

current groundwater conditions, and potential solutions to decreasing supplies. It focuses on climate change without a protracted discussion of global warming causes, but with innovative analyses of the consequences of groundwater withdrawals and changing climates over geological time-scales. Finally, Dragoni and Sukhija underline an important issue in their paper: the need for a high quality network of data collection, including groundwater-related data such as water levels and withdrawal or discharge rates. This has also been mentioned in other publications, but it is well worth restating.

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## History of Geomorphology and Quaternary Geology

Edited by **R. H. Grapes, D. Oldroyd and A. Grigelis**

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This Geological Society Special Publication resulted from the 2006 annual conference in Vilnius, Lithuania, of the International Commission on the History of Geological Sciences (INHI-GEO), which is affiliated with the International Union of Geological Sciences (IUGS) and the International Union on the History and Philosophy of Sciences (IUHPS).

The conference volume, which sells for US \$170.00 in North America, will be attractive to those who happen to be interested in one or more of the papers, all of which are on quite specific topics. Furthermore, there are several thorough and thoughtful papers that will serve as models for review and analysis of the history of topical and regional themes in these fields.

Topics addressed by the various papers include origin of the term Quaternary, several biographies, the history of ideas in regional geomorphology and glacial geology, Australian geomorphology, peneplains in China, as well as Japanese Quaternary history.

Individual papers deal with an introduction, Adolphe von Morlot's contribution to the term Quaternary, the Spokane Flood debates, pluvial lakes of the US West, evolution of the theory of continental glaciation in Europe, development of ideas on Pliocene and Quaternary glaciations in Europe, Kropotkin's 1876 monograph on the Glacial Period, Quaternary research in the Baltic countries, glaciomorphology research in Lithuania and Poland, work on the Quaternary of Lithuania, early ideas about erratic boulders and glacial phenomena

in the Netherlands, planation surfaces in China, the Palaeo-Tokyo Bay concept, Cenozoic history of Australia, desert dunes in Australia, early ideas on the development of the river systems in eastern Australia, early geological investigations of the Pleistocene Tamala Limestone in Western Australia, a Charles Cotton biography, and glaciation and earth movements in New Zealand.

The introduction by D.R. Oldroyd of the University of New South Wales and R.H. Grapes of Korea University is thorough in its review of past work on the history of geomorphology, including discussion on the pivotal roles of Davis and Penck in the discipline, and a review of historical analyses of their work, those that preceded them, and those that came after. They similarly review the roots of Quaternary geology. To complete their introduction, Oldroyd and Grapes then carefully discuss each of the disparate papers in the volume.

Broad reviews begin the volume, and the review of the term Quaternary by M. Klemun is timely, given recent discussion on usage of the term. V. Baker's paper on debates regarding catastrophic flooding in the US Northwest is an important case study in the way thinking can evolve that, at least, is relevant to geomorphology. The review of work on western US pluvial lakes by A. Orme is well structured with respect to its review of phases in the research back to initial recognition prior to 1870, while also examining current developments such as linkage of pluvial lake history to regional ecology and global climate. The paper on the evolution of the theory of continental glaciation in northern and eastern Europe by A. Raukas deals with early recognition of continental glaciation in Switzerland, as well as the influential figures who played a role in widespread adoption of this model.

Biographical papers and themes in European regional geology follow, beginning with an autobiographical account by E. E. Milanovsky that reviews his own work on the origin and development of ideas on Pliocene and Quaternary glaciations in northern and eastern Europe, Iceland, Caucasus and Siberia. T. K. Ivanova

and V. A. Markin then outline how the great later nineteenth century works in Quaternary geology by Piotr Alekseevich Kropotkin are little known in the west, at least relative to his writings in anarchist philosophy. A. Gaigalas reviews Quaternary research in the Baltic countries, including discussion on social and political context, and thoughtfully structures the article into periods ranging from nineteenth century to post-1990 progress. A. Gaigalas, M. Graniczny, J. Satknaš, and H. Urban review the work of Czesław Pachucki, considered a pioneer of modern glaciomorphology in Lithuania and Poland. O. Kondratienė and M. Stančikaitė then present a paper on studies of the Quaternary formations in Lithuania by Valerija Čepulytė (1904–1987) – the first woman in Lithuania to take a doctoral degree in geographical science. In the final paper on the European theme, F. R. Van Veen discusses early ideas about erratic boulders and glacial phenomena in the Netherlands.

