must now be studied in modern systems and linked to young deposits, as shown for example by *Mather* in the Sorbas Basin, Spain and *Gillchrist* in the Gulf of Corinth area, Greece.

Fluvial Basins & Tectonics

There were a large number of contributions to this session (26 posters and 11 talks). Much discussion centred on the usefulness or otherwise of numerical models utilizing parameters describing basin subsidence and sediment flux. *Crews et al.* related sediment flux to elevation, following Ahnert's (1970) suggestion, whereas *Heller et al.* used a diffusion law, so that sediment flux was proportional to the slope. Such models allow some enquiry into the relationship between progradation of coarse clastics and basin subsidence. The two groups from the University of Wyoming believe that strong progradation takes place during periods of tectonic quiescence at which times subsidence (induced by supracrustal loading) is less. *Burbank's* study of the Siwaliks of Pakistan, where sedimentation and tectonics are tightly constrained by superb palaeomagnetic dating, was an immediate test case for the general principles forwarded by *Crews et al.* and *Heller et al.* Burbank showed that gravels prograded from the Jhelum reentrant along an axis of maximum subsidence, contradicting the model results. However, these early attempts at modelling are helpful in prompting us to ask the right questions in our studies of alluvial stratigraphy.

Tracing of time-significant surfaces bounding marine (shoreface) parasequences into the adjacent alluvial tract allowed *Shanley & McCabe* and *Gardner & Cross* to relate base level change to alluvial architecture. These studies build on a framework of detailed sedimentological analysis using modern concepts of sequence stratigraphy. The impact of such studies will be enormous.

The final session on applied fluvial sedimentology comprised 8 papers and 12 posters.

In the last decade there has been a significant shift in our studies from river hydraulics and geomorphology towards basin analysis and the role of tectonics. This has, I perceive, resulted in a widening of the gap between hydraulic engineers, geomorphologists and geologists. The reasons for this are probably varied, but one may be the resistance of commercial concerns (chiefly oil companies) to fund research on "fundamentals". Paradoxically, this is, in part at least, the fault of those of us in academia; it is our responsibility to demonstrate to those in industry that such fundamental research is

important to the more "downstream" or "applied" research which makes dollars. My hope is that it is not already too late to reverse this drift.

The conference was crowned with a dinner overlooking the Mediterranean. A tutor in Cambridge once told me over a flickering candelabrum that his greatest wish was to eat his way through the entire animal kingdom. I suspect he would have enjoyed our conference dinner for the variety of marine life that presented itself to us. Cai Puigdefabregas with resolute modesty toasted the contributions of Professor Oriel Riba from the "downtown" University in Barcelona. In joining him, we were in effect toasting the contributions of Spanish sedimentologists in general (27 Spanish geologists were involved in the running of the field trips). Like an anastomosing river, I avulsed quietly back to my hotel along the sea front and paused to listen to the traditional Catalan folk music drifting strongly across the deserted bay. The level of applause from the conference participants suggested that most had reserves of energy which had in me been long exhausted.

Philip Allen

Oxford

CONFERENCE REPORT:

Sea-level changes at active plate margins: processes and products

Report of an international symposium held in London on 9-11 May 1989, convened by David Macdonald, and sponsored by the International Association of Sedimentologists and the Geological Society of London. This conference was aimed at furthering our understanding of the role of eustasy as a control on sedimentation within tectonically active basins, rather than from the passive margin basins, where the concept of sequence stratigraphy was developed. A wide range of tectonic settings were discussed by the speakers, including basins developed within fore-arc, back-arc, foreland and cratonic regions. The meeting attracted 170 scientists from 20 countries. Technical sessions took place on three consecutive days, and consisted of 48 talks and 11 posters.

The first two keynote addresses underlined one of the major problems with the concept of sequence stratigraphy. Haq (USA) introduced the concept of sequence stratigraphy and global cycle charts, where systems tracts and sequences can be used for regional and interregional correlation. Taking this well-argued concept of global eustasy, Dewey and Pitman (UK,USA) discussed the problem of how eustatic sea-level changes might be generated. They argued that long-term cycles can be best explained in terms of changes in the volume of mid-ocean ridges, but that short-term (third order) cycles must be attributed to changes in ice volume during periods of glaciation. So, therefore, how were rapid falls in sea-level generated during, for example, the supposedly ice-free Cretaceous? Although this problem was discussed, it was apparent that no easy solution

is available. However, it was useful to recognise the different approaches to the evaluation of sea-level change in the geological record, ranging from one of total acceptance, to one of caution, bordering on scepticism.

