Conclusions

Prior to c. 8000 cal. years BP sedimentation of a lake sediment record from western Ymer Ø, East Greenland, was strongly influenced by a high terrigenous sediment supply, probably due to glacier retreat in the catchment. From at least 7800 cal. years BP, the pollen record well reflects the general climatic development of interior East Greenland during the middle and late Holocene, in contrast to the biogeochemical record that indicates strong fluctuations of the organic matter deposition. These differences may be due to differing areas and time scales being represented by both records. The pollen record obviously indicates the slower reaction of landplants on environmental changes, and integrates over a larger area. The biogeochemical record, in contrast, probably reflects oscillations of the ice cap to the northeast of the lake, which created a periodically increase of a local terrigenous sediment supply and, in addition, affected the faster reacting bioproduction within the lake.

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Mineral Dust Record from the Antarctic Epica Ice Core

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ABSTRACT. Insoluble dust concentration and size distribution of particles from the Epica ice core drilled at the Dome C (Antarctica) has been investigated over the first 580 meters. The ice core provides an atmospheric aerosol record from the Last Glacial Maximum (LGM) period to the present. The sampling resolution is about one sample per four metres for the Holocene period (i.e. one sample per 150 years) and one sample per 3 metres for LGM (i.e. one sample per 300 years) respectively. Samples have been analysed using a 256-channel Coulter Counter Multisizer IIe, allowing detection of particles with diameter greater than 0.7 microns. Both the profiles of the total microparticle number and mass concentration evidence a sharp decrease from high LGM value to the Holocene value. The mean dust number and mass concentration of Holocene samples are about 4000 particles/g and 15 10-9 g per g respectively both represent a value 50 times lower than LGM concentrations. The volume-size distribution of the particles shows a mode centred around 2 microns and fairly changes over the different climatic period. Moreover, at the end of the climatic transition, the Epica core suggests a slight increase in dust concentration during the Antarctic Cold Reversal that is new from Antarctic records. This event seems analogous to the dust reappraisal recorded in Greenland ice at the time of the cool period of the Younger Dryas. Beside the natural variability of data, the Holocene record suggests a slight but significant general decreasing tendency with the time. This trends seems also observed in several others record from East Antarctica.

KEY WORDS: ice core, dust concentration, Antarctica, Last Glacial Maximum, Holocene.

Introduction

Insoluble dust concentration and size distribution of particles have been investigated over the first 580 meters of the new Epica ice core drilled at the Dome C (75°06'S, 123°24'E) in the framework of the European Project for Ice Coring in Antarctica (EPICA) during the field seasons 1997/98 and 1998/99. The ice core provides an atmospheric aerosol record of about the past 30,000 years, i.e. from the latest part of the last glaciation including the Last Glacial Maximum (LGM) to the present.

Methods and material studied

The sampling resolution is about one sample per four metres for the Holocene period (i.e. one sample per 150 years) and one sample per 3 metres for LGM (i.e. one sample per 250 years), respectively.

Samples have been analysed using a 256-channel Coulter Counter Multisizer IIe©, allowing detection of particles with diameter greater than 0.7 microns.

Results and discussion

Both the profiles of the total microparticle number and mass concentration evidence a drastic decrease from LGM to the Holocene of a factor of about 50, corresponding to a flux ratio of about 26. Mean Holocene levels are about 4000 particles/ml and 14.5 ppb, while for LGM these values are 195,000 part/ml and 777 ppb respectively.

The insoluble aerosol carried by atmospheric winds to Antarctica has mainly a continental origin (Briat et al., 1982; Gaudichet et al., 1988); mineralogical analyses on microparticles entrapped in ice from East Antarctica (Gaudichet et al., 1986, 1988, 1992) have evidenced high proportions of illite (~ 30%) that is a world-wide detritic component of sediments, feldspars (~ 18%) and crystalline silica (~ 15%), whose abundance is used in continental and deep sea sediment records as a continental aridity index. This mineralogical species are mixed with lower proportions of other clay minerals such as smectite (~ 7%), chlorite (~ 3%) and kaolinite, and with metallic oxides, amorphous silica, chlorite, colloids, amphiboles and pyroxenes, carbonates and volcanic glasses.

Recent investigations on the isotopic fingerprints ($^{87}Sr/^{86}Sr$ and $^{143}Nd/^{144}Nd$) of continental aerosol from Vostok and Dome C cores and reconstructions of atmospheric circulation patterns derived from studies on the volcanic ash provenance (Basile et al., 1997a) have supported the hypothesis already suggested by some authors (e.g. Gaudichet et al., 1986) of the southern South America origin of the dust carried to East Antarctica, with a possible admixture of a small contribution (10–15%) from south Africa and/or Australia.

