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NATIONAL MEETING ON ANTARCTIC GLACIOLOGY

Padova, June 11th - 12th, 1996

ABSTRACTS

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PROGRAMMA NAZIONALE DI RICERCHE IN ANTARTIDE

CONVEGNO NAZIONALE DI GLACIOLOGIA ANTARTICA

Padova, 11-12 giugno 1996

ITALIAN ANTARCTIC RESEARCH PROGRAMME

NATIONAL MEETING ON ANTARCTIC GLACIOLOGY

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Dipartimento di Geografia "G. Morandini"
Università degli Studi di Padova
Via del Santo, 26 - 35123 Padova (Italy)

Foreword

Scientific interest in Antarctica has more and more grown in the last decades, owing to the fact that Antarctica plays a critical role in Global Change. Glaciological and palaeoclimatic studies contribute towards our knowledge both of the global change in progress and of those that have occurred in the past, essential for the construction of reliable forecasting models.

Among the environmental problems indicated by the term "Global Change" perhaps the one that causes most concern is the sea level rise, presently evaluated at around 1.5 mm/year.

The role of the great polar ice sheets, in particular in the Antarctic is uncertain. Each year a quantity of snow equivalent to a 6 mm layer of water covering the entire area of the oceans is accumulated in Antarctica. It is not yet clear whether this accumulation is returned, diminished or incremented, to the sea through iceberg calving, melting of the ice shelves, etc. It is fundamental to know through an assessment of the mass balance, whether the Antarctic Ice Sheet today contributes towards, or instead slows down, the rise in sea level, and even more, what its role will be if there is a further increase in global warming.

Another important problem is the early diagnosis of the variations in the extent, the features and the dynamics of Antarctic glaciers, obtainable by comparisons of satellite images, repeated GPS geodetic measurements, controls of particular glacial bodies such as small glaciers and frozen lakes, by means of repeated measurements of networks of stakes, comparisons of digital models obtained from different series of aerial photographs, recording of variation in the levels of lakes, etc.

The ice shelves play an important role in the balance of the Antarctic glaciers and of the oceans as part of their volume displaces ocean water; with their movements they feed the iceberg calving. Moreover the ice shelves undergo processes of both melting and freezing, while growth of ice occur at their base. Modelling of the ice shelve is one of the primary objectives of Antarctic glaciology. This aims to tackle the question of ice-atmosphere-ocean interaction, with special attention to the role played by the polynyas and of preparing forecasting models in the various possible scenarios of evolution of the global climate.

The study of the "ice cores" has been the most significant advance in the field of palaeoclimatology in recent years, producing quantitative and detailed data, year by year, of numerous parameters directly linked with the climatic variables or even supplying compositional analyses of the atmosphere in the past.

The Pacific sector of the East Antarctic Ice Sheet is among the least known regarding the necessary data for assessing the Mass Balances, and has been indicated as one of the priority areas for this type of studies.

Victoria Land, where there is an ice field with complex of mountain glaciers terminating in ice shelves and ice tongues, constitute an analogue of the Antarctic Peninsula and is of special interest for the early monitoring of on-going changes in the Antarctic land ice. The Nansen and Hell's Gate ice shelves, characterised by partial or total surface ablation and basal freezing, and connected with the facing polynya of Terra Nova Bay, form a single system in the Ross Sea, particularly important for the study of the ice-atmosphere-ocean

interaction, also in relation to the role the ice shelves play in the stability of the Antarctic Ice Sheet. Shallow drillings in the Pacific sector of the eastern ice sheet are of importance in the Antarctic context for obtaining data on the average annual accumulation and its variations in the last 2 millennia, and for obtaining documentation on the recent activity of the nearby Mt. Melbourne volcano, presently a dormant volcano, of use also for identifying reference horizons of continental importance. Victoria Land and the adjoining Antarctic plateau areas of accumulation (snowfields and a peripheral culmination of the ice sheet) are particularly suitable for the study of the climatic and environmental evolution of this sector, exposed as it is to the circum-Antarctic cyclonic storms, and to it comparison with the Holocene glacial history of the Antarctic borders.

Sampling and coring into the marine sediments of the Ross Sea floor is solving two main problems: the relations glaciations-sea level changes and ages and dynamics of the rifting which generated the Ross Sea Rift System. This process can be detected through the information gained by the volcano-tectonic and sedimentary evolution studied on the cores.

Periglacial morphology and studies on Antarctic permafrost are a matter of great interest since the beginning of the Italian Antarctic exploration.

The Italian glaciologists have been recently involved in international Antarctic programmes, such as the European Project of Ice Coring in Antarctica (EPICA), the International Transantarctic Scientific Expeditions (ITASE) and the international project for mass balance evaluation supported by the SCAR. In particular the Italian glaciologists played a major role in the geophysical and geodetic surveys necessary to locate the deep ice drilling at Dome C. Long range oversnow traverses under Italian responsability are planned for the 96/97 and 97/98 field seasons. The evaluation of the mass balance of the Pacific sector of the East Antarctic ice sheet has been assigned to the Italian glaciologists in the framework of a general attempt to evaluate the contribution of the Antarctic ice sheets to the sea level rise.

The glaciology project is currently involved in systematic search for meteorites and in the study of the meteorite trap at Frontier Mountain. The search for meteorites yielded very satisfactory results with the recovery of about three hundred ninety meteorites.

Facing those scientific items, the present National Meeting on Antarctic Glaciology (CONGA - Convegno Nazionale di Glaciologia Antartica) will be held in Padova on June, 11th-12th 1996 at the Department of Geography "G. Morandini", organized by the Operative Unit GLA 24 under the Patronage of the ENEA, the Comitato Glaciologico Italiano, the University of Padova and the Department of Geography.

It follows two previous meetings, the first held in Rome (ENEA-Casaccia Centre) in 1994 and the second in Milan (Department of Environmental Sciences of the University of Milan) in 1995. The congress gives to the researchers involved in glaciological and paleoclimatological research in the frame of the Italian Program for Antarctic Research (PNRA - Programma Nazionale di Ricerche in Antartide) the opportunity to meet and to establish the state-of-the-art of Italian antarctic glaciology.

About three dozen of abstracts, dealing with oral communications and posters, are collected in this special issue of the "Materiali" of the Department of Geography, University of Padova, devoted to the CONGA.

Contributes are quite disomogeneous, relating both with strategic projects and minor research programmes, field reports of the past expedition and planning of future programmes. They highlight the lively activity of the research party of Glaciology and Paleoclimate, which is also witnessed by the large number of participants.

The meeting occurs at the end of the first eleven years during which, after the first scouting of the area and the testing of the scientific instruments and equipments, the aims and the methods of the research have been improved and directed to specific topics, with a sharp and precise outcome.

If the general aim of the party is both to detect the past climate and present processes (mainly to forecast the mass balance of the inlandsis), from the topics of the submitted papers we can identify the following (of course often linked each to the other) matters of interest:

- ice shelves (Hell's Gate and Nansen): ocean water circulation models under ice shelves, mass balance, GPS applications and ice corings;
- outlet glaciers and local glaciers;
- snow accumulation in the northern Victoria Land and physical and chemical data of recent snowfalls;
- glacial and periglacial morphology, thematic mapping and remote sensing;
- permafrost;
- sea-floor sediments, in their sedimentological, geotechnical, palaeoenvironmental, glaciological and geophysical aspects; ocean sediments drifts;
- climatological analyses;
- stable isotopes analysis, physical and chemical analysis, trace elemnts and atmospheric dust concentration in ice cores;
- antarctic glacial history and sea level changes;
- GPS and geodetical applications; GPS strain nets monitoring;
- meteorites collection and traps; GIS applications.

The variety of themes of research highlights the multithematic and multidisciplinary approach to the antarctic environment, in which scientists demonstrate that collaboration is not even possible, but the right key to obtain valuable results.

In the submitted papers, the wide participation of foreign scientists points also out the international co-operation in Antarctic research, which is at the basis of an actual scientific progress.

In our opinion a valuable achievement was obtained by the access of young scientists both to research and to the antarctic expeditions, even when not yet employed in the government institutions. In such a manner, a staff of skilled researcher will grow up, and its scientific production increase in consideration.

The Organizing Committee aknowledges with gratitude the sponsoring Organizations who supported the meeting: the PNRA, the University of Padova and the Department of Geography.

Aldino Bondesan *Mirco Meneghel* *Giuseppe Orombelli*

PAPER SESSION

Abstracts

Abstracts are listed in alphabetical order by the family name of the first Author

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Recent Planktic Foraminifera in Joides Basin (Ross Sea)

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Recent planktic foraminifera in Joides Basin were collected in two array of floating traps moored in two stations (St.11c and St.15c) positioned during ROSSMIZE CRUISE (November-December 1994) (see Tab. 1).

Station	Date	Latitude	Longitude	Depth (m)
15c-traps mooring	12/12/1994	74°00'117S	175°01'696E	577
15c-traps retrieving	12/13/1994	74°02'866S	175°06'189E	583
11c-traps mooring	12/13/1994	74°42'411S	175°07'280E	416
11c-traps retrieving	12/14/1994	74°42'484S	175°06'298E	415

Table

In each station four traps were positioned at 50-100-150-200 m water depth and were retrieved after 13 hours (St.11c) or 12 hours (St.15c). The content of each trap was filtered at 0.45μm and examined although it was not possible to distinguish living and dead specimens.

Almost the totality of the specimens are left coiling and the following two morphs were recognized:

morph A: subspheric and very thickened test, 4-4½ chamber in the last whorl, aperture with a lip;

morph B: lobate and thin walled test, 4-4½ chambers in the ventral side, aperture with a lip, depressed sutures, greater final chamber.

According to BÈ (1960), KENNETT (1966) and LIPPS & KENNETT (1974) these morphs belong to the subpolar species *Neogloboquadrina pachyderma* (EHRENBERG). In literature morph B is known to represent the early stage of the life cycle living in the surface water and morph A is the terminal stage. During the latter one *N. pachyderma* moves to deeper waters (>200 m) producing the typical thickened test. The result of this study confirms the above pattern. In fact morph B was found in the uppermost traps (50 and 100 m) while morph A in the deepest ones (200 m).

Foraminifera fluxes show some differences between the two stations:

1) in St.11c the flux calculated at 50 m depth is 399 specimens m^{-2} day^{-1}. St.15c displays a lower value (216 spec. m^{-2} day^{-1}) at the same depth.

2) at 100 m depth St.11c shows the minimum value (66 spec. m^{-2} day^{-1}), while in St.15c the flux is higher (324 spec. m^{-2} day^{-1}). St.15c presents the lowest value (72 spec. m^{-2} day^{-1}) at greater depth (150 m).

An explanation of the above discrepancies could be the different depth of the chlorophyll maximum in the two stations. *N. pachyderma* is an erbivorous species, symbiont lacking

and living in polar and subpolar areas. KOHFELD (1995), in a study carried out in artctic areas on *N. pachyderma* collected with tows and sediment traps, related max abundances of this species with chlorophyll maximum. Preliminary results of ROSSMIZE cruise (AA.VV. 1995) show chlorophyll maxima at 40 m and 60 m depth respectively in St.11c and St.15c. This suggests that in St.15c the food availability for *N. pachyderma* extended to depth greater than 50 m, confirming that the *N. pachyderma* max abundances are somewhat related to the chlorophyll maxima.