Other important points which recurred throughout the symposium were:

- i) the problem of good age control, without which it is impossible to correlate "global" sequence boundaries
- ii) the rate of response within sedimentary basins to tectonic and eustatic events
- iii) the variety of scales of sedimentary cycles which reflect a tectonic, eustatic or autocyclic control on sedimentation

Although accurate dating of sequence boundaries is relatively easy in some basins, for example the excellent biostratigraphical control from the Neuquen Basin of Argentina (Legarreta and Uliana, Argentina), there are many basins where this is a problem. Correlation of sequence boundaries to the sea-level cycles charts of the Exxon Group cannot be applied to areas which lack a refined biostratigraphical age control. Perhaps the development of new techniques to date sequences accurately, such as Sr isotope stratigraphy (Smalley, UK), which is most useful for the interval 0-40 Ma ago, will help to solve this problem.

Variation in the rate of change of sea-level was highlighted by several contributions, notably by Carter et al. (Australia) who suggested that eustatic and tectonic events from both fore- and back-arc basins in New Zealand could be determined on the basis of the rate at which they occur. Fortuin and de Smet (The Netherlands) showed that pulses of uplift along the Banda Arc took place as rapidly as eustatic third order sea-level changes, but were an order of magnitude larger.

Several presentations discussed the variation in scales of sedimentary cycles, amongst them Mossop (Canada) and Flint (Canada), both independently looking at the Alberta foreland basin. The delineation of autocyclic sediment depocentre switching is an important factor to take into account before sequence stratigraphy and correlation of sequence boundaries can be attempted.

A further series of papers assessed the problem of eustatic versus tectonic controls on sedimentation from basins where the tectonic history was well constrained. Particularly good examples of this were given by Morris and Busby-Spera (USA) from the Rosario fore-arc basin of the Peninsula Ranges, and by Smith (UK) from the Welsh basin. In both these examples adjacent parts of the same basin underwent different tectonic histories, producing a complex interaction between tectonically- and eustatically-controlled changes in sea-level across the basin. Flint et al. (UK) suggested that regionally variable patterns of Quaternary to Recent coastal uplift along the north Chilean coast is controlled by the subduction of an aseismic ridge, rather than eustatic sea-level fluctuations.

The combination of several review papers and many case studies from a variety of sedimentary basins presented at this meeting has begun to tackle the problems of differentiating between tectonic and eustatic causes of sea-level change at active margin settings. This was a well-organised, thought-provoking conference, with excellent advance planning enabling the meeting to take place the week before the London tube strike. The proceedings of this conference are to be published as a series of papers in a special publication of the International Association of Sedimentologists,

edited by David Macdonald. This should be a useful addition to the rapidly expanding literature on sea-level changes.

Pete Butterworth

(B.A.S.)

Dear Fellow Sedimentary Enthusiast:

As you may be aware, I assumed the editorship of the Journal of Sedimentary Petrology in September 1988 from Norm Smith, whose term (although not Norm) had expired. Along with all the work, the editorship carries with it a few "percs", foremost among which is the possibility of affecting the future course of the Journal.

In recent years, the Journal has been receiving a rising chorus of complaints from SEPM members and others about a perceived narrowness of focus. There is a perception that the Journal has been missing many of the new geophysical, geochemical, geomathematical, and stratigraphic insights of relevance to sedimentology that have emerged in recent years. Examples include: the renewed interest in sequence stratigraphy; organic/inorganic interactions in the subsurface; computer simulation of sedimentary processes and the increasing ability of wireline logs to monitor diagenetic changes. The explanation for the near-absence of these topics from Journal pages is straightforward. Papers on these topics are rarely submitted to us. Because of perceptions of the sedimentary community about what is suitable for publication in the Journal of Sedimentary Petrology, manuscripts concerning these subjects are nearly always submitted elsewhere.

As Editor, I would like to change this and broaden the focus of the Journal to include such topics (and others) that have a direct bearing on the sedimentary record. This is the reason I am writing to you. You are active in some of the areas I would like to see better represented in the Journal. Perhaps we have published some of your papers; if so, I encourage you to send more. If you have not been considering us as an outlet until now, I ask that you try us. I can assure you that your work will be welcomed in the editorial office. Contrary to the belief of some, JSP readers interested in petrologic aspects of sedimentary rocks are not averse to thermodynamic calculations; those with a dominant interest in diagenesis will not be repulsed by organic chemistry. Those concerned with the relationship between tectonics and sedimentation will abide necessary geophysical calculations concerned with rates of uplift. Please do not think that "this manuscript has too much chemistry for JSP", or that use of the words "mantle convection" makes the manuscript unsuitable, or that papers with a stratigraphic slant are of no interest to JSP readers. Our readers include earth scientists with diverse interests, including many of those that you yourself have.