Moreover, Basile et al. (1997a) suggest that the region of provenance has been the same both during interglacial and glacial times: in these ones however the source area was considerably more expanded, since the lowering of the sea level of about 120 m caused the emergence of the Argentine continental shelf.

The high atmospheric dust load in glacial times observed in the EPICA ice core has been observed also in many paleoenvironmental archives such as polar and low-latitude ice cores (e.g. Hammer, 1985; De Andelis, 1987; Steffensen, 1997), marine (e.g. Rea, 1994) and terrestrial sequences (e.g. Kukla, 1989). It is linked to many factors such as the increased aridity on the continental land masses (change in soil moisture and/or in vegetation cover), the enlargement of the dust-source areas caused by sea-level lowering (Jossaume, 1990; Petit et al., 1981), the more vigorous atmospheric circulation from low to high latitudes generated by the steeper meridional temperature gradient (COHMAP Members, 1988) and the reduction in the hydrological cycle leading to less efficient scavenging by precipitation and consequently to a more efficient transport of dust (Jossaume, 1989; Hansson, 1994; Yung et al., 1996).

An important feature in the dust profile of the EPICA core can be observed during the Antarctic Cold Reversal phase of the isotopes (see Fig. 1), where microparticle concentration increases up to about two times the mean Holocene level. This higher dust input is quite an important paleoclimatic signal that has never been observed before in other Antarctic ice core records; in fact, even if this feature does not resemble a return to glacial conditions it may be the imprint of a cooler and drier mid-deglaciation phase that may have involved the source regions of dust.

This dust increase reminds the one recorded in Greenland ice cores at the time of the cold Younger Dryas event (e.g. Fuhrer et al., 1999): however, timing and amplitude are very different since in the Greenland records the aerosol concentration returned as high as in glacial times and dust variations are strictly linked with the isotope changes.

From the onset of Holocene conditions to modern times the dust concentration evidences, beside natural variability of data, a slight decreasing trend, probably suggesting a reduction of the dust source (primary production and mobilization).

The volume-size distribution of the particles shows a mode centred around 2 microns along the whole core length; moreover, glacial particles appear much more well-sorted than Holocene ones. This results compare well with those previously calculated in the old Dome C core (Royer et al., 1983) and with those of Vostok (De Angelis et al., 1984; Mounier, 1988). However, a shallow increase in particle mode can be observed in the second part of the Holocene; it may be linked to changes at the source regions, that are the highest latitudes of southern South America.

The EPICA dust record therefore gives new and important contributions to paleoenvironmental reconstructions, on one side, but also opens new and original questions about past climate dynamics for which further investigations are needed.

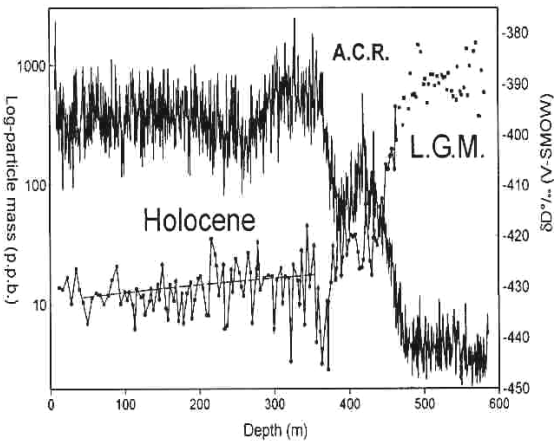

Fig.1. Mass concentration of EPICA ice core (ppb) and Deuterium profile.

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Speleothems and Upper Pleistocene Climate - New Results from Caves in Germany

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ABSTRACT: Here we present and discuss new dating results obtained from speleothems of caves in southern Germany. So far, four stalagmites from three caves have been dated by the Uranium-series TIMS (Thermion Mass Spectrometry) method. Their dates range from MIS 5e to MIS 2. Two stalagmites from the Klaus-Cramer Cave in the Bavarian Alps yielded ages around 125 ka BP. The Upper Pleistocene part of a stalagmite from the Sontheimer Cave (Swabian Alb) grew throughout MIS 5. A stalagmite from the Hintere Kohlhalden Cave (Swabian Alb) started to grow 21 ka BP, i. e. during the Dansgaard/Öschger Interstadial 2.

KEY WORDS: speleothems, Uranium-series (TIMS) dating, Upper Pleistocene climate, South Germany.

Introduction

In 1999 our two groups (Kempe and Rosendahl, Univ. of Technol. Darmstadt; Eisenhauer, GEOMAR, and Wiegand, Univ. of Göttingen) began to cooperate in a project entitled "Sinter and Palaeoclimate in Central Europe during the Pleistocene". The project mainly focuses on the analysis of speleothemes from caves in different German karst regions (Kempe and Rosendahl, 1999). To start we focused on samples from southern Germany, i.e. the Franconian- Swabian Alb (with more than 6000