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PREFACE

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This volume contains 54 of the 120 papers presented at the Conference on Quaternary Deserts and Climatic Change held at Al Ain, United Arab Emirates, from December 9 to 11, 1995 under the auspices of the International Geological Correlation Program (IGCP-349). The Conference was organized by A.S. Alsharhan, United Arab Emirates University and K.W. Glennie of the University of Aberdeen.

The Conference had the following objectives: (1) to exchange and collate information on climatic change within desert regions so as to better understand reasons for local short- and long-term changes; (2) to date the timing of past dune and wadi activity and so improve our understanding of natural subsurface water resources and the relative rates of depletion versus recharge; (3) to use Quaternary desert history as an analog for the better understanding of ancient desert sequences of economic importance (reservoirs for water and hydrocarbons in, for example, the Arabian Gulf, the North Sea, USA); (4) to learn from errors on the ecological management of arid areas; and (5) to improve our understanding of all aspects of deserts. In this respect, Arabia, and especially the Emirates, has much to offer to the rest of the world.

The papers are distributed over the following chapters:

1. Quaternary sedimentation and diagenesis,
2. Dunes and inland sabkhas,
3. Fluvial and Wadi systems,
4. Quaternary climatic changes,
5. Geochemical applications to Quaternary deserts,
6. Remote sensing,
7. Quaternary analogs to ancient and recent sediments,
8. Archaeology, and
9. Glossary.

Many of the papers in this volume emphasize the alternations of wet and dry climatic phases experienced by today's deserts during the past 200,000 years in Arabia, North and South Africa, Australia, India, the Far East and North America. They described recent applications of lake and soil calcretes as palaeoclimatic indicators, NaCl crystals as paleothermometers, chlorine percentage as a proxy for recharge, groundwater character and its tie to the diagenetic history of the geologic record, and luminescence dating techniques recording how the times of deposition of both wind and water-transported sediment can now be dated with considerable accuracy.

Some papers established a strong time correlation between extremes of aridity and the glacial maxima of high-latitude in many areas, especially those of the northern hemisphere. Similarly, times of northern hemisphere interglacials were also matched by wetter periods in the desert. Nevertheless, some modern desert margin areas experienced a higher rainfall during the glacial maxima while in contrast, the coastal part of the Namib Desert in southern Africa has possibly been almost continuously hyperarid for the past 40 million years (Ma), responding to the influence of the Benguela Current. Other papers dealt with Remote Sensing and Archaeology with an emphasis on evolving climate and man's response to desert change.

So much water was stored as land ice during the last glacial that, at its maximum, global sea level fell by some 100 to 130 meters (m) and the Arabian Gulf dried out to become the site of southward-migrating sand dunes. The post-

glacial rise in sea level cut off the supply of sand to the United Arab Emirates from the north. The wind continued to blow, however, so that in the present near-coastal areas, the sand surface was deflated down to the water table, thereby creating both coastal and inland sabkhas. The influence of wind, blowing from a somewhat different direction, enabled later sand to partly swamp the dunes of glacial age.

Using the adage 'the Present is the key to the Past', it is now clear that the evidence uncovered from Quaternary deserts and their climatic changes had its counterparts in the geologic record. For instance, back in the Permian when deserts existed in northwest Europe and North America, glaciers existed over parts of Gondwana, including southern Arabia. At this, and at other geologic times, aeolian sands were important climatic indicators but often tended to form only thin units in the geologic record.

It appears that glacial lowstands of sea level coincided with dry climates in the vicinity of the tropics of Cancer and Capricorn, and that the effects of these dry periods could be important in terms of aeolian erosion and transport of unconsolidated sediment but often resulted in relatively insignificant aeolian accumulations. This probably is because many regions of desert sedimentation, both Quaternary and in the past, either were not subsiding or did so at very low rates, and therefore could not accommodate great thicknesses of sediment. The sedimentary fill of the Rub' al Khali Basin, for example, was deposited over a time span of 4 Ma but only locally reaches a thickness of 160 +50 m, the basin being by-passed through lack of accommodation space, and dune sands now flanking the mountains of Yemen reach an altitude of 1,200 m. In contrast, up to 2,000 m of desert sediments in northwest Europe were deposited in the rapidly subsiding intracratonic Permian Rotliegend basin in around 8 Ma or less. A lack of crustal subsidence, may explain why thin wedges of tidal-flat carbonates on cratonic margins often represent long periods of time in the geologic record.

Interestingly, the aeolian carbonate sands of the UAE are confined to the coastal zone because they were cemented early; further inland, the fragile grains were reduced to dust and removed in suspension. Elsewhere, there is a continual battle for dominance between wind and water. Dunes thrive in arid lands, but the rare flash flood can remove the evidence of years of aeolian activity. This is clearly seen in Namibia, for example where the Kuiseb River forms an abrupt boundary preventing the northward migration of the Namib dunes. Similarly the Wahiba Sands of Oman are truncated by the occasional fluvial activity of Wadi Batha in the north, while Wadi Andam controls its western flank. As can be seen from the contents list, this volume contains papers that describe and discuss many different aspects of the above themes from a wide variety of countries and desert settings.

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