

Second International Research Symposium on Clastic Tidal Deposits

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aware that irreplaceable parts of our scientific heritage lie forgotten. One wonders how we could let our geological heritage deteriorate to such a degree.

Anyone interested in geological conservation should be aware of *Geological Curator*, a journal published by the Geological Curators Group, and their *Guidelines for the Curation of Geological Materials*.

The workshops during Session 7 covered a number of topics from computer-generated labels to packing specimens for travel to methods for extracting plant fossils. The final day was devoted to storage design and materials for natural history collections. Presentations during this session perhaps best point out the serious problems facing museum collections by demonstrating what we know (or how little we know) about many of the materials that surround our specimens. Paper, plastic, fumigants, paint, and other materials all come into contact with specimens and, in many cases, their effects on specimens have been neglected or not understood. While a lot of work has been done in art and archival conservation, it is only recently that natural sciences collections have begun to receive the conservation attention they deserve.

A common theme presented by many of the participants was concern about long-term, subtle damage to specimens. The word "subtle" means not noticeable rather than referring to the seriousness of damage. Most geoscientists do not work in museums or manage large collections on a daily basis. Therefore, they may only observe acute damage such as physical breakage. As pointed out by several speakers at the conference, chronic problems caused by repeated handling, temperature and humidity fluctuations, vibration and oxidation may cause serious damage at imperceptibly slow rates. When museums consider storage over tens and hundreds of years, chronic effects are realistic considerations that must be dealt with by conservators and collections managers. SPNHC has taken a large step toward taking better care of our natural history collections. For those of us who collect, base our research on specimens, or manage collections, the SPNHC organization offers valuable information on preserving our natural sciences heritage.

Information about the Society for the Preservation of Natural History Collections and *Collection Forum* can be obtained from SPNHC, 5800 Baum Blvd., Pittsburgh, Pennsylvania, USA 15206.

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Second International Research Symposium on Clastic Tidal Deposits

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The First Symposium in this series was held in Utrecht in 1985. The proceedings were published in 1988 as *Tide-Influenced Sedimentary Environments and Facies*, edited by P.L. de Boer, A. van Gelder, and S.D. Nio (Reidel, 530 p.).

The Second Symposium, held in Calgary on August 22-25, 1989, was jointly sponsored by the Canadian Society of Petroleum Geologists (CSPG) and the Society of Economic Paleontologists and Mineralogists (SEPM). The meeting was co-chaired and efficiently organized by Ray Rahmani (Canadian Hunter Exploration) and Derald G. Smith (Department of Geography, U of Calgary). It was attended by 185 registrants. Field trips before, during and after the conference visited the Bay of Fundy, Peace River, Drumheller, the Columbia Ice Fields, Writing-on-Stone Provincial Park, and Willapa Bay (Washington State, USA). Most of the trips were well attended, and allowed considerable discussion of the outcrops and of issues related to tidal sedimentation raised by them and by papers presented at the symposium.

The Symposium itself consisted of two and a half days of oral presentations and poster displays, held at the University of Calgary; a half-day core and peel workshop, held nearby at the Energy Resources Conservation Board (ERCB) Core Research Centre; and a day devoted to a choice of field trips, the core/peel workshop, posters, or a Short Course, given by S.D. Nio. The Short Course was also offered before the meeting: a total of 182 persons registered. Though the Symposium extended over four days (not including field trips before or after the main session), most participants found that their time was fully occupied, and some complained that not enough time had been set aside for examination of posters and for discussion.

The oral presentations were organized around the themes of Quaternary Sedimentology, Tidal Rhythmites, Tidal Inlets, Tidal Flats and Fauna, Modern Sediments and Processes, Facies Models, Bedforms, and the Stratigraphic Record of Tides. It is obviously impossible to summarize all the papers, and what follows is largely a personal reaction to the presentations, ameliorated by input from several other registrants.