Finally additional factors can be responsible of the observed differences in the flux values, e.g. predation, foraminifera settling velocity and the fact that *N. pachyderma*, capable to live in the ice interstices, is released in the sea water during ice melting.

References

AA. VV. (1995) - *Programma Nazionale di Ricerche in Antartide. Rapporto sulla Campagna Antartica Estate Australe 1994-95.*

BÈ A.W.H. (1960) - *Some observations on arctic planktonic Foraminifera.* Contr. Cush. Found. Foram. Res., 11 (2), 64-68.

KENNETT J.P. (1966) - *The fauna of Ross Sea: Part 6, Ecology and distribution of Foraminifera.* New Zealand Department of Scientific and Industrial Research, Bull. 186. New Zealand Ocean. Inst., Mem. 46, 47pp.

KOHFELD K.E., FAIRBANKS R.G., SMIRH S.L. & WALSH I.D. (1995) - *Decoupling of abundance and geochemical signals of Neogloboquadrina pachyderma (left) in polar marine sediments, as seen in plankton tows and sediment traps.* Abstract, 5th International Conference on Paleoceanography (Halifax, Nova Scotia, Canada, 10-14 October 1995), p. 163.

LIPPS, J.H. & KREBS, W.N. (1974) - *Planktonic foraminifera associated with Antarctic Sea ice.* Jour. Foram. Res., 4 (2), pp. 80-85.

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Lead in Antarctic Snow: a Possible Tracer of Aerosol Origin and Pathway in the Southern Hemisphere

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Several studies have recently been devoted to the identification of the possible origins and relative contribution of the most important sources of aerosols reaching the Antarctic ice sheet. Both the last glacial maximum (LGM) and the present climatic conditions have been considered. Some of the studies are based on natural variations in the isotopic composition of lead (ROSMAN et al., 1994), and neodymium and strontium (GROUSSET et al., 1992), while others consider the mineralogical nature of clay species (GAUDICHET et al., 1992), general atmospheric circulation models (GAUDICHET et al., 1992) and the spatial distribution of major ion concentrations (DE ANGELIS et al., 1992; DELMAS & PETIT, 1994). When different tracers are considered, however, contrasting hypotheses on aerosol origins are reported.

The anthropic, long-distance contribution to the lead content of Antarctic snow has increased markedly during the present century, particularly since leaded gasoline has begun to be used as car fuel. Pb concentration, which was about 2 pg/g at the beginning of the century, increased rapidly (particularly since the 1950s) to about 10 pg/g in the mid-1970s (GÖRLACH & BOUTRON, 1992; WOLFF & SUTTIE, 1994). In more recent years the trend was suddenly inverted and decreasing values were observed for snow deposited during the last 1-2 decades both in the Atlantic sector (Coats Land) (WOLFF & SUTTIE, 1994) and the Pacific sector (Victoria Land) (BARBANTE et al., 1996) of East Antarctica. This last pattern has already been attributed to the increased use of unleaded gasolines in the countries of the Southern Hemisphere. Nevertheless, while the maximum lead content observed in Coats Land occurred approximately in 1975 (WOLFF & SUTTIE, 1994), the peak in Victoria Land happened in the mid-1980s (BARBANTE et al., 1996).

Statistical data on leaded gasoline consumption in the major Southern Hemisphere users of the product (such as Brazil and Australia), show that metal emission into the atmosphere follows approximately the same general increasing pattern observed in the Antarctic snow. However, they also highlight, interestingly, that the reduction of emission in South America (especially Brazil) began approximately 10 years earlier than in Australia.

This communication presents our laboratory's updated lead data from the Victoria Land region and compares the Antarctic trend of lead content in snow with known lead emissions into the Southern atmosphere. A close relationship is observed between lead emissions in South America and the lead content in the snow of Coats Land and between lead emissions in Australia and lead in the snow of Victoria Land.

This findings make it possible: (i) to confirm that the introduction of low lead gasolines has been reflected in a marked decrease of lead concentration in Antarctic snow and, (ii) to hypothesize that, under the present climatic conditions, aerosols reaching the Atlantic and

Pacific sectors of East Antarctica originate mainly in South America and Australia, respectively.

Acknowledgements

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References

BARBANTE C., TURETTA C., CAPODAGLIO G. & SCARPONI G. (1996) - *Recent decrease in the lead content of Antarctic snow*. Int. J. Environ. Anal. Chem., in press.

DE ANGELIS M., BARKOV N. I. & PETROV V. N. (1992) - *Sources of continental dust over Antarctica during the last glacial cycle*. J. Atmosph. Chem., 14, 233-244.

DELMAS R. J. & PETIT J. R. (1994) - *Present Antarctic aerosol composition: a memory of ice age atmospheric dust*? Geophys. Res. Lett., 21, 879-882.

GAUDICHET A., DE ANGELIS M., JOUSSAUME S., PETIT J. R., KOROTKEVITCH Y. S. & PETROV V. N. (1992) - *Comments on the origin of dust in East Antarctica for present and ice age conditions*. J. Atmosph. Chem., 14, 129-142.

GÖRLACH U. & BOUTRON C. F. (1992) - *Changes in heavy metals concentrations in Antarctic snows from 1940 to 1980*. J. Atmos. Chem., 14, 205-222.

GROUSSET F. E., BISCAYE P. E., REVEL M., PETIT J. R., PYE K., JOUSSAUME S. & JOUZEL J. (1992) - *Antarctic (Dome C) ice-core dust at 18 k.y. B.P.: Isotopic constraints on origin*. Earth Planet. Sci. Lett., 111, 175-182.

ROSMAN K. J. R., CHISHOLM W., BOUTRON C. F., CANDELONE J. P. & PATTERSON C. C. (1994) - *Anthropogenic lead isotopes in Antarctica*. Geophys. Res. Lett., 21, 2669-2672.

WOLFF E. W. & SUTTIE E. D. (1994) - *Antarctic snow record of southern hemisphere lead pollution*. Geophys. Res. Lett., 21, 781-784.

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Chemical Profiles of Snow Pits and Shallow Firn Cores from Campbell Glacier (Northern Victoria Land, Antarctica)

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The chemical composition of snow and firn samples was studied to investigate the contribution from the different emission sources (marine biogenic activity, sea, crustal, volcanic, etc.) in the different geographic positions. Moreover CH_3SO_3, no sea salt (nss) SO_4 and H_2O_2 give a seasonal signal that can be useful to evaluate accumulation rate of snow and ice.

A snow pit (2 m in depth) was dug in the Campbell Ice Tongue (74°41' S-164°30' E), at about 6.5 km from the cliff, and 50 m a.s.l., during the 1994-95 Italian Antarctic Expedition. Another snow pit (1.4 m) was dug in the Campbell Glacier at about 800 m a.s.l. (74° 15' S-164°04' E). At the bottom of this pit a core (2.02 m) was collected. Finally, a core (6 m) was taken at the altitude of 1560 m from the same glacier (73 45' S-163° 20' E).

Samples were stored frozen. Then after surface cleaning in cold room, they were sub-sampled and stored in pre-cleaned polyethylene containers and sent to laboratory where they were melted in clean room before chemical analyses.

Analyses of Na, K, Mg, Ca, CH_3SO_3 (MSA), Cl, NO_3, SO_4 were performed by ionic chromatography (Dionex 2020i). The separations were obtained with ion-exchange columns Dionex AS5 (NaOH 5 10^{-4} N and NaOH 3 10^{-2} N eluents) and Dionex CS12 (methane sulfonic acid 20 mM eluent) for anions and cations respectively.

H_2O_2 was analyzed by an electrochemical detector (ANTEC mod."Decade") in which the potential of the cell was at 650 mV.

Some of the more important features of studied samples are here reported.

Samples from Campbell Ice Tongue are characterized by a high level of dissolved impurities due to the influence of marine spray. The concentration of major constituents is very high in the first 60 cm and it decreases in the lower part of the core.

Figure 1, that shows the Campbell Ice Tongue and Drygalski Ice Tongue Na profile (CAPRIOLI et al. 1996), points out the extremely high concentration of Na in the upper levels of the Campbell Ice Tongue.

Some of those levels are characterized by a high content of no sea salts (nss) SO_4 and NO_3. The enrichment of nss SO_4 can be explained supposing a reaction between H_2SO_4 and NaCl with production of Na_2SO_4 and HCl that can be fractionated before their deposition (LEGRAND et. al., 1988). In this way enrichment or depletion of those two compounds are possible.

At present we are not able to give information about the causes of the high enrichment of sea salt. Anyway the determination of $\delta^{18}O$, δD and analysis of meteorological data could allow a better understanding of the processes that determined the chemical characteristics of Campbell Ice Tongue samples.

