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FOREWORD

The papers in this *Memoirs* volume are based on presentations at a workshop* that addressed environmental changes in Antarctic coastal areas during the Holocene. This period, which extends over the last 10000 years, represents the Earth's most recent environmental excursion. Understanding the dynamics of this recent climate system and its major components is a necessary first step in developing accurate predictions about future environmental events and responses. One of these major components is the cryosphere, and on the Earth today, 90% of the ice is located in Antarctica. The Antarctic ice sheets influence poleward temperature gradients, oceanic circulation patterns, water mass formation, and sea level. The relevance of Antarctic coastal areas is that they contain integrated environmental records about the glaciological, geological, chemical and biological dynamics around the continent during the Holocene (Fig. 1).

The Antarctic coastal zone is the circumpolar region which is directly impacted by ice-sheet expansion, retreat and melting. Most of the 32000 km of Antarctic coastline is occupied by ice shelves, ice streams, ice walls and outlet glaciers (Table 1). When the ice sheets extend into the ocean, coastal marine habitats are eliminated. During periods of ice-sheet retreat, coastal marine habitats are impacted by pulses of meltwater that

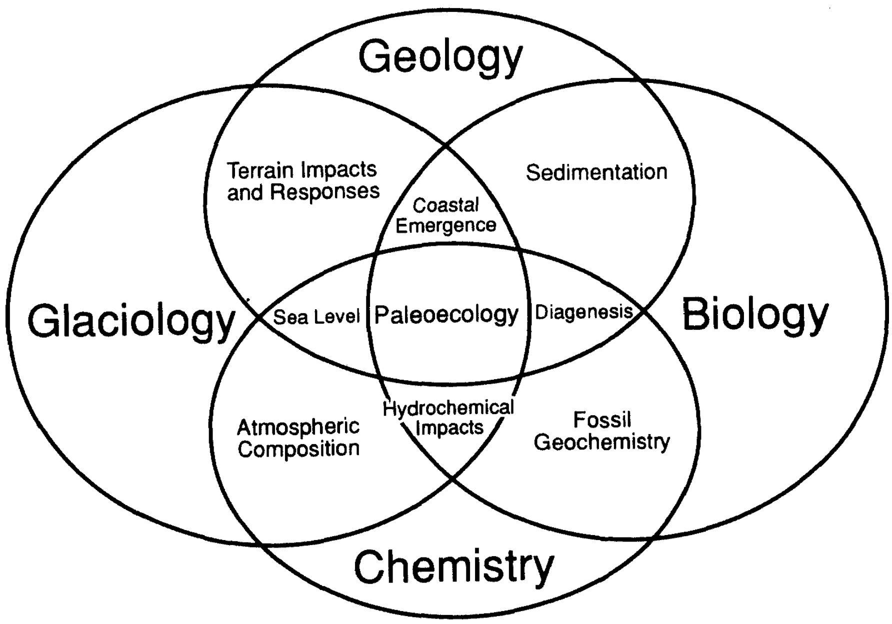

Fig. 1. The rosette of interdisciplinary research in Antarctic coastal areas during the Holocene.

*Based on discussions from the "International Workshop on Holocene Environmental Changes in Antarctic Coastal Areas" which was held at the National Institute of Polar Research in Tokyo, Japan, from October 20–23, 1993. Workshop Participants: AHN, I.-Y. (Korea); BARONI, C. (Italy); BERKMAN, P. A. (U.S.A.); HAYASHI, M. (Japan); KIM, Y. (Korea); MCMINN, A. (Australia); MORIWAKI, K. (Japan); WADA, H. (Japan); YOSHIDA, Y. (Japan); and ZHANG, Q. (China).

Table 1. Coastal types around the Antarctic margin (from DREWRY *et al., 1982).*

	Distance (km)	Coastal percentage
Ice shelf	14110	44
Ice walls	12156	38
Ice stream/outlet glacier	3954	13
Rock	1656	5
Total distance	31876	

alter their hydrochemistry. The reduced ice volume also will affect the isostatic emergence of these coastal habitats and their associated marine fossils. Analyzing the interaction between Holocene climate changes and ice-sheet marginal variations can best be interpreted in these coastal areas where the initial impacts in the marine environment occur.

Within the Holocene, however, the relationship between the Antarctic ice sheets and the ocean is poorly understood. Sea level has risen more than 30 m over the last 10000 years (FAIRBANKS, 1989), but there is no definitive evidence about the meltwater source. It has yet to be determined whether the Antarctic ice sheets contributed 25 m of meltwater to Holocene sea level (NAKADA and LAMBECK, 1988; TUSHINGHAM and PELTIER, 1991) or less than 2.5 m (KIRK, 1991; COLHOUN *et al.*, 1992). Over shorter time scales, the relationship between the Antarctic ice sheet and decadal oceanographic climate shifts (DAYTON, 1989) also has not been resolved. The underlying unknown is the dynamics between the Antarctic ice sheets and climate during various time intervals over the last 10000 years (ALLEY and WHILLANS, 1991; JACOBS, 1992).

Antarctic ice-covered areas contain high-resolution Holocene records of environmental change (CIAS *et al.*, 1992). Comparable high-resolution records also are found in adjacent offshore areas (DUNBAR *et al.*, 1985; DOMACK *et al.*, 1991). In the exposed coastal oases around the continent there are numerous lakes (PICKARD, 1986; GREEN and FRIEDMANN, 1993), moraines (SUGDEN and CLAPPERTON, 1980; DENTON *et al.*, 1989) and raised beaches (YOSHIDA, 1983; ZHANG and PETERSON, 1984; BERKMAN, 1992; BARONI and OROMBELLI, 1994) which often contain biological records of past environments. These geological, chemical, glaciological and biological phenomena represent an integrated framework for interpreting the dynamics between the Antarctic ice sheets, sea level and climate in a circumpolar context during the Holocene (Fig. 1).

Interdisciplinary and international research in Antarctic coastal areas ideally complements the broad objectives of the Scientific Committee on Antarctic Research and the International Geosphere-Biosphere Program (WELLER and LORIUS, 1989). It is our hope that these presentations will facilitate the shared task of hypothesis development and interpretation of Holocene environmental variability in Antarctica.

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