In summary, if your manuscript deals with the origin, transport, environment of deposition, geochemistry, geodynamics or burial history of sedimentary materials, JSP is interested. Manuscripts dealing with topics we have heretofore neglected will receive the same rigorous reviews that authors have come to expect from our Journal. For your information, our average publication is now less than 12 months.

Harvey Blatt, Editor
Journal of Sedimentary Petrology

Phanerozoic oolitic ironstones

IGCP Project 277 is organizing a session on Phanerozoic oolitic ironstones at the 13th ISC in Nottingham 1990, under Theme 3A. Appropriate contributions are welcome. The Project will also sponsor a four-day pre-Congress field trip to ironstones in the

Jurassic of England and Ordovician of Wales. Abstract sheets will be sent on receipt of 134h ISC registration from (deadline 02.28.90). For field trip details contact Dr. T.P.Young, Dept. of Geology, Univ. of Wales, PO Box 914, Cardiff CF1 3YE, UK (deadline 01.01.90).

Franklyn B. Van Houten

International Sedimentology Congress 1990
Theme D: Global Environmental Change
Symposium 1: Orbital Forcing and Cyclic Sequences

Convenors:

1. Dr David G. Smith, Stratigraphy Branch, BP Research Centre, Chertsey Road, Sunbury on Thames, Middlesex, U.K. TW16 7 LN.

2. Dr P.L. de Boer, Comparative Sedimentology Division¹ State University of Utrecht, Budapestlaan 4, PO Box 80.021, 3508 TA UTRECHT, The Netherlands.

Orbital forcing of climate change is firmly established as a major influence on the Quaternary stratigraphic record. Acceptance of similar effects in the older record varies from enthusiastic to highly sceptical. A key problem is that the Milankovitch frequency band - tens to hundreds of thousands of years - is one about which we know all too little. Sedimentology deals largely with processes on the scale of seconds to hundreds of years, while stratigraphy tends to be concerned with much longer timescales. It may well be that the effects that really shape the stratigraphic record fall mainly into this intermediate part of the scale, which is too long for actualistic or historically based observations, yet too short for detailed resolution in much of the stratigraphic record. It seems possible that, for instance, the controversy over eustatic versus tectonic controls on the development of depositional sequences will be resolved at this scale. But what are the relative rates of the key processes at this scale and how are we to study them? Are we dealing with abrupt changes in e.g. climate and sea-level, or are gradational changes more normal? Can we use supposed Milankovitch rhythmicity as a time-scale, or does this invoke circular reasoning?

Call for papers:

Oral and poster contributions are invited. We expect to have a few longer keynote papers, and a larger number of short contributions, but the format of the symposium will depend very much on the level of interest. Please let one of us know if you would like to offer a paper. We would welcome mathematical contributions as much as stratigraphic and sedimentological ones, and models as well as data.

Publication:

The International Association for Sedimentology has agreed to the publication of a Special Publication, which will bring together papers from this symposium with those of its sister symposium, on Sedimentology, Sea-level and Seismic Stratigraphy. We confidently expect this to be an exciting and even controversial publication, with scope for new ideas in these highly topical areas.

D.G.Smith and P.L.de Boer

Geochemical data bases

The National Geophysical Data Center (NGDC) archives and disseminates two major geochemical data bases: The Igneous Petrological Data Base (IGBA); and the Marine Minerals Data Base and Bibliography.

IGBA, Version 3, contains over 12,000 specimen descriptions from more than 1,000 sources worldwide, and has incorporated software which allows the user easy access and retrieval of data.

The Marine Minerals Data Base includes 146,000 elemental and oxide analyses of 12,000 samples. When available, entries contain complete documentation on station location, analytical procedures and geographic location.

We believe the data described in the accompanying announcements will be of special interest to your members.

For more information, please contact:

National Geophysical Data Center
NOAA/NESDIS E/GC4
325 Broadway, Department 738
Boulder, CO 80303
or call (303) 497-695

Mai Edwards

FUTURE MEETINGS

December 18-21, 1989

U.K. (Leeds)

B.S.R.G. ANNUAL GENERAL MEETING

Contact: Dr. Jim Best (Tel. 0532 335202) and Dr. Martyn Pedley (Tel. 0482 465455), Department of Earth Sciences, University of Leeds, Leeds LS2 9JT, U.K.

