Introduction

Calcareous microfossil based paleoceanographic studies in the Northwestern Pacific are lagging behind their North Atlantic counterparts. There is presently no deep water formation in the North Pacific and the deeper water (Pacific Deep Water) that reaches the Pacific Basin is much older and and therefore CO_2 under-saturated. With its great depth and corrosive deeper waters, sediments occurring above the present-day carbonate compensation depth are rare. As a result, there is an extreme scarcity materials suitable for foraminifer or calcareous nannofossil studies. The understanding of the past and present oceanographic processes in the North Pacific, however, remains an essential part of global climate research. It is twice as large as the North Altantic Ocean and it is believed to be an important sink for atmospheric CO_2.

Recently, a number of relatively long and uninterrupted sediment cores were collected by the research vessel *R/V Hakurei-Maru* at Shatsky Rise, Northwestern Pacific, under the "Northwest Pacific Carbon Cycle Study" of the Kansai Engineering Co. Ltd. by the New Energy and Industrial Technology Development Organization. Three cores (NGC 102, NGC 106, and NGC 108), strategically located along a north-south transect, were selected from

this site for the present study. The study area is situated along a narrow zone where the axis of the eastward extension of the Kuroshio Current (Kuroshio Extension) passes. The present sub-artic frontal boundary is located just north of this area and is estimated to be between 40-45^{0}N latitude. Regions at or very near oceanic frontal boundaries are ideal sites for paleoceanographic studies (Kenneth, 1980); potentially preserved in these areas are records documenting migration of frontal boundaries associated with the Pleistocene climatic oscillation. Highest glacial-interglacial changes in sea surface temperatures (SST) have been recorded in mid-latutude transitional areas (CLIMAP, 1976; Moore *et al.*, 1980; Thompson, 1977, 1981). In the Northwestern Pacific, southward migration of the Oyashio Cold Current has been well documented (*e.g.* Moore *et al.* 1980; Thompson 1977; Chinzei *et al.*, 1987; Xu and Oda, 1995). In addition, this oceanic frontal boundary where the Oyashio and Kuroshio current merge is a region of intense mixing and therefore of high primary productivity. It is also believed to be a prime location for the formation of North Pacific Intermediate Waters (Reid, 1965). Primary paleo-productivity estimates for this region based on organic carbon accumulation rates as well as benthic foraminiferal data (Kawahata *et al.*, 1997, *in press*; Ohkushi, 1998 MS)

indicate increased primary productivity during the glacial stages relative to interglacials. Several theories have been proposed to explain the observed increased glacial productivity in this region. It may have been a direct consequence of the migration of the highly productive sub-arctic water mass during glacial periods (Kawahata et al., in press) and subsequent reorganization of the water column (Xu and Oda, 1995); or related to increased supply eolian derived biolimiting elements such as phosphorous (Kawahata *et al.*, 1997) and iron (Martin, 1992). These underscore the importance of understanding how sea surface conditions have varied through time, and how this relates to the observed changes in primary productivity. The primary objective of this research is to reconstruct sea surface conditions in the area for the late Quaternary using planktic foraminiferal census data. From the planktic foraminiferal data, sea surface temperature (SST) is estimated using both the planktic foraminiferal transfer function FP-12E and the modern analog technique and the results compared. Movement of the sub-artic waters, the Kuroshio Extension, and the sub-tropical waters are traced using spatial and temporal abundance data of such species as *Neogloboguadrina pachyderma* (sinistral), *Globigerina quinqueloba*, *Pulleniatina obliquiloculata* and *Globorotalia truncatulinoides*.

As in all calcareous microfossil based paleoceanographic studies however, the effect of carbonate dissolution should be addressed before the faunal data can be fully interpreted. Ideally, only well preserved sediments where carbonate dissolution is minimum should be used. As previously stated, this condition is quite rare in North Pacific marine sediments. As will be proven later, all three core samples have been subject to dissolution effects albeit at different intensities. A secondary objective of this research is to document the timing and maginitude of carbonate dissolution/preservation in the Northwestern Pacific.

The paper is divided into two parts: 1) carbonate dissolution/preservation history, and 2) sea surface paleoceanography. Discussion of carbonate dissolution history, although a secondary objective, takes precedence over sea surface paleoceanography as the results of the former potentially affects interpretation of the latter.