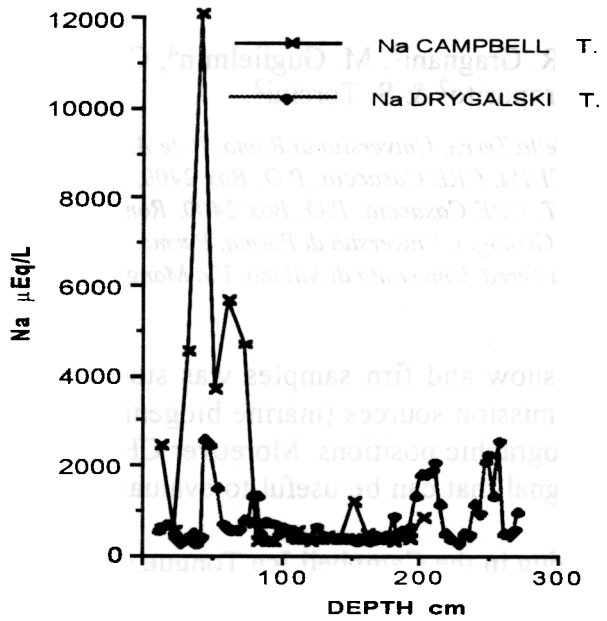

Figure 1 - Na in the Campbell and Drygalski Ice Tongues profiles

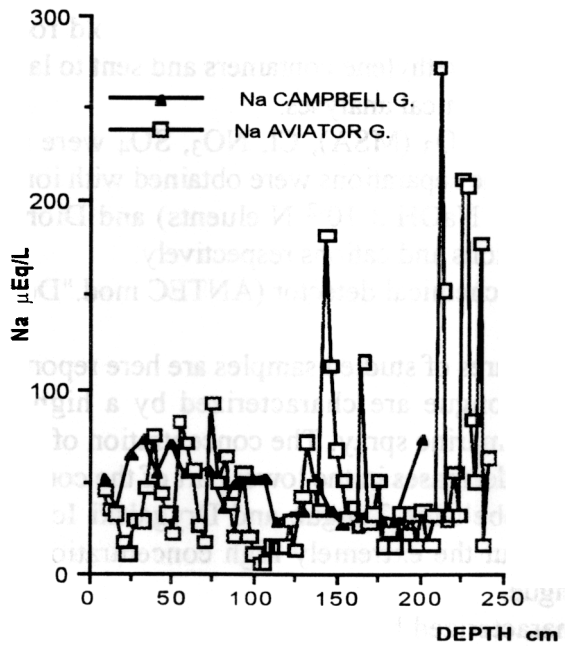

Figure 2 - Na in the Campbell and Aviator Glaciers profiles

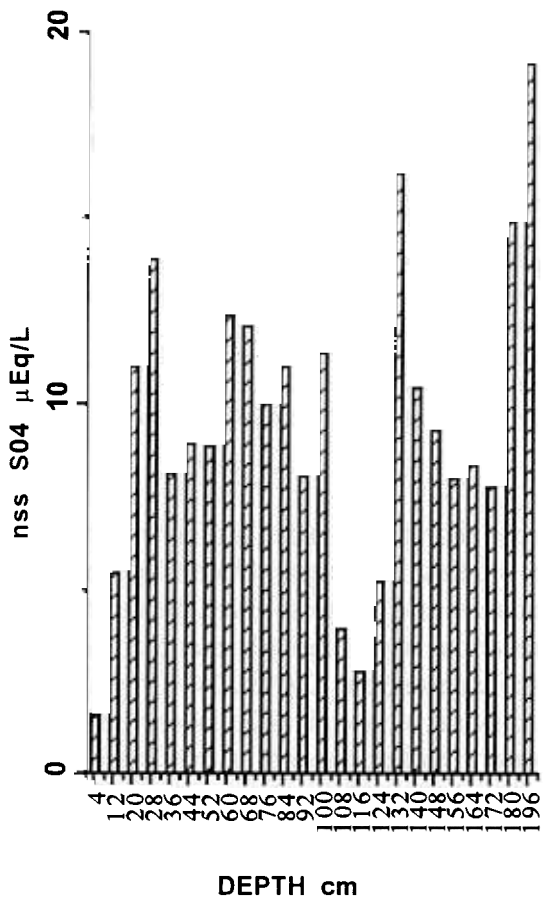

Figure 3 - nss SO_4 in the Campbell Glacier profile (at 800 m a.s.l.)

The firn samples from Campbell Glacier (800 m a.s.l.) show a content of dissolved salts that is in the range of the values found at the terminal part of Aviator Glacier (Fig. 2, CAPRIOLI et al., 1996).

MSA, nss SO_4, NO_3 and Ca profiles show a rather good definition and two annual cycles could be represented. In Fig. 3 the distribution of nss SO_4 is reported as an example.

Acknowledgements

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References

LEGRAND M., LORIUS C., BARKOV N. I. & PETROV V. N. (1988) - *Vostok (Antarctica) ice core: atmospheric chemistry changes over the Last Climatic Cycle (160,000 years)*. Atmos. Environ., 22, 317-331.

CAPRIOLI R., DELLA VEDOVA A. M., GRAGNANI R., GRIGIONI P., MAGGI V., SERRA F., STENNI B. & TORCINI S. (1996) - *Stratigraphic, isotopic and chemical profiles of a firn core from Drygalski Ice Tongue and a snow pit from Aviator glacier (Northern Victoria Land, Antarctica).* Terra Antarctica, in press.

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Preliminary results of two 45-meters marine ice cores from the Nansen Ice Sheet (Terra Nova Bay, Antarctica)

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The glaciological Italo-Belgian collaborative work in the Terra Nova Bay area has focused on Ice Shelf bottom mass balance studies. Melting and freezing processes at the base of ice shelves are only a matter of recent scientific progress given the restricted accessibility to the ice shelf-ocean interface. Until recently, it was thought that three major zones exist under ice-shelves with different mass-balance regions (ZOTIKOV, 1986). Close to the grounding line, active freezing was thought to occur (although never observed) where fresh continental basal meltwater enters into sea water. Further seaward, slow freezing (observed at J9, Ross Ice Shelf) is occurring by simple conduction through the ice-shelf. Finally, strong melting was invoked close to the ice shelf front, under the influence of warm oceanic summer surface waters. In the last decades it has been shown both in the field (by remote and direct measurements - for example, THYSSEN, 1988 and OERTER et al., 1992) and theoretically (by modelling - for example, JENKINS, 1991) that deep thermohaline circulation in a continental shelf cavity generates melting at grounding lines and thick marine ice accretion under certain zone of the ice shelf.

Our previous work at Campbell glacier Tongue and Hell's Gate Ice Shelf (HGIS) has revealed the existence of two different types of marine ice formed at grounding lines, either by "double-diffusion" freezing of fresh continental basal meltwater seeping though the sea floor sediment, or by filling of narrow crevasses forming where the glacier gets afloat (SOUCHEZ et al., 1995). Moreover, Hells Gate Ice Shelf was considered as an ideal location ("outdoor laboratory") for detailed study of ice-ocean interactions and marine ice production, as a result. It allowed us to build a model of ocean circulation below the ice shelf and to suggest that both ocean circulations mode-1 and mode-3 (JACOBS et al., 1992) are effective under HGIS, the latter being linked with a process of marine ice transfer at the base of the ice shelf, impeding the net melting effect of warm ocean surface waters, forced below the ice-shelf front by tidal activity (TISON et al., 1996).

The question arose whether these observations were atypical of larger floating ice bodies, like, for example, the Nansen Ice Sheet. Remote measurements (FREZZOTTI et al., this symposium) suggested that large amounts of marine ice accretion should occur to sustain the mass balance determined from satellite images aerial photographs and GPS ice surface elevation measurements. A few $\delta^{18}O$ measurements gave intermediary values between continental ice and sea ice (FREZZOTTI, personal communication).

In order to check these assumptions an extended air survey across the main body of the Nansen Ice Sheet was performed to search for marine ice outcrops. Ice texture measurements of surface samples allowed discrimination between continental ice, surficial lake ice and marine ice, and revealed the occurrence of large fields of marine ice outcrops, mainly located at the limit of major individual ice flows, a situation similar to the one observed in the upper area of HGIS, and, on a larger scale and at depth, at the Filchner Ronne Ice Shelf (FRISP report n°9). Again, the intense activity of the katabatic winds provides us here with a unique opportunity to sample these marine ice bodies directly from the surface. Most of these major outcrops are initiated in the highly crevassed zones thought to represent the grounding area at the foot of the Reeves Glacier and of the smaller ice bodies flanking Mont Nansen.

One of the outcrops was chosen to locate two 45-meters deep ice cores, one as close as possible from the grounding line (7.5 kilometers), the other about 10 kilometers downstream, on the flank of the first large rift dissecting the Nansen Ice Shelf.

This work presents preliminary results from 5-meters intervals depths of the two ice cores. Thin sections, salinity measurements, major cations and $\delta^{18}O$ measurements where performed on the samples and lead to the following conclusions:

- thick layers of marine ice indeed sustain the mass balance of the Nansen Ice Shelf;
- they form as a "welding unit" between individual flows of continental ice getting afloat at the grounding line;
- all variables suggest large scale deformation processes (folding) bringing more recent layers from a lower depth at a higher elevation in the profile, and it therefore complicates comparison with other deep marine ice cores;
- however, as in other marine ice cores, the facies is mainly orbicular and very low salinity units are encountered (down to $60\mu Scm^{-1} \sim 0.07\%$ salinity), suggesting accretion from circulation mode-1 exclusively in this upstream area;
- as in ice cores from the "pinched" marine ice outcrops at Hells Gate Ice Shelf, a "string-lined" facies strongly develops in the more stressed areas;
- as in ice cores from HGIS, the least saline units are also showing the highest chemical fractionation. Furthermore they also display the most vigorous "string-lined" facies. Since these are most likely representing the sheared crystals from higher depths, this supports the idea of a decreasing salinity and increasing chemical fractionation as one goes down a stratigraphically undisturbed profile. This is coherent with observations in other deep marine ice core (OERTER et al., 1992) and with the reconstructed sequence at HGIS (TISON et al., 1996);
- the highest salinity units are up to $500\mu Scm^{-1}$ (1.2‰ salinity). They are higher than the maximum value observed in the higher parts of marine ice cores from the Filchner-Ronne and Amery ice shelves. This probably reflects very fast consolidation under near-atmospheric conditions in the crevassed area at the grounding line, and therefore confirms that units of higher salinity are located higher stratigraphically in the undeformed sequence.

References

JACOBS S.S., HELMER H.H., DOAKE C. S. M., JENKINS A. & FROLICH R. M. (1992) - *Melting of ice shelves and the mass balance of Antarctica.* J. of Glaciol., 38 (130), 375-387.

JENKINS A. (1991) - *A one-dimensional model of ice shelf-ocean interaction.* J. Geophys. Res., 96, 20671-20677.

OERTER H., KIPFSTUHL J., DETERMANN J., MILLER H., WAGENBACH D., MINIKIN A. & GRAF W. (1992) - *Ice-core evidence for basal marine shelf ice in the Filchner-Ronne Ice Shelf.* Nature, 358, 399-401.

OERTER H. (Ed.) (1995) - *Filcher-Ronne Ice Shelf Programme (FRISP) - Report n°9* - Alfred Wegener Institute for Polar and Marine Research, Bremerhaven, 128 pp.

SOUCHEZ R., TISON J.-L., LORRAIN R., FLÉHOC C., STIÉVENARD M., JOUZEL J., & MAGGI V. (1995) - *Investigating processes of marine ice formation in a floating ice tongue by a high resolution isotopic study.* Journal of Geophysical Research, 100 (C4), 7019-7025.

THYSSEN F. (1988) - *Special aspects of the central part of Filchner-Ronne Ice Shelf,* Antarctica. An. Glaciol., 11, 173-179.

TISON J.-L., BARBANTE C., LORRAIN R., BONDESAN A., STIÉVENARD M., BOUZETTE A. & CAPRA, A. (1996) - *Ice shelf water and marine ice production in the frontal zone of Hells Gate Ice Shelf (Antarctica): implications on mass balance,* in prep.

ZOTIKOV I. A. (1986) - *The thermophysics of glaciers,* 275 pp., Reidel, Dordrecht.

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Confirmations of Coreless Winter in the Region of Terra Nova Bay (Northern Victoria Land, Antarctica) and Comparisons with the Permafrost Thermic Regime

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The "coreless winter" phenomenon consists in some significative period of thermal inversions during the winter seasons, especially in July (MEINARDUS, 1938; VAN LOON, ALLISON at al., 1993).

The analysis of data recorded by AWS stations located in the Terranova Bay area from PNRA lets to recognise coreless winter events in this region (GRIGIONI et al., 1992). The research made with data of 1987-1994 period confirms this phenomenon; in all 9 recording stations the data show some periods of increasing temperature scattered since June to August with increases of the monthly mean air temperature (fig. 1). The phenomenon is particularly evident in July, when the mean increase of temperature was about 2 °C.

Since 1989 the National Institute of Vulcanology of Catania surveys the soil temperature in the M. Melbourne at 1.5 and 2.4 m depth. The data collected let a comparison with air temperature data (in the fig. 2 is shown the location of soil temperature stations around the M. Melbourne).