February 24, 1990

U.K. (Reading)

B.S.R.G. - P.R.I.S WORKSHOP

CARBONATE SANDBODIES

Contact: Dr. B.Sellwood (BSRG), P.R.I.S. University of Reading, P.O.Box 227, Reading RG6 2AB, U.K.

March 19-23, 1990

CANADA (Vancouver)

Globe '90 Trade fair and Conference

Contact: Globe '90, 250-1130 West Pender Street, Vancouver, B.C. V6E 4A4, Tel: (604)681-6216; Telex: 04-352848; Fax: (604)681-1049

May 5-11, 1990

U.S.A.

Tidal Inlet and Estuarine Sand Bodies: Modern and Ancient

Registration: \$ 495.00

Contact: Susan Green, SEPM, P.O.Box 4756, Tulsa, OK 74159-0756, U.S.A.

May 6-12, 1990

AUSTRALIA (Queensland)

PACIFIC RIM 90
CONGRESS

Contact: The AusIMM - PACRIM 90, PO BOX 731, TOOWONG QLD 4066, Australia.

May 9-12, 1990

POLAND (Krakow)

Muschelkalk Workshop

Contact: Joachim Szulc, Jagiellonian University, Institute of Geological Sciences, 2a, Oleandry Str., 30-063 Kraków, Poland.

May 20-24, 1990

ARGENTINA (San Juan)

THIRD ARGENTINE MEETING OF SEDIMENTOLOGY

Contact: Dr. Felisa Bercowski, Departamento Geologia, Fac. Cs. Ex., Fis. y Nat. - UNSJ, Avda. Cereseto y Meglioli - Rivadavia, 5400 San Juan - ARGENTINA. Tel.: (064) 231945, telex: UNSJ AR 59100.

May 24-June 1, 1990

U.S.A.

Field Trip, "Fluvial Processes and Deposits
of the Colorado River"

Registration: \$ 1,300.00 Deadline 02/21/90

Contact: Susan Green, SEPM, P.O.Box 4756, Tulsa, OK 74159-0756, U.S.A.

June 2-3, 1990

U.S.A. (San Francisco CA)

Short Course "Integrated Stratigraphic Analysis"

Contact: Susan Green, SEPM, P.O.Box 4756, Tulsa, OK 74159-0756, U.S.A.

June 3, 1990

U.S.A. (San Francisco, CA)

Student Short Course, "Comparative Sedimentology of
Coastal Clastic Deposits - Bridges to Ancient
Shorelines"

Registration: \$25.00 pre registration, 40.00 on site.

Contact: Susan Green, SEPM, P.O.Box 4756, Tulsa, OK 74159-0756, U.S.A.

June 3, 1990

U.S.A. (San Francisco, CA)

Core Workshop, "Miocene and Oligocene Petroleum
Reservoirs of the Santa Maria and Santa Barbara -
Ventura Basins, California"

Registration: \$130.00 pre registration, 145.00 on site, 40.00
student, 55.00 on site student.
Contact: Susan Green, SEPM, P.O.Box 4756, Tulsa, OK 74159-0756,
U.S.A.

June 5, 1990

U.S.A. (San Francisco, CA)

"What You Can Do: Improving Earth Science Education"

Registration: Free
Contact: Susan Green, SEPM, P.O.Box 4756, Tulsa, OK 74159-0756,
U.S.A.

June 26-July 2, 1990

FINLAND (Oulu)

III International Drumlin Symposium

Contact: Risto Aario, Department of Geology, University of Oulu,
90570, Finland.

July 1-6, 1990

SOUTH AFRICA (Cape Town)

GEOLOGY AND MINERAL RESOURCES
OF CONTINENTAL MARGINS: ANCIENT AND MODERN

Contact: The Congress Secretary, GEOCONGRESS '90, P.O. Box 1739,
Belville, 7535 South Africa.

July 9-11, 1990

U.S.A. (Durango, Colorado)

1990 WATERSHED MANAGEMENT SYMPOSIUM
DURANGO, COLORADO, USA

Contact: Mr. Robert Riggins, USACERL, PO Box 4005, Champaign, IL
61824-4005, U.S.A.

July 9-13, 1990

FRANCE (Marseille)

INTERNATIONAL SYMPOSIUM "LITTORAL 1990"

Contact: Association EUROCOAST, Symposium "LITTORAL 1990", c/o
D.R.G.M., Domaine de Luminy, F-13009 Marseille, France. Tel: (33)
91412446, Fax: (33) 91411510, Telex: 401585 F.