Reviews of themes that relate to east Asia and Australia are the next set of conference papers in the volume, beginning with a paper on one hundred years of investigation on the planation surfaces in China by K. Zhang, followed by a paper on the Palaeo-Tokyo Bay concept by M. Yajima. Papers on Australia follow, beginning with a review of work on Australian Cenozoic history by D. Branagan, and followed by discussion on the study of desert dunes in Australia by C. R. Twidale, and a paper by D. R. Oldroyd on early ideas on the development of the river systems of the Sydney region of eastern Australia. Finally, W. Mayer discusses early geological investigations of the Pleistocene Tamala Limestone in Western Australia.

R. H. Grapes then presents a paper on New Zealand geomorphologist Sir Charles Cotton (1885–1970). Finally, M. S. Brook presents a review of the work of George Leslie Adkin (1888–1964) on glaciation and earth movements in the Tararua Range, North Island, New Zealand.

## Biochemical Controls on Paleooceanographic Environmental Proxies

Edited by **W.E.N. Austin** and **R.H. James**

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This publication comprises eleven papers presented at the 2005 meeting of the Geological Society of London, in a session entitled ‘Biogeochemical Controls on Palaeoceanic Proxies’. According to the opening paragraph of the book, the primary goal of the organizers was to have an interdisciplinary evaluation of the pros and cons of those proxies now widely used for paleoceanographic modelling and paleoclimatic reconstructions. A secondary goal was to provide a forum to describe techniques, largely untried but based on new, exciting research.

As a neophyte on the subject of proxies, my first question was, “What is the context in which the authors are using this term?” Fortunately, the editors William Austin and Rachael James had forestalled me. According to their definition in the Introduction, proxies are “... biogenic components which have a close relationship to environmental parameters and may be identified as so-called ‘proxy-variables’..., providing measurable descriptions of key climatic and environmental variables”. However, the definition of proxy in your standard dictionary is somewhat different than its use in the above sense.

The publication includes contributions that provide timely and necessary reviews, as well as those that represent original research. There are five general or review papers if we include the Introduction. Four papers highlight benthic foraminifera. Three

of the others focus on planktonic foraminifera, one on corals, and one on an intertidal acorn barnacle.

How does one review this interesting but somewhat eclectic series of papers? I decided that the most logical approach is to focus on subject matter. That was obviously what motivated the editors in their selection of the first three papers, which review the various proxies and analytical techniques. Following the brief but insightful introduction, James and Austin give a fascinating oversight of important biological and geochemical proxies and how they are of immeasurable value in paleoclimatic modelling and in interpreting paleoceanographic conditions. These authors point out that biologically produced carbonates are the biosphere’s largest carbon reservoir, with calcareous organisms affecting the oceans’ CO<sub>2</sub> and pH content and, hence, atmospheric CO<sub>2</sub>.

In the sections on the fossil groups, James and Austin cover foraminifera, coccolithophores, diatoms, corals and molluscs. These authors include the foraminifera in the Kingdom Protoctista, although recent classifications assign them to the Rhizaria. Oxygen isotope analyses of foraminifera are invaluable for indicating sea-surface temperatures, paleoclimates and salinity. An increasingly versatile proxy determined from foraminifera tests is the Mg/Ca ratio, which is an important paleothermometer. Other promising proxies are: the Sr/Ca ratio in coccoliths, which correlates with rates of organic carbon fixation and calcification; δ<sup>30</sup>Si and δ<sup>15</sup>N values in diatoms, which denote nutrient utilization; and Sr/Ca and U/Ca ratios in corals, which relate to sea-surface temperatures.

James and Austin note that serious obstacles to using geochemical proxy records in modelling are contaminants, preservation of the fossils, and recrystallization. Equally critical caveats are that the present may not be a true reflection of the past, so that established calibrations are variable, and that the proxy relationships for extinct species cannot be calibrated. Subsequent papers elaborate on some of the above concerns.

The paper on biomineralization by R.P.J. Williams evaluates inor-