The dominant themes of the Symposium were subtidal sedimentation, estuaries, and the development and recognition of tidal rhythmites. Most notable by their near-absence were papers dealing in depth with intertidal sedimentation, though intertidal sediments were discussed in passing in many oral and poster presentations. An exception was Martini's discussion of the cold tidal flats of James Bay. The most exceptional features of these flats are that they are very wide, have a restricted fauna, and almost no tidal channels. This contrasted nicely with the paper by Zhuang and Chappell on mangrove-fringed, grassy and sandy tidal flats from SE Australia.

In his opening address, Middleton pointed out that tidal sedimentary environments are found in four major environmental complexes: estuaries and bays, barrier island complexes, tide-dominated shelves, and tide-dominated river deltas. Although 8 of the 12 largest rivers (ranked by sediment discharge) show strong tidal influence, none of them has yet been adequately studied by sedimentologists. This symposium, however, heard several papers dealing with major estuaries (defined geomorphologically as drowned river valleys rather than as regions of mixed salinity). Notable examples discussed were the Cobequid Bay / Salmon River system (Zaitlin and Dalrymple), the Gironde (G.P. Allen), and the James (Johnson, Nichols and Peebles), as well as several ancient examples, including the deposits seen on the Drumheller field trip (Rahmani), the Middle Devonian Mahantango (Duke and Prave), and several formations seen in the core workshop. My industry friends tell me that the search for tidal estuaries is now "hot" in the Alberta oil patch.

Facies models for estuaries were presented by several speakers at the conference, but agreement seems to be limited to a rather primitive level: estuaries generally are sandy at the head, with the sand supplied by a river, muddy in the center, and sandy at the mouth, with sand supplied from the coast (the tripartite model). This model works for the James and the Gironde, and for several small Australian estuaries, but is not true for some larger macrotidal estuaries such as the Cobequid/Salmon and the Severn, where sand comes mainly from the outer part of the estuary. Some estuaries, such as Chignecto Bay in the Bay of Fundy (Amos and Tee) are predominantly muddy, with the mud having multiple sources. The only paper to give a

fully developed facies model of an estuary, with a seismo-stratigraphic interpretation of extensive data from borings, was that presented by George Allen.

The present phase of interest in tidal rhythmites began with the description by Visser (1980: *Geology*, v. 8, p. 543-546; see also conference report in *Geoscience Canada*, v. 7, p. 33-34) of well preserved neap-spring cycles in "tidal bundles" preserved in Holocene subtidal cross-strata in the Netherlands. Subsequently several good ancient examples were described, but the supply seems to be temporarily exhausted, as no new ones were described at the symposium. Instead, interest shifted to finely laminated silty/fine sandy deposits in Australia (G.E. Williams), Oregon (Kreisa, Leithold and Bourgeois), and the Illinois Basin (Archer and Kvale), where fairly convincing tidal rhythms were related to a model of tidal modulation of prodeltaic (or distal ebb tidal delta) sedimentation. Another example of preserved neap-spring cycles was described from the upper tidal flats in the Salmon River estuary (Dalrymple, Makino and Zaitlin).

Large subtidal bedforms have been a topic of interest at meetings for some years, and the Calgary conference was no exception. At an SEPM conference in Austin in 1987, consensus was reached that use of the terms "megaripple" and "sand wave" should be discontinued in favour of "dune". Most speakers at Calgary seemed to have no serious objection to this proposal, though some had only just heard of it, as publication of the report (now in press in *Journal of Sedimentary Petrology*) has been delayed. The most striking results in Calgary were those obtained by S. Berné from several European shelves. His images of the internal structures of these "giant dunes", obtained using high-resolution seismic studies, considerably advanced our understanding of the internal structures of shelf sand dune fields.

Publications of the Calgary symposium, including the abstracts, several excellent field guides, a core and peel workshop guidebook, and a book of Short Course notes, can be purchased from the Canadian Society of Petroleum Geologists (#505, 206-7th Ave. SW, Calgary, Alberta T2P 0W7).

The next conference will be held in Wilhelmshaven, Germany, in 1992. For information write to B.W. Flemming, Senckenberg Institute, Schleusenstrasse 39a, 2940 WILHELMSHAVEN, West Germany.