August, 1990

BRAZIL (Rio de Janeiro)

3rd INTERNATIONAL SYMPOSIUM ON SOUTH ATLANTIC EVOLUTION

Contact: Dimas Dias-Brito (Symposium Coordinator)
PETROBRAS/CENPES/DIVEX/SERIFE, Cidade Universitária, Q, 7 - 1,
Fundao, 21910 Rio de Janeiro, RJ - Brazil.

August 9-13, 1990

U.S.A. (San Francisco, Ca)

Research Conference, "Ancient Eolian and ERC
Margin Deposits"

Contact: Susan Green, SEPM, P.O.Box 4756, Tulsa, OK 74159-0756,
U.S.A.

August 20-24, 1990

U.S.A. (Denver, CO)

Research Conference, "Cretaceous Resources Event and
Rhythms/Global Sedimentary Geology Program"

Contact: Susan Green, SEPM, P.O.Box 4756, Tulsa, OK 74159-0756,
U.S.A.

August 23 - September 1, 1990

U.S.S.R. (Alma-Ata)

International symposium
NONMARINE CRETACEOUS CORRELATION

Contact: Prof. V.A.Krassilov, Institute of Biology and Pedology,
Vladivostok 690022, U.S.S.R.

August 26 - September 1, 1990

U.K. (Nottingham)

13th INTERNATIONAL SEDIMENTOLOGICAL CONGRESS

Contact: Prof. J.N. McCave, Dept. of Earth Sciences, University
of Cambridge, Downing Street, Cambridge CB2 3EQ, U.K. Teleph.:
223-333422.

October 8-9, 1990

U.S.A. (Missouri, Colombia)

CLAY MINERALS IN SANDSTONES
(Clay Mineral Society Symposium)

Contact: David Houseknecht, Department of Geology, University of
Missouri, Colombia, MO 65211, U.S.A.

October 20-25, 1990

KUWAIT (Safat)

"GEODYNAMICS OF THE ARABIAN PLATE"

Contact: Dr. Waris E.K. Warsi, Department of Geology, University
of Kuwait, P.O.Box 5969, Safat 13060, Kuwait.

April 7, 1991

U.S.A. (Dallas, TX)

Core Workshop, "Mixed Carbonate - Siliciclastic Sequences"

Registration: \$130.00 pre registration, 145.00 on site, 40.00
Student, 55.00 student on site.

Contact: Susan Green, SEPM, P.O.Box 4756, Tulsa, OK 74159-0756,
U.S.A.

April 7, 1991

U.S.A. (Dallas, TX)

Student Core Workshop, "Identifying Carbonate Facies
and Interpreting Depositional Environments from Cores"

Registration: \$35.00 pre registration, 50.00 on site.

Contact: Susan Green, SEPM, P.O.Box 4756, Tulsa, OK 74159-0756,
U.S.A.

August 15-18, 1991

U.S.A. (Portland, OR)

SEPM Midyear Meeting, "Continental Margins: Tectonics
Eustacy and Climate Change"

Contact: Susan Green, SEPM, P.O.Box 4756, Tulsa, OK 74159-0756,
U.S.A.

September 6-11, 1991

CHINA (Nanjing)

SECOND INTERNATIONAL CONGRESS ON PALEOECOLOGY

Contact: Dr. Ma Yu-ying, Nanjing Institute of Geology and
Palaeontology, Academia Sinica, Chi-Min-Ssu, Nanjing 210008, The
People's Republic of China. Tel.: 631818, Telex: 34025 ISSAS CN,
Cable: 0657 Nanjing.

August 1-14, 1992

U.S.A. (Washington, D.C.)

Meeting to Focus on Global Change

Contact: ASPRS, Don Hemenway, 210 Little Falls Street, Falls
Church, VA 22046, U.S.A.

Edited by
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DK-1350 Copenhagen K
Danmark

April 7, 1991

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U.S.A.

September 6-11, 1991

CHINA (Nanjing)

SECOND INTERNATIONAL CONGRESS ON PALEOECOLOGY

Contact: Dr. Ma Yu-ying, Nanjing Institute of Geology and
Palaeontology, Academia Sinica, Chi-Min-Ssu, Nanjing 210008, The
People's Republic of China. Tel.: 631818, Telex: 34025 ISSAS CN,
Cable: 0657 Nanjing.

August 1-14, 1992

U.S.A. (Washington, D.C.)

Meeting to Focus on Global Change

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