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Editorial

From the late seventies to the present day, lacustrine sedimentology and lacustrine-related basin analysis have developed from a near-marginal academic curiosity into a new ground-breaking multidisciplinary body of learning. The starting-point was economic interest in ancient lacustrine sequences as potential suppliers of natural resources such as raw materials (diatomites, clays), evaporite salts and energy (hydrocarbons and coal). The early discoveries of substantial hydrocarbon reserves connected with lacustrine facies in the western USA heralded the huge reserves found later in China, Brazil, western Africa, southeast Asia and the Caspian Sea, among other places. As well, lacustrine successions often contain well-preserved records of regional to global environmental changes. Recognition of the importance of ancient lacustrine deposits, as archives of past global changes on continental surfaces has been growing at a rapid pace during the last fifteen years. Lacustrine sequences are often the best available record of past regional to global tectonic, climatic and palaeobiological situations. Tectonics and palaeoclimate are primary controls on short- to long-term evolution of lacustrine systems, although it is often difficult, indeed puzzling, to demonstrate their relative influence.

It has been three years since the completion of two successive International Geological Correlation Program projects, whose aim was to deepen understanding of the lacustrine systems through an international cooperative and coordinated task involving several groups of researchers from 32 countries all over the world. Much has happened since. The IGCP Project Number 219 on 'Comparative Lacustrine Sedimentology in Space and Time' (1984–1990) was followed by a later project (Number 324 on 'Global Palaeoenvironmental Archives in Lacustrine Systems' — GLOPALS, 1991–1995). IGCP Project 219 catalyzed interest in ancient and recent lacustrine successions in very different world zones and represented a major effort to begin compilation of a Global Geological Record of Lake Basins. In its turn, IGCP-324-GLOPALS was intended to continue this first effort an also to open discussion on methodological and technical questions of the study of ancient lake systems. The prosecution of these ambitious aims resulted in several regional meetings (Istanbul–Ankara, Turkey, 1991; Madrid–Salamanca, Spain, 1992; Connecticut, Pennsylvania, USA, 1993; Varsaw–Zittau, Poland, 1994; Antofagasta–S. Pedro de Atacama, Chile, 1995) and a major congress (First International Limnogeological Congress — ILIC, Copenhagen, Denmark 1995). This latter event resulted in many stimulating discussions and an outstanding set of papers, which have recently been published in this journal (Vol. 140).

The papers assembled in this special issue of *Palaeogeography, Palaeoclimatology, Palaeoecology* are in turn the outcome of the meeting on 'Recent and Ancient Lacustrine Systems in Convergent Margins' which was sponsored by the IGCP (UNESCO–IUGS) and IAS. The meeting was held at Antofagasta, Chile in 1995 and was accompanied by a field trip investigating several aspects of the ancient to recent lacustrine systems in the arc and fore-arc zones of northern Chile. The meeting was based on the central idea that major advances in the understanding of the lacustrine record will come from integrating Earth and Life Science disciplines rather than from extreme specialization. Convergent margins were seen as a key because they were the setting for a wide variety of lacustrine systems. The number of ancient and recent lakes developed in subduction and collisional margins is large; and the studies

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on lacustrine basins in episutural and perisutural regions began before the start of the twentieth century. Research on lacustrine systems in orogenic settings was hampered by the variety and intensity of interaction between magmatic, tectonic and sedimentary processes. This obvious and yet subtle interplay between internal and external driving forces, so well recorded by the sensitive lacustrine systems, continues to enthuse researchers.

As mentioned before, there is a long tradition of using lacustrine sedimentary records as palaeoenvironmental archives. More recent studies have focused on ancient to recent lacustrine systems in active orogenic settings, since a lot of information has been gathered on the climatic changes probably triggered or enhanced by mountains rising in large thrust-fold belts where tectonic and sedimentary mass transfer processes occur. The widespread existence of recent and ancient lacustrine systems in or near recently active orogens, has provided many opportunities for examining late Cenozoic to Recent palaeoclimatic changes which affected these processes. Therefore, Tertiary to Recent lacustrine basins in currently or relatively recently active orogens give rise to thought-provoking case studies which establish and test models of interplay between tectonic, magmatic and sedimentary processes. When ancient and recent lacustrine systems in diverse orogenic zones are compared, many shared features are recognized, but also many noticeable and sometimes striking differences arise.

The objectives of this special volume were mostly to provide new data and views on lacustrine depositional processes and lacustrine system evolution in some recent and ancient convergent margins. In fact, the volume illustrates the increasingly diverse range of approaches to analysing lacustrine successions in convergent and collisional settings.