The mean monthly temperature of soil at 1.5 m depth ranges between -34.37 °C recorded in 1994 August in the station named Vil (2030 m a.s.l.) and -2.08 °C in 1994 January in the station Fal 1 (800 m a.s.l.) (Fig. 3).

At 2.4 m depth the temperature of soils ranges between -33.54 °C of 1994 September (Vil) and -7.35 °C of February 1993 (Fal 1).

The annual trend of the temperature at 1.5 m depth is characterised by a maximum in correspondence of January in the Fal 1 e Vil stations and in February in the other stations, while the minimum value changes every year and in a different way for each station.

In the winter season some months show values with an inverse tendency against the annual pattern; these episodes could be related to the coreless winter recorded by AWS stations. This phenomenon is present in all four stations during the July of 1992 and 1994 whereas in three stations is recorded also another event during 1993 June.

These increases of mean monthly temperature range from 4.3 °C (July 1993 in Fal 1) to 0.7 °C (July 1992 in Cont).

At 2.4 m depth the monthly differences are smaller but synchronous to those recorded near the surface.

The daily values of temperature at 1.5 m depth recorded during June 1993 and July 1994 show that there are two or three periods differently long (8-9 days in June 1993 and 4-5

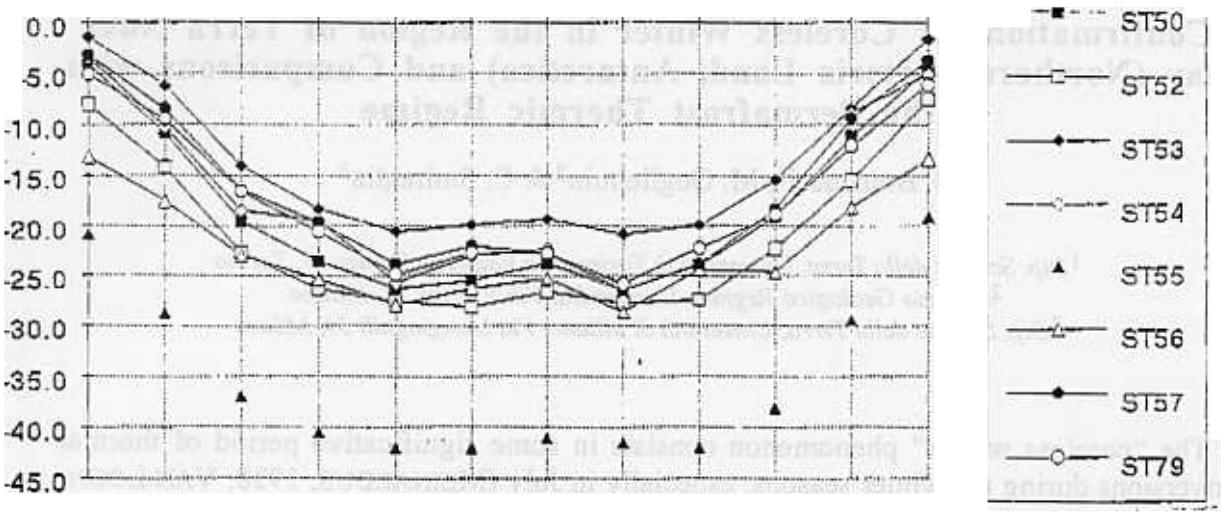

Figure 1 - Mean monthly temperatures from 1987 to 1994 for eight AWS stations in the region of Terra Nova Bay.

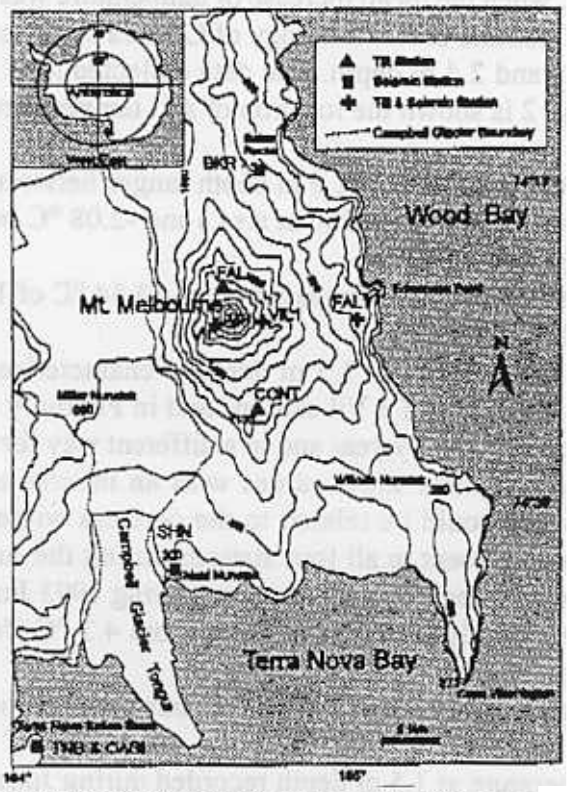

Figure 2 - Location of soil temperature stations around M. Melbourne

days in July 1994) in which the temperature of soils increases abruptly. These events are synchronous in every station except in the Fal 1 where these events are recorded 2-3 days earlier.

The delay of these thermal anomaly at 2.4 m depth is of 1-2 days and the value of increase is very reduced (generally less than half). It is interesting to point out that the station nearer to the coast and located at lowest altitude (Fal 1) show the greatest thermal anomalies that are recorded earlier than all other stations.

Also in permafrost thermal regime there are clear signals of thermal inversion periods during the winter season (named "coreless winter"), but the timing correlation with air temperature is not always evident.

In the Terra Nova Bay area, the "coreless winter" has been referred to local breaks out of the thermal inversion layer that characterised the Antarctica continent in winter favourishing the ingression of warmer air masses that cause the increase of winter temperature (GRIGIONI et al., 1992).

A more careful analysis of thermal regime of permafrost could be useful to understand the climatic significance of "coreless winter" and its causes.

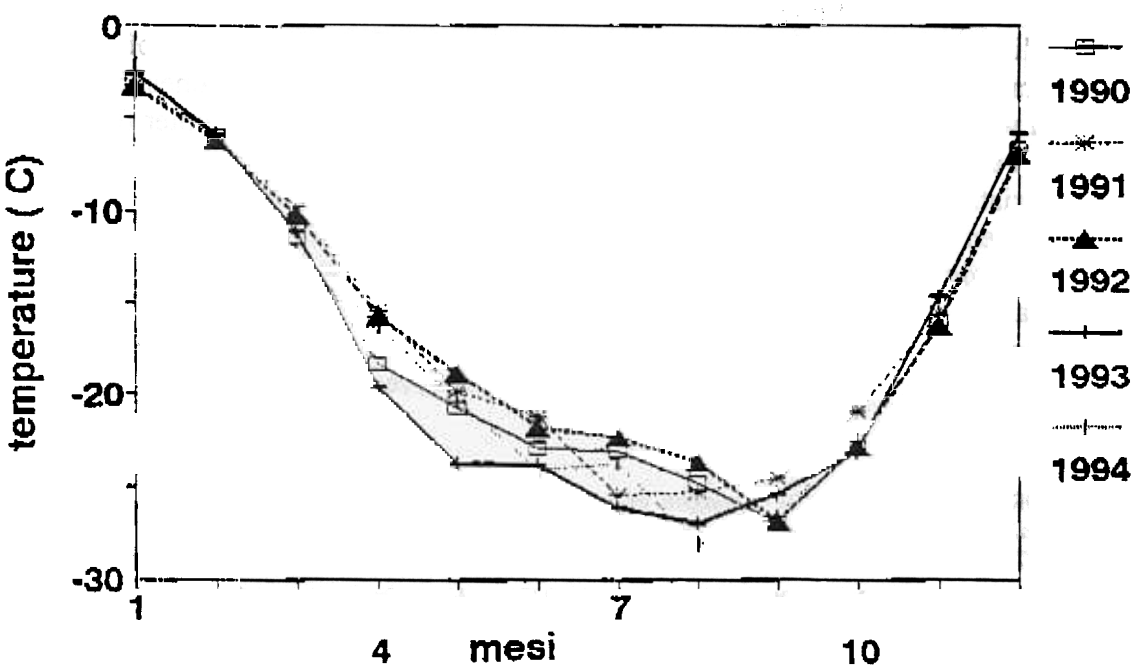

Figure 3 - Mean monthly temperatures from 1990 to 1994 for the station Fal 1 at 1.5 m depth.

References

ALLISON I., WENDLER G. & RADOK U. (1993) - *Climatology of the East Antarctic Ice Sheet (100° E to 140° E) derived from Automatic Weather Stations.* Journ. Geophis. Res., 98 (5), 8815-8823.

GRIGIONI P., DE SILVESTRI L., PELLEGRINI A. & SARAO R. (1992) - *Some climatological aspects in the Terra Nova Bay area, Antarctica.* Conf. Proc. "Italian Reearch on Antarctic Atmosphere", SIF, Bologna, 97-121.

MEINARDUS W. (1938) - *Klimakunde der Antarktis.* In: KOEPPEN W. & GEIGER R., "Handbuch der Klimatologie". Borntrager, Berlin.

VAN LOON H. (1967) - *The half-yearly oscillations in middle and high southern latitudes and the coreless winter.* Journ. Atmosph. Sc., 24, 472-486.

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Some Observations of Snowpack Features in the Northern Victoria Land, Antarctica

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First results of snowpack observations carried out in Antarctica during the Italian scientific expedition in 1994/95 winter are presented here. In a mountainous area of about 50 000 km^2 in the northern Victoria Land, where the Italian Base Station is located, several conventional snow profiles have been performed down to variable depths, from some centimetres to a maximum of one metre indulges some situations. Observations have been carried out utilizing the classic field instruments. In particular, for every snow profile the following characteristics have been analysed: grain shape and grain size, hardness index, density, liquid water content and snow temperature. Besides, during the helicopter flights, observations on avalanches activity have been done. Analysis of snow profiles has cleared some characteristics that distinguish the antarctic snowpack from the alpine types. In general, it has been checked a low structural diversification with an alternance of layers of small rounded particles and layers of faceted crystals. Hardness index profiles present on the average shapes of type "quasi-hydrostatic" that confer a relative stability to snowpack. Snow characteristics integrated by climatological analysis of the period have consented to formulate some hypotheses on the low avalanche activity observed in the region.

References

BARONI C. & OROMBELLI G. (1989) - *Indagini geomorfologiche e glaciologiche nella Terra Vittoria (Seconda spedizione del Programma Nazionale di Ricerche in Antartide, 1986-1987).* Geogr. Fis. Dinam. Quat., 10, 337-350.

BORFECCHIA F.& FREZZOTTI M. (1990) - *Antartide-Baia di Terra Nova. Immagine realizzata nell'ambito del Programma Nazionale di Ricerche in Antartide.* SPOT (R)-c CNES 1988. PNRA, ENEA-EDI, TELESPAZIO. Fratelli Palombi, Roma.