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Friends of Igneous Rocks — Fourth Annual Meeting

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The Friends of Igneous Rocks met in Ottawa for a two-day meeting (August 24 and 25), followed by a field trip to the Timmins-Kirkland Lake area. This year's conference was organized by Tony Fowler and André Lalonde of the University of Ottawa and the Ottawa-Carleton Geoscience Centre and was a great success. The "Friends" gather each year (this is the fourth annual meeting) to present and discuss their research interests in igneous petrology. The setting is informal and fosters enthusiastic discussion and feedback.

This year's meeting began with a welcome by Keith Bell, director of the Ottawa-Carleton Geoscience Centre (OCGC). The technical presentations covered a diverse array of topics all very exciting and innovative.

Jim Nicholls of the University of Calgary showed how the Y-intercept on Pearce Element Ratio (PER) Diagrams can be used to discriminate between magma batches in historical lavas of Kilauea. He also explored the use of complex numbers ($X + iY$) in error analysis on PER diagrams. Pete Roeder of Queen's University surveyed the compositional range of chromites using the data in his comprehensive database of published analyses and presented new experimental data showing the strong effect of f_{O_2} , but the limited effect of total pressure, on chromite composition. He also introduced us to his versatile computer program for displaying and analyzing mineral chemistry data, including plotting spinel compositions on a spinel prism. Interested persons can contact Pete for a copy of this program.

Richard Ernst of the University of Ottawa and the OCGC interpreted magma flow in mafic dykes using the technique of anisotropy of magnetic susceptibility. In the Mackenzie dyke swarm (1270 Ma) in the vicinity of the Muskox intrusion, the magma was injected vertically while in the Great Abitibi

Dyke of the Abitibi swarm (1140 Ma) magma flow was subhorizontal. André Lalonde covered biotites in granites. Using data from the Hepburn and Bishop granites of Wopmay Orogen, he showed that biotite composition ($Fe/Fe+Mg$ ratio versus Al) is a sensitive measure of oxidation state and peraluminosity, parameters which are fundamental to granite origins and classification.

Tom Pearce from Queen's University gave a potpourri of current research topics: the possibility and potholes on the road toward automated interpretation of laser interferograms; application of PER diagrams to identify the composition and distribution coefficients of plagioclase crystallizing from liquids within plagioclase grains; and some startling applications (e.g., to feldspar zonation patterns) of the emerging new science of self-organization and chaotic systems. Keith Bell of Carleton U and the OCGC reviewed the Rb-Sr, Nd-Sm, Pb-Pb data on carbonatites and gave us the latest news on SCUM (subcontinental upper mantle). Canadian carbonatites seem to be wholly derived from SCUM while African carbonatites are explained by mixing of SCUM with asthenospheric mantle.

Sara-Jane Barnes from the Université du Québec à Chicoutimi detailed (with excellent field photographs) the internal structure of komatiite flows, and she outlined the evidence that spinifex-textured rocks represent crescumulates rather than quench textures. Tony Fowler and Robert Thériault discussed their work (done in collaboration with Dan Roach) on the applications of fractal geometry to disequilibrium rock textures. Tony Fowler gave a basic introduction to fractals. After reviewing various deterministic fractals such as the Koch Curve and the Cantor set, he described how to determine the fractal dimension of textural features such as dendrites, as well as of boundaries (e.g., crystal boundaries). The fractal dimension of the latter can be used as a measure of crystallinity. Robert Thériault described unusual branching pyroxenes from the Centre Hill gabbro (a stop on the field trip). These pyroxenes are fractal objects and Robert demonstrated various techniques for determining their fractal dimension.

In addition to the presenters, this year's conference was attended by Bob Baragar (Geological Survey of Canada (GSC), Ottawa), Mavis Stout (U of Calgary), and numerous students from both the Ottawa U and Carleton U campuses of the Ottawa-Carleton Geoscience Centre.

The field trip to the Timmins-Kirkland Lake area began immediately following the meeting. The morning's field work was devoted to rocks showing disequilibrium igneous textures and began with a stop at an outcrop of pillowed meta-basalt (Kinojevis suite) containing plagioclase spherulites (varioles) formed during crystallization of a liquid. Discussion centred around the mechanism of