The geographical distribution of the contributions to this issue is wide but not uniform. Seven of the eleven papers span a Pacific convergent margins (northern Chile, central Mexico and southern Argentina) and present results from late Neogene to Holocene lacustrine systems which developed mainly in volcanic arc and fore-arc settings. The important convergent–collisional Mediterranean Alpine belt is tackled by two papers: on the Oligocene–Miocene, the peripheral foreland basin of the Pyrenees (Ebro basin) and on a Miocene piggyback basin in the Central Apennines (Le Vicenne). Finally, the case study of a late orogenic, fault-controlled basin in the Lower Devonian Old Red Sandstone of Scotland represents the ancient Caledonian belt.

Ignoring their geographic locations, the diverse papers included in this volume have been ordered according to their thematic affinities. Given the meeting was held in northern Chile, a substantial contribution came from the international research groups working there. Therefore, the volume includes a first group of five papers which provide a snap-shot of some of the ongoing research projects on lacustrine evolution and palaeoclimatic record in the late Neogene to Holocene arc and fore-arc basins of the southern Central Andes. Sáez et al. provide a palaeoenvironmental and palaeogeographic overview of the late Neogene lacustrine record in the Quillagua–Llamara basin, whereas Chong et al. focus on the geochemical signatures in the halite-dominated successions of the closely related Salar Grande. The importance of tectonics in the Upper Miocene–Pleistocene evolution of the Calama basin is emphasized by May et al., whereas Gaupp et al. point to the probability of significant palaeoclimatic control of the Mio–Pliocene sedimentation in the intra-arc Lauca basin. A high-resolution insight into the Holocene lacustrine deposition in the intra-arc zones close to the Atacama Altiplano is provided by Valero-Garcés et al. The difficulties in deciphering the meaning and relative influence of tectonic and climatic driving forces on the lacustrine record are made explicit in these contributions. Several conceptual debates in these papers deal with gathering criteria and arguments either in favour of one alternative or of the interplay of both factors.

Sedimentary facies models and tectonosedimentary analysis are the main scope of the second group of papers. Arenas and Pardo focus on the facies model and palaeogeographic evolution of latest Oligocene–Miocene low-gradient lacustrine systems in a peripheral foreland basin (central Ebro basin, southern Pyrenean region, northeast Spain) and emphasize the substantial importance of asymmetrical contributions from surrounding, tectonically active basin margins. Cipollari et al. describe the thrust-top lacustrine-lagoonal basin evolution in a Late Miocene (late Messinian) accretionary wedge

in the Central Apennines (Le Vicenne basin, Italy) and point to the structural control of evolving thrusts on the hydrochemistry of ancient lacustrine zones connected with open sea. Finally, Clarke and Parnell propose a depositional model of a back-tilted lacustrine basin in a Lower Devonian strike-slip zone of Scotland. They emphasize the role of the late orogenic evolutionary stages in the generation of oil source rocks and traps in lacustrine systems.

The importance of the palaeobiological record for the analysis of ancient lacustrine archives is highlighted by the last three contributions, which examine fossil diatoms, ostracods and palynomorph assemblages. Gliozzi analyzes a Late Miocene (late Messinian) brackish-water ostracod assemblage from Le Vicenne basin (Central Apennines, Italy), provides additional palaeobiological support to some of the features of basin evolution discussed in the paper by Cipollari et al. and discusses the Paratethyan affinity of the faunal assemblage. Israde and Garduño put forward an evolutionary tectonosedimentary trend to explain the Late Miocene to Holocene lacustrine zones in the Trans-Mexican Volcanic Arc. They focus on the evolution of the late Neogene Cuitzeo palaeolake system and on fossil diatom assemblage analysis. Whatley and Cusminsky discuss on the late Quaternary lacustrine ostracods from the Lake Cari–Laufquen region (Río Negro Province, Argentina) and place them in their palaeoenvironmental and evolutionary context.

In summary, the contributions to this special volume fulfil two aims. They represent a heterogeneous combination of single case studies, and synthetic and conceptual approaches embracing several basin types and tectonic and depositional frameworks. Therefore, they increase our knowledge of the lacustrine successions in some previously poorly known regions and fit another piece into our space- and time-scattered jigsaw of the lacustrine record. We should be aware that we are still some way from the full picture, but all these pieces draw us closer to our final aim. Further, the examples described show how widespread the occurrence of diverse lacustrine systems is in tectonically influenced zones. They also reinforce the understanding of the significance of even relatively minor tectonic structures in triggering short-term, sharp hydrological changes in lake systems, which in some cases may nest other minor, higher-frequency changes whith probably have more to do with climate.

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(Guest-Editors)