COLBECK S., AKITAYA E., ARMSTRONG R., GUBLER H., LAFEUILLE J., LIED K., MC CLUNG D.& MORRIS E. (1993) - *The International Classification for Seasonal Snow on the Ground.* International Commission on Snow and Ice, IASH, 23 pp.

MENEGHEL M.& SMIRAGLIA C. (1991) - *Snow Stratigraphy and Accumulation at Browning Pass (Northern Victoria Land - Antarctica). Preliminary Observations.* Mem. Soc. Geol. It., 46, 49-58.

OROMBELLI G. (1989) - *Glaciers and Glacial Morphology at Terra Nova Bay: An Opportunity for Significant Studies on Environmental and Climate Global Changes.* Mem. Soc. Geol. It., 46, 9-16.

ZANON G. (1989) - *Ricerche preliminari sul bilancio glaciale nell'area della Baia Terra Nova (Antartide).* Geogr. Fis. Dinam. Quat., 11, 56-58.

ZILIOLI E:, CAGNATI A. (1995) - *Radiometric Measurements of Snow and Ice Surfaces in Antartctica.* In: "European Symposium on Satellite Remote Sensing", Paris, 25-28 sept. 1995 (in stampa).

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Detection of Ice Shelves Grounding Lines through Kinematic GPS Profiles (Nansen and Hell's Gate Ice Shelves, Antarctica)

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During the former three Italian Antarctic Expeditions (IX, X and XI), a reasearch on GPS applications to ice shelves tidal undulation was carried out. The Hell's Gate Ice Shelf (HGIS), a small Antarctic ice shelf of about 70 km^2 surface area, and the Nansen Ice Sheet (NIS), a bigger ice shelf (despite of the name) have been studied.

Owing to its peculiar meteorological regime, with strong katabatic winds sustaining large ablation rates and to its reduced dimensions, HGIS is a unique site to study ice shelf dynamics, structure, mass balance and marine ice accretion processes (SOUCHEZ et al., 1991 ; TISON et al., 1993).

Static GPS measurements were performed in 1993/94 using fixed GPS 24-hour recording stations. This first experiment indicated free response of the ice shelf to the tidal forcing in its lower part (BONDESAN et al., 1995) while glaciological features at the ice shelf surface called for partial grounding or significant side effects on the flow patterns.

The aim of the reasearch was to investigate the dynamical model of the ice flows, pointing out the grounding zones and the connections between the two ice shelves (HGIS and NIS).

Fast static GPS measurements were made to study the effect of tidal undulation on the Hell's Gate Ice Shelf. The results of GPS measurements showed that the vertical movement curves are in phase and in good agreement with the sea tidal curves provided by the tide gauge recordings.

During the IX Italian Expedition a limited number of stations allowed to cover a small area for grounding line detection; after, during the X Expedition, a test was made for kinematic profiles, allowing to improve the method and the logistic; then, during the XI Expedition, a continuous kinematic GPS survey was planned to cover a wide area: a profile was carried out towards the Browning Pass for about 30 km; a second profile was carried out betweenVegetation and Inexpressible Islands about 20 km long, crossing the border between the Nansen and the Hells Gate Ice Shelves (fig.1).

Field operations were performed in two steps: (a) a continous recording 40 hours long on some particular points to draw a tidal response curve of floating ice shelf; (b) kinematic profiles, made at maximum and minimum tidal amplitude periods.

The GPS antennas were located on two skidoos, while the two reference stations were situated at a distance ranging from 5 to 30 km.

Through a preliminary comparison of the profiles it was possible to detect the presence of floating and grounding ice along the trajectories.

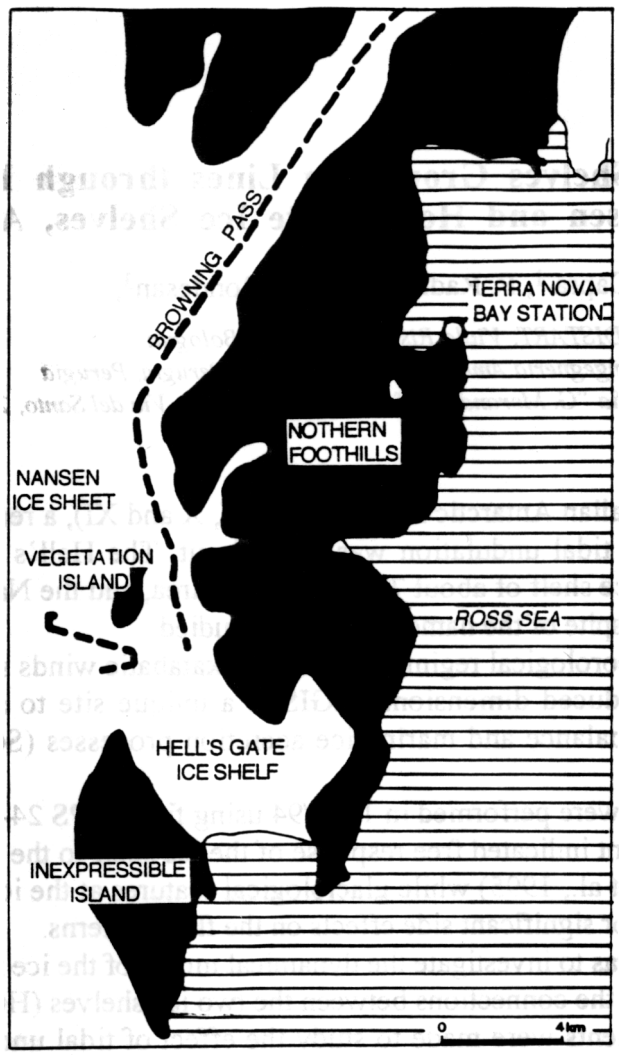

Figure 1 - Location of the GPS kinematic profiles (dotted lines)

Partial GPS data processing showed for the profiles carried out towards the Browning Pass a difference in elevation of the same amplitude of tidal excursion: this area may be ascribed to floating ice.

On the contrary, the differences between the profiles in the area close to Vegetation Island are scattered, but the mean value is centred around zero: so it could be hypothised that the profile was probably made on a grounding zone.

References

BONDESAN A., CAPRA A., GUBELLINI A. & TISON J.-L. (1995) - *On the use of static GPS measurements to record the tidal response of a small antarctic ice shelf of a small Antarctic ice shelf by static GPS measurements (Hells Gate Ice Shelf, Victoria Land).* Geogr. Fis. Dinam. Quat., 17, 123-129.

SOUCHEZ R., MENEGHEL M., TISON J.-L., LORRAIN R., RONVEAUX D., BARONI C., LOZEJ A., TABACCO I. & JOUZEL J. (991) - *Ice composition evidence of marine ice transfer along the bottom of a small Antarctic ice shelf.* Geophysical Research Letters, 18, 849-852.

TISON J.-L., RONVEAUX D. & LORRAIN R. (1993) - *Low salinity frazil ice generation at the base of a small antarctic ice shelf.* Antarctic Science, 5 (3), 309-322.

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GPS Monitoring of the Strain Net Network Established on the Frontier Mountain Blue Ice Field (Northern Victoria Land, Antarctica): Implications for the Meteorite Concentration Mechanism

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The Italian Antarctic Research Programme (PNRA) is currently involved in the study of the meteorite trap at Frontier Mountain (FM). During the 1993-94 field campaign a grid of eighteen stakes was established on the blue ice field downstream of the nunatak. In the following 1994-95 and 1995-96 expeditions, both ablation rates and horizontal ice flow vectors were measured. Ablation rates were obtained by measuring the stake height above the ice surface. Ice flow vectors were determined through GPS positioning, a method which has already provided very satisfactory results in Antarctica (CAPRA et al., 1994).

Results (Fig. 1) confirm the general ice flow pattern previously determined through interpretation of satellite images and field data on morphology and dust band bedding (FOLCO et al., 1995); in particular, the ice depression is confirmed to be the actual boundary between the two ice streams which flow past FM. Furthermore, data indicates that the blue ice area is characterized by very high ablation rates (mean value 6 cm/y, peak value 10 cm/y) and very low horizontal speeds (ranging from 70 to 0 cm/y). In detail, we observe that i) the entire southern ice stream, thought to be the only carrier of the meteorite found at FM (Fig. 1), is completely blocked and undergoes the strongest ablation; ii) the meteorite concentration on the northern slope of the ice depression also lies on a stranding surface; iii) the northern ice stream moves out of the blue ice area, draining any possible concentrations northeastwards; only in small areas at the foot of the central section of FM ice flow is impeded.

In light of this data, we argue that present-day glaciological conditions can fully explain the origin of the meteorite concentration at FM.

Acknoledgements

We are extremely grateful to S. Gandolfi and L. Vittuari (DISTART, Bologna) for their collaboration in acquiring GPS measurements.

References

A. CAPRA, A. GUBELLINI, F. RADICIONI & L. VITTUARI (1994) - *Crustal deformations in the Mount Melbourne area (Antarctica).* Reports on Geodesy, Warsaw University of Technology, Institute of Geodesy and Geodetic Astronomy, 4 (12), 265-277.

L. FOLCO, I. A. FRANCHI, M. MELLINI & C. T. PILLINGER (1995) - *Report of activities undertaken by the EUROMET/PNRA meteorite collection expedition to Frontier Mountain, North Victoria Land, Antarctica.* LPI Technical Report number 95-02, 27-29.

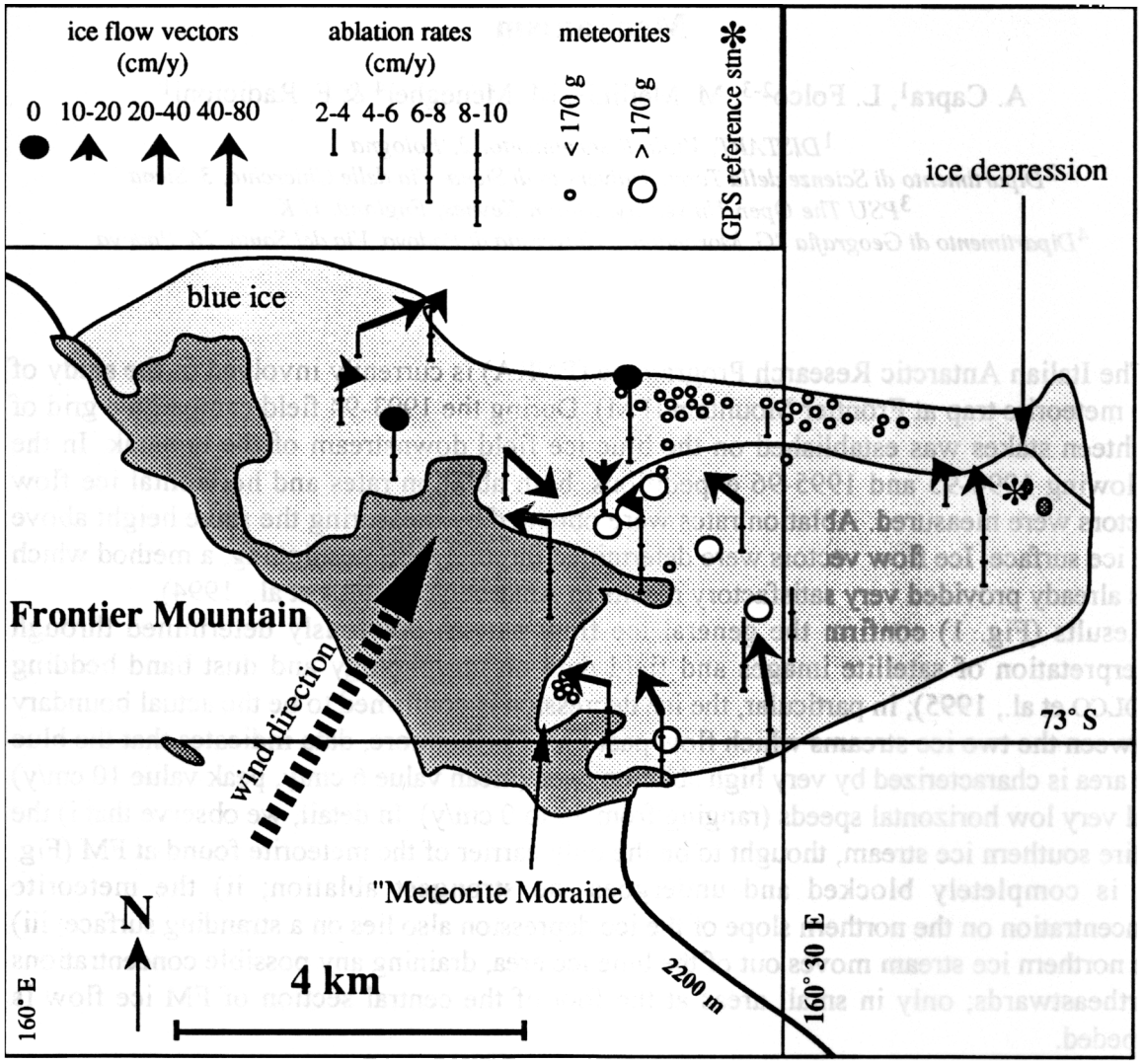

Figure 1 - Schematic map of the FM blue ice area. Grey area: Frontier Mountain Nunatak. Horizontal ice flow vectors and ablation rates are shown along with wind direction and meteorite finds. For the three stakes with no arrow, GPS data are not yet available. Data on geographic distribution on finds and wind strenght suggest that: 1) meteorites with m > 170 g are not moved on the ice surface by wind; therefore they locate areas where meteorites emerge form the ice; 2) wheighting less than 170 g, meteorites of the accumulation site due N of the ice depression emerge where large meteorites are found, to be then moved northeastwards till the snowfields; 3) the small meteorites of the Meteorite Moraine emerge in the moraine itself because trapped whithin rock debris; 4) all the meteorites found at FM to date come from the southern stream.

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First Results of Geotechnical and Sedimentological Determinations on Joides Basin Cores in Relation to the Pleistocene Grounding Line

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Researches carried out on samples collected in the Joides Basin during the X and XI Antarctic expeditions of the "Programma Nazionale di Ricerche in Antartide" within the frame of the "Glaciologia e Paleoclima" Project have been addressed to the effects caused by West Antarctic Ice Sheet advance in the Last Glacial Maximum. The Western Ross Sea continental shelf is characterized by a series of northeast-southwest trending banks and basins on sediments.

The Joides Basin represents one of these depressions and it is characterized by the presence, near the continental shelf break, of a threshold higher than the centre of the basin.

The sedimentation patterns of the Ross Sea continental shelf, known in literature, show many glacial erosion surfaces and relative overlying sediments.

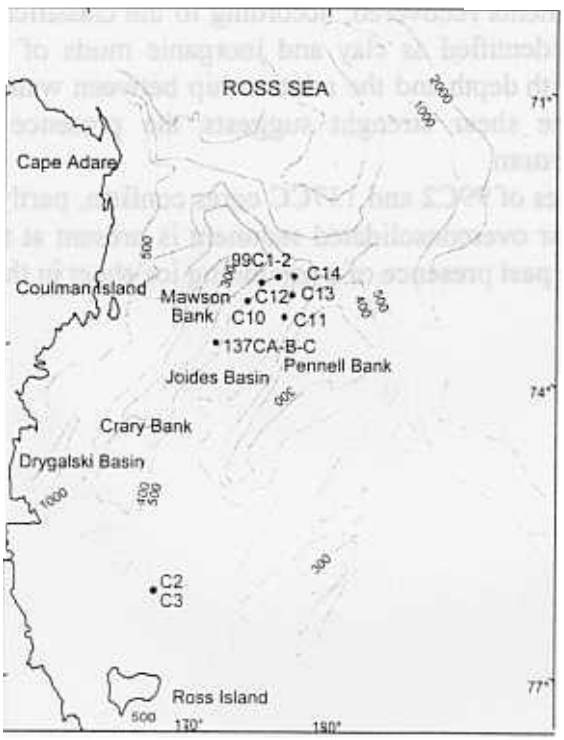

Figure - Map showing sites of gravity cores. Isobaths are in metres.

The sedimentary sequence following the last glacial event consists of three facies representative of three different depositional environmental: (a) marine, (b) glacio-marine and (c) glacial sediments. The sedimentary sequences reflect particular thicknesses of each facies referring to the location site in the continental shelf. The pelagic sedimentation (a) constituted by diatomaceous mud or ooze sediments with limited internal unconformities which is representative of expanded series in the central basin deposits. Flanks of bank are more characterized by largest moraine deposits, constituted by coarse textural sediments (b-c), with its tipical morphology where some glacial erosional surfaces may outcrop. Lastly the banks are coarse sedimentary deposits (thin thickness of layer (a), more representative (b-c) levels) with many and clear internal unconformities somewhere reaching the sea floor.

Geophysical surveys have been conducted in the study area to show the geometry and seismostratigraphy of the uppermost sedimentary sequences. These studies allowed to locate the sampling sites.

13 gravity cores were collected for sedimentological and geotechnical studies. Preliminary considerations started immediately after collecting samples on board of the oceanographic ship.

First results show that the cores, collected near the continental shelf break, are characterized by low sedimentation rate sequence and the sediment texture is essentially sand sometimes hardly distinguishable from the glacial-marine sediment below.

The cores recovered on side banks where the glacial erosion surfaces outcrop include low sedimentation rate sequences and lightly overconsolidated sediment. The samples collected in the central basin floor are characterized by a higher sedimentation rate than those of other sampling sites and the moraine sediments are clearly different from glacial-marine sediment (site 137). Generally sediments recovered, according to the classification on the Plasticity Chart of Casagrande, are identified as clay and inorganic muds of middle-low plasticity. Water content decreases with depth and the relationship between water content, Atterberg's limits and undrained vane shear strenght suggests the presence of overconsolidated sediment at some cores' bottom.

The results of lab-analyses of 99C2 and 137CC cores confirm, partly, the preliminary "on board" results. In particular overconsolidated sediment is present at the 99C2 core bottom and so we can suppose the past presence of a grounding ice sheet in that site.

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Seismic Sequences and Late Cenozoic Glacial History in the Ross Sea

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Analysis of seismic facies character and distribution, integrated with stratigraphic data, provides new insight into Ross Sea Cenozoic paleoenvironments.

Until late Oligocene time the Ross Sea was underlain by many subsiding basins separated by ridges that outcropped above sea-level. Most basins were isolated from one another and separated from the Southern Ocean. The outcropping ridges, as well as the Transantarctic Mountains, hosted valley glaciers that calved at sea.

In early Miocene time, the combined effects of eustatic changes and tectonic subsidence produced a relative sea-level rise and the settlement of open marine conditions on most of the shelf.

During the Miocene the depositional environment was generally glacio-marine, although some sea-level drops caused the episodic outcrop of large portions of the continental shelf. Outcrops were particularly widespread in the central Ross Sea, where subsidence was minor compared to the western and eastern Ross Sea. During these periods, ice caps enucleated from the emerged area and strongly influenced the depositional environment of the surrounding basin.

The first well documented advance of the Antarctic ice sheet to the shelf edge occurred during early Pliocene, likely at 4 Ma. A prominent erosional unconformity and a sudden change in seismic character marks this event.

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Ice-Ocean Interactions at the Front of Hells Gate Ice Shelf: the Sea Ice Perspective

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Recent glaciological and oceanographical work at Hells Gate Ice Shelf (HGIS - Terra Nova Bay, Antarctica) has clearly demonstrated the occurrence of circulation mode-1 and mode-3, as defined by JACOBS et al. (1992), for ice shelf-ocean interactions processes (TISON et al., 1995 ; LORRAIN et al., 1995). It has also been suggested that the formation of the banded rectangular marine ice facies accreting in large amounts under the frontal zone of the Hells Gate Ice Shelf reflects neo-formation of frazil ice crystals by a double diffusion process at the interface between Ice Shelf Water (circulation mode-1) and the outcoming branche of circulation mode-3. This process is likely to partly affect the ice-shelf mass balance by impeding the strong melting from tidal forcing of warm summer surface water below the ice-shelf, and enhancing ice-shelf resistance to calving ; the net result favouring ice-shelf stability (TISON et al., 1996).

A potential source for new arguments in favour of these ice-ocean interactions patterns is the first-year sea ice cover seasonally forming in front of the ice-shelf. Recent work by JEFFRIES et al. (1991a, 1991b, 1993a, 1993b) has concentrated on sea ice properties in Mc. Murdo Sound and the western Ross Sea, but only a few cores were located close to ice shelf fronts. Nevertheless, these indicated a higher proportion of platelet ice (thought to reflect frazil ice production in the Ice Shelf Water of circulation mode-1) with regard to congelation ice (forming by direct freezing of sea water) close to ice shelf borders.

This work presents results from two sets of sea ice cores sampled in Evans Cove, at the front of HGIS, respectively during January 1994 (West-East transect of 8 ice cores at a distance 50-500 meters from the ice cliff) and October 1995 (North-South transect of 3 ice cores at 200, 750 and 1200 meters from the ice cliff).

Thin-sections have been performed on whole length for each core, and c-axes fabrics measured in specific textural facies. Salinity samples were collected with a mean resolution of 10 centimeters and isotopic sampling for $\delta^{18}O$ performed in selected spots, chosen for their peculiar textural or/and salinity characteristics.

The main conclusions pulled out from the data are as follows:

- no snow ice exists at the surface of the sea ice cover at any time;
- winter time accretions mainly consist in orbicular and draped facies;
- the platelet facies, when present, is best developed at the beginning and at the end of the winter season;

- the banded rectangular facies starts to form at the beginning of the summer and still accretes during most of the summer;
- the winter accretion facies are thinner in front of the central sector of the Ice Shelf, but it is not clear if it results from accretion deficiency or increased bottom melting in the beginning of the summer season;
- the banded rectangular facies is inexistant in front of the western sector of the Ice Shelf (west of the dirt cone moraine) and forms between 44% and 54% of the whole consolidated ice core in front of the central and eastern sector.

These conclusions support the hypothesis of existence of the two circulation modes in front of HGIS, on a seasonal basis. Remnants of frazil ice formation in the Ice Shelf Waters from circulation mode-1 mainly accrete during the winter. In the summer these facies are not actively accreting anymore. Instead the banded rectangular facies builds up, resulting from the initiations of circulation mode-3, and is underlain by a thick layer of loose rectangular frazil ice crystals. The spatial distribution of the banded rectangular facies confirms the pattern of a gyre in which warm surface waters are tidally forced under the western sector of the Ice Shelf (no cliff visible) and Ice Shelf Waters mode-3 exit in front of the central/eastern sector, with their "load" of rectangular frazil ice crystals (TISON et al., 1996).

References

JACOBS, S.S., HELMER, H.H., DOAKE, C.S.M., JENKINS, A. & FROLICH, R.M. (1992) - *Melting of ice shelves and the mass balance of Antarctica.* J. of Glaciol., 38 (130), 375-387.

JEFFRIES, M.O. & WEEKS, W.F. (1991a) - *Fast-ice properties and structure in McMurdo Sound.* Antarct. J. U. S., 26 (5), 94-95.

JEFFRIES, M.O. & WEEKS, W.F. (1991b) - *Summer pack-ice properties and structure in the western Ross Sea.* Antarct. J. U. S., 26 (5), 95-97.

JEFFRIES, M.O. & WEEKS, W.F. (1993a) - *Structural characteristics and development of sea ice in the western Ross Sea.* Antarct. Sci., 5 (1), 63-75.

JEFFRIES, M.O., WEEKS, W.F., SHAW, R. & MORRIS, K. (1993B) - *Structural characteristics of congelation and platelet ice and their role in the development of Antarctic land-fast sea ice.* J. of Glaciol., 39 (132), 223-238.

LORRAIN, R., TISON, J.-L., BONDESAN, A, RONVEAUX, D. & MENEGHEL M. (1995) - *Preliminary results from 60 shallow cores and from one 45m deep marine ice core at Hell's Gate Ice Shelf, Victoria Land Antarctica. Terra Antarctica,* in press.

TISON, J.-L., BARBANTE, C., BONDESAN, A., LORRAIN, R. & CAPRA, A. (1995) - *Ice Shelf ocean interactions at the front of Hell's Gate Ice Shelf. Terra Antarctica,* in press.

TISON, J.-L., BARBANTE, C., LORRAIN, R., BONDESAN, A., STIEVENARD, M., BOUZETTE, A. & CAPRA, A. (1996) - *Ice shelf water and marine ice production in the frontal zone of Hells Gate Ice Shelf (Antarctica): implications on mass balance,* in prep.

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Thermal Conductivity Measurement (TCM) of the Ice Cores: Devices and Procedures

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The quantitative determination of the heat flow developing through the ice sheet at Dome C is possible by means of precise measurement of the thermal gradient profile dT/dz in the hole, from the surface to the bed rock, and the punctual measurement of thermal conductivity K on the ice cores (TCM).

The well-known relation $Q = K\ (dT/dz)$ gives the value of the vertical component of the heat flow Q. Therefore, the experimental measurements of the value of the thermal conductivity of the ice cores from the Antarctic ice cap is as important as the thermal logging of the borehole.

An apparatus has been developed expressly to work at temperatures below 0° C for the determination of the thermal conductivity of the ice, which can be measured by the line source method. This technique is similar in principle to that of the transient hot wire method of ITO, et al. (1977). Thermal conductivity is determined by tracking the thermal pulse propagation in the sample versus the time logarithm. The thermal sensor is a Pt resistance of 4 cm length at the surface of the probe, coinciding with the central part of the hot line. The heat impulse transferred to the ice gives a temperature increment of about 12-15°C for a time of 40". Each measurement requires a few minutes only.

Measurements made so far in a cold room give K values varying from 2.1 to 2.5 $W\ m^{-1}\ K^{-1}$ at -20°C for several samples of ice prepared with tap water. These values are within the range of those reported by S. P. Clark in the Handbook of Physical Constants - GSA Memoir 97, 1966.

In good experimental conditions, the expected repeatibility of the measurements is within ± 3% (Fig. 1). The precision of this relative method depends on whether the instrument has been calibrated by reliable standard samples, certified by absolute methods. In the case of homogeneous sampling rates, a statistical analysis can control the quality of the data; small changes in the parameter K can be detected along with the errors.

The main sources of error affecting the measurements are:

- roughness, uneven surface of the ice sample, irregular contact ice surface-probe surface, which can prevent reliable measurements;
- extraneous thermal gradients affecting the sample before and during the test period (sample not in a thermal steady state condition).

Basic requirements for good experimental conditions are:

- temperature of the samples stabilized and in equilibrium with that of the measurement room (shelter);
- temperature no higher than about -20°C;
- flat plane surface of the cut half-ice core, allowing good contact with the thermal probe.

We assume that heat flow is perpendicular to the surface and to the ice layers; we also assume that the core hole is almost vertical.

The ice core is layered and anisotropic. We must therefore determine the vertical component of K by taking measurements in two orthogonal directions.

Apart from heat flow determination, the measured data of the parameter K can give some important stratigraphic information.

The value of the K of the natural ice is a variable quantity, depending on temperature, density, porosity and gas content, tephra and powders content, chemical content (salts, clathrate hydrates), crystal and structural anisotropy, etc.

Measurements of K could therefore give a diagram (points) and characterize the stratigraphic sequence of the ice core versus depth, along with the continuous temperature log of the drillhole.

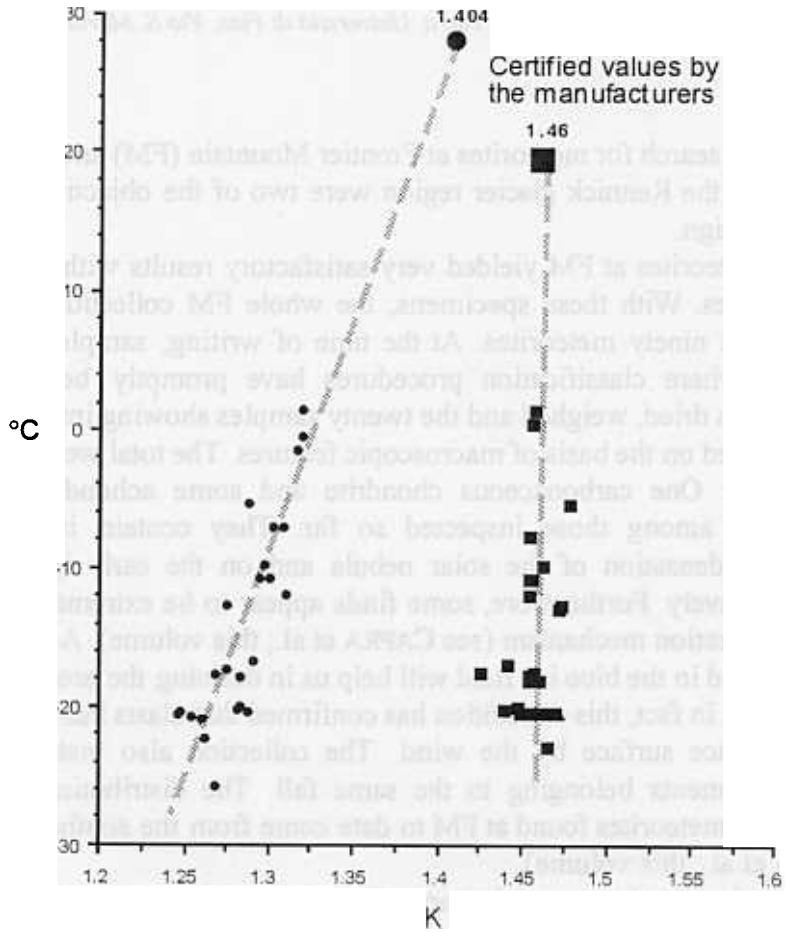

Figure 1 — Calibration and repeatibility tests. Experimental determination of thermal conductivity K at low temperatures, with two different silica standard samples.

Reference

ITO Y., SAITO T. & NAGUMEO M. (1977) - *Shotherm QTM measurement of rock specimens, Shotherm Sales Information No. 111.* Abstracted and translated, with permission, from the original paper in Japanese: Shotherm QTM measurement of rock specimens. Chinetsu, 14, 21.

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The 1995/96 PNRA/EUROMET Meteorite Collection Expedition: New Finds from Frontier Mountain and Reconnaissance of Blue Ice Fields in the Rennick Glacier Region (North Victoria Land, Antarctica)

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Further systematic search for meteorites at Frontier Mountain (FM) and the reconnaissance of blue ice fields in the Rennick glacier region were two of the objectives of the 1995/96 antarctic field campaign.

The search for meteorites at FM yielded very satisfactory results with the recovery of an additional 48 samples. With these specimens, the whole FM collection remarkably totals about three hundred ninety meteorites. At the time of writing, samples are at the Open University (UK) where classification procedures have promptly begun. In fact, the meteorites have been dried, weighed and the twenty samples showing interior surfaces were preliminarly classified on the basis of macroscopic features. The total weight of the 1995-96 collection is 787 g. One carbonaceous chondrite and some achondrites are the most interesting samples among those inspected so far. They contain information on the mechanisms of condensation of the solar nebula and on the early igneous activity on protoplanets respectively. Furthermore, some finds appear to be extremely valuable for the study of the concentration mechanism (see CAPRA et al., this volume). Actually, a meteorite weighing 190 g found in the blue ice field will help us in defining the area where meteorites emerge from the ice. In fact, this expedition has confirmed that clasts heavier than 170 g are not moved on the ice surface by the wind. The collection also includes seven paired meteorites, *i.e.* fragments belonging to the same fall. The distribution on the blue ice confirms that all the meteorites found at FM to date come from the southern ice stream (see Fig. 1 in CAPRA et al., this volume).

During the campaign for the reconnaissance of new meteorite traps in the Rennick Glacier region, the blue ice fields of Lichen Hills, Mt. Weihaupt, Roberts Butte and Johannessen Nunatak were visited. All these areas were found to be sterile.

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Mass Balance Evaluation of David Glacier-Drygalski Ice Tongue and Nansen Ice Sheet (Antarctica)

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The mass balance of the Antarctic Ice Sheet is between accumulation and iceberg calving-basal melting; surface ablation is negligible. Basal melting/freezing of floating glaciers (ice tongue, glacier tongue, ice shelf) fringing Antarctic coast are very poorly known, making impossible to obtain a reliable estimate of the present day mass budget. The pattern of melting under a floating glacier is complicated, basal melt rate has been derived from surface measurements, on the assumption that the floating glacier is in a steady state. The ice discharge and mass balance of David Glacier-Drygalski Ice Tongue and Nansen Ice Sheet have been calculated on the basis of new data sets whose increased accuracy permit a more reliable assessment of the present dynamics of major glaciers and floating glaciers of Northern Victoria Land. Field and remote sensing researches have provided data about ice thickness, velocity and accumulation/ablation rate. Accumulation/ablation rate have been obtained from 5 years stake measurements. Airborne radar sounding positioned precisely with GPS navigation provides the determination of ice thicknesses in detail. Surface average velocities has been determined from tracking crevasses and other patterns moving with the ice on two sequential satellite images. These data have been verified and augmented by means of surface measurements using repeat GPS survey of stake positions. Using velocity, ice-thickness, and accumulation/ablation data, the ice discharge fluxes across gates of outlet glaciers have been obtained. The variations of along-flow ice discharge have allowed the estimation of the basal melting and freezing rates.

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ITASE TRAVERSE: Result of First Scouting and New Remote Sensing Data for Forthcoming Traverse

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The Italian Antarctic Research Programme undertook a field survey of the first leg of the Terra Nova Bay Station-CONCORDIA Station (Dome C) from Nov. 8th to Nov. 12th 1993. The covered distance reached 280 km and the party arrived to location 157°30'E 74°38'S (2050 m a.s.l.). The purpose of this preliminary traverse was to verify the accessibility of the plateau from Terra Nova Station with heavy vehicles. During October and November 1996 a scientific traverse will be performed from Terra Nova Bay to Talos Dome (1200 km) and in the following 1997/98 season the traverse Terra Nova Bay-Dome C (2600 km) will be accomplished with a French collaboration. These traverses project is a part of the Franco-Italian programme Station Concordia and of the International Trans-Antarctic Scientific Expedition (ITASE) program. The scientific objectives of traverse programme are to develop a high resolution (sampling interval: 150 km) interpretation and 3-D map documenting the last 200 years of the climate, atmosphere and surface conditions over the Dome C drainage area.

The route of scouting traverse 1993 was identified and surveyed in Italy from georeferenciated satellite images analysis and a land survey with skidoo and helicopter was performed in October 1993. During the traverse the precise coordinates of route were measured by GPS in kinematic mode and the track in the main crevassed area was marked with stakes. The precise coordinates of five points along David Glacier basin were measured by GPS technique during 1993, the measurements were repeated 2 years later to obtain displacements and hence velocities. Snow accumulation/ablation data, from stake measurements, were performed and integrated with data obtained from satellite image analysis and with result of streamlines of the katabatic windfield and katabatic wind speed obtained by mesoscale numerical modelling (BROMWICH et al., 1990). The area of forthcoming traverse 1996 and 1997 has been analysed by remote sensing. The data in visible and near-infrared bands (AVHRR, Landsat TM), have allowed to survey the surface morphology and to discriminate snow and bare ice. The bare ice at the glacier surface indicates the presence of ablation areas where deflaction and sublimation are caused by persistent katabatic wind. Antarctica surface topography derived from ERS1 satellite radar altimeter (BRISSET & REMY, in press) has allowed to improve the location of Talos Dome culmination in comparison with the previous maps. The analysis of ERS1 SAR and Landsat TM imageries, combined with ground survey, show that the back-scatter coefficient of SAR imagery is due to ice stress, that results in facture and crevasse.

Reference

BRISSET L. & REMY F. (in press) - *Antarctica surface topography and kilometric scale roughness derived from ERS-1 Satellite Altimeter.* An. Glaciol., 23.

BROMWICH D.H., PARISH T.R. & ZORMAN C.A. (1990) - *The confluence zone of the intense katabatic winds at Terra Nova Bay, Antarctica, as derived from airborne sastrugi surveys and mesoscale numerical modelling.* J. Geophys. Res., 95, 5495-5509.

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GPS Strain Network in Dome C Area (Antarctica)

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In the framework of the European Science Foundation Project, named EPICA (European Project for Ice Coring in Antarctica) was established an international plan for deep ice core drilling in Antarctica, to study environments aspects of global relevance. The most important aim of EPICA is a high resolution reconstruction of the climatic and atmospheric composition history of the changes through the study of Antarctic ice cap that recorded several glacial/interglacial cycles. The ice thickness, in central part of Antarctica can reach 4 km, and on the basis of low rate of ice accumulation, the span of time recorded in a deep ice core can overcome 500 000 years.

These informations will improve the knowledge about the interaction between atmospheric chemistry and climate. This aspect cover an important role in climate change and permits to enforce numerical models used to predict future climate.

Through the employment of a geodetic network two aspects can be investigated: ice surface topography and strain field detection. The ice core drilling planned in Dome C area, requires for a geodetic network, centred at drilling site and characterised by a circular shape of 50 km diameter. In order to investigate these aspects, during the 11th Italian Expedition in Antarctica (aerial and terrestrial) Radio Echo Sounding surveys were carried out (TABACCO et al., 1996), and was established a GPS geodetic network on an area of about 2000 km^2. Moreover some kinematic GPS profiles were surveyed to obtain a detailed description of the topographic surface.

The expected ice movements in Dome C area, are at few centimetres level (0-5 cm/years), and comparison of adjusted coordinates can furnish informations about the flow detection in two or three years. Through a comparison between simulated results and logistical constraints was established the final shape of GPS network (Fig. 1). The strain net is composed by 37 points, distributed on four concentric rings respectively at 3, 6, 12.5 and 25 kilometres from the centre.

The extreme environmental conditions of Antarctic plateau require for an accurate study of each aspects of the survey and so a measurements plan was established before the installation of the points.

The absolute position of a point installed in 1993 and surveyed by a DORIS system was used as coordinates emanation point for baselines computation and network adjustment. In a preliminary phase, these coordinates were also used to obtain approximate positions of GPS stations, in order to allow, not only the simulation, but even the monumentation (through GPS navigation) in a area completely devoid of natural reference points.

During the survey of static network, some kinematics profiles were performed using a device to set up the geodetic GPS antenna on each tractor. The survey was made with the aim to accurately describe the altimetry of dome top.

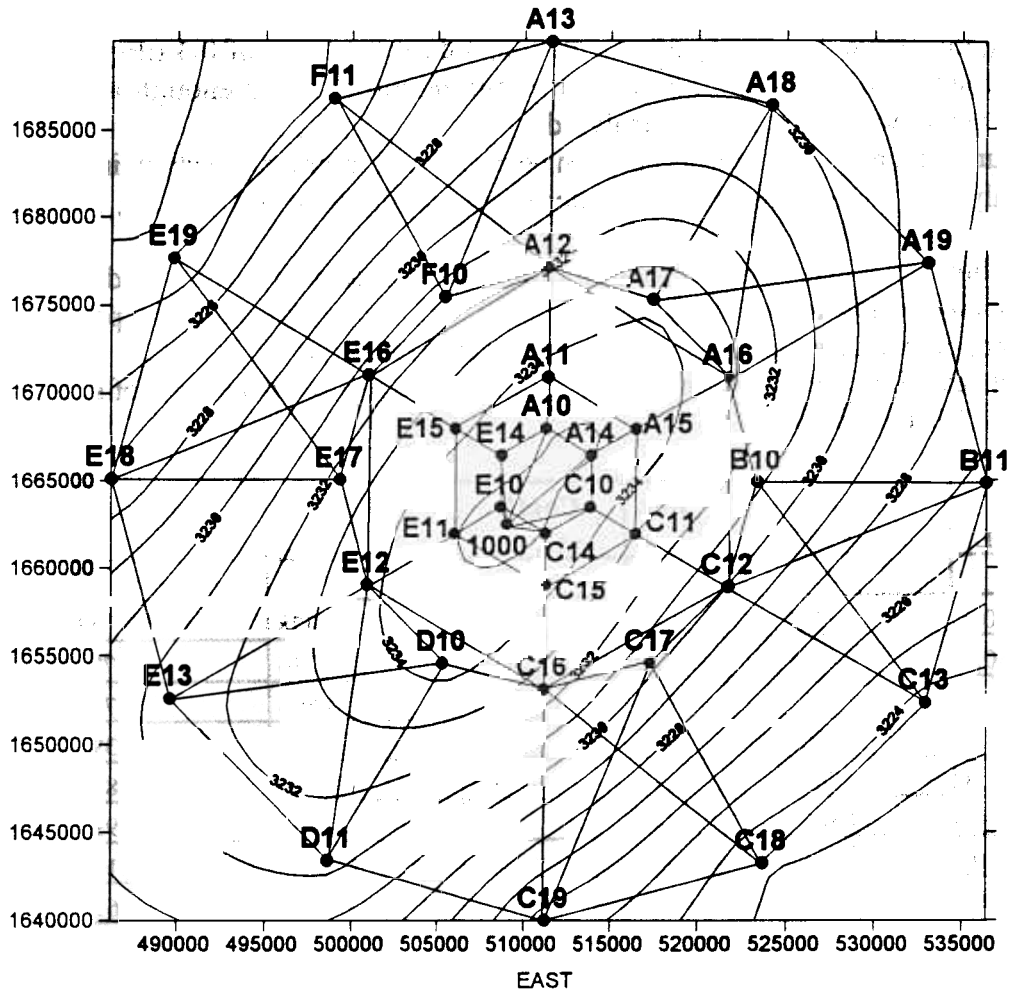

Figure 1 - Scheme of Dome C Strain Network.

Materialisation of designed net geometry was possible on a wide area of Antarctic plateau through GPS navigation. A good measures planning based on experience of Antarctic GPS observation has permitted to overcome logistical and environmental constraints, and from the analysis of preliminary results the expected precision are confirmed (GANDOLFI et al., 1996). These measurements will be useful for drilling site choice and by a repetition of GPS survey (planned in 1998/99) the strain net can furnish measurements of ice flow.

References

GANDOLFI S. & VITTUARI L. (1996) - *Preliminary results of the first GPS strain net survey in Dome C area (Antarctica).* Reports on Geodesy, DISTART, M.Unguendoli editor, Bologna, 1996.

TABACCO E. & PASSERINI A. (1996) - *Rapporto sulla Campagna Antartica, Estate Australe 1995-96.* Programma Nazionale di Ricerche in Antartide. ENEA Progetto Antartide, Roma.

VINCENT C. (1994) - *Project Concordia, Glaciology at Dome C.* Pub. Institut Francais pour la Recherche et la Technologie Polaires, 1994.

Results and discussion

Utilizing the above described instrumentation, a detection limit of 0.4 μEq/L of SO_4 is reached when 2 ml of sample are loaded in one minute. This is enough to produce a continuos record when ice cores are analysed.

The volume and the flow of the sample can be changed to improve detection limit.

The analysis is performed in one minute; since loading time is 1 minute, we have an analytical response every two minutes.

When a bichannel instrument is used in order to alternate both loading and analyses, a continuos monitoring is performed. Presumably, improving the aforesaid procedure, it could be possible to determine chloride and nitrate concentrations too.

Standard deviations and variation coefficients relative to replicated analyses of sulphate are reported in Tab 1.

SO4 μEq/L	Mean U.A.	Std. Dev.	Coeff. var. %	Min.	Max
0.4	3547	403	11.3	378	434
0.8	6203	720	11.6	5156	7200
1	6471	948	14.6	4806	7448
2	19361	2892	14.9	13332	23928
4	39627	3570	9.0	32470	48347
8	83664	6919	8.3	72509	99900
16	159147	9505	6.0	141890	171630
24	234610	21600	9.2	195740	266960

Table 1 - Statistical analysis results

