Diatom and radiolarian Summer Sea Surface temperature estimations and sea ice reconstructions for the LGM (16-19.5 ka) in the Southern Ocean

Selection of LGM samples to be included to MARGO data base
No visual indication of major dissolution and reworking and regional fitting of temperature and sea ice estimates.

SST Reconstruction (Southern Summer)

SST reconstruction only represents SOUTHERN SUMMER SST (SSST)

IKM Rads R55/23/4 Standard deviation of estimate ±1.2°C (Abelmann et al. 1999)

IKM Diat D93/29lg/3 Standard deviation of estimate ±0.7°C (Zielinski and Gersonde, 1997; Zielinski et al, 1998)

MAT Diat, follow up of the data set published in Crosta et al. (1998), Standard deviation of estimate ±0.85°C

Sea Ice Reconstruction (diatom record)
Sea ice has been estimated
a) by using MAT (Crosta et al. 1998) in terms of month per year (Standard deviation 0.53 month per year) and sea ice concentration (percent concentration of sea ice,, Standard error: 30%)
b) based on the percent occurrence of sea-ice indicator species (>3% in total assemblage = average sea ice presence, 1-3% maximum sea ice extent) (Gersonde and Zielinski, 2000).

MARGO sea ice information is provided as

- 0/1
0 = No sea ice (sea ice <0.5 month/year is considered as no-sea ice)
1 = Presence of winter sea ice
This MARGO Antarctic sea ice information indicates maximum occurrence of WINTER SEA ICE.

- Average August sea ice concentration (%)

Definition of Qualitative Levels for IKM (Imbrie&Kipp Method) Summer Sea Surface Temperature Estimation based on Radiolarians and Diatoms in the Southern Ocean

Level 1: Communality > 0.8
  + T difference between rads and diatoms <1.5°C

Level 2: Communality > 0.7-0.8
  + T difference between rads and diatoms <1.5 °C

Level 3: Communality < 0.7
  For diatom estimates only: T difference between rads and diatoms > 1.5°C

Comparison between diatom and radiolarian estimates indicates that diatom estimates obtained from Subantarctic and warmer core location may be biased towards colder temperatures due to selective dissolution of diatom species. Considering this observation quality levels of diatom estimates obtained from locations where both diatom and radiolarian estimates are available have been downgraded to ensure that radiolarian estimates will be used preferentially at these locations. The observation also indicates that all other diatom estimates from Subantarctic and warmer sites that lack radiolarian estimates should be treated with caution. In case of the occurrence of no-analog LGM samples the quality level has been downgraded to 3 when no-analogs presented the majority of the LGM samples at the individual core locations.

Definition of Qualitative Levels for MAT Summer Sea Surface Temperature Estimation based on Diatoms in the Southern Ocean

The quality level is based on the dissimilarity (Index of distance between the fossil and the modern analogues – 0 means the assemblage is equal, and 1 means it is totally different)
Level 1: Dissimilarity 0-0.1

Level 1: Dissimilarity 0.1-0.2

Level 1: Dissimilarity 0.2-0.25

Dissimilarity levels above 0.25 indicate no-analog situations.

General information on provided MARGO data set (November 2003)

Total number of Diatom IKM and MAT LGM observations 106
Stratigraphy Level (SL) 1: 12 obs., Level 2: 37 obs, Level 3: 19 obs, Level 4: 38 obs,
Quality level (QL) 1: 45 obs, Quality Level 2: 50 obs, Quality Level 3: 11 obs
Observation with SL + QL better than 3: 42

High number of SL Level 4 observations is due to the inclusion of LGM observations based on single sample estimates (1 sample per LGM interval) representing the CLIMAP LGM level.

Total number of Rad IKM LGM observations: 19
Stratigraphy Level (SL) 1: 2 obs, Level 2: 16 obs, Level 3: 1 obs. ,
Quality level (QL) 1: 5 obs, Level 2: 11 obs., Level 3: 3 obs.
Observation with SL + QL better than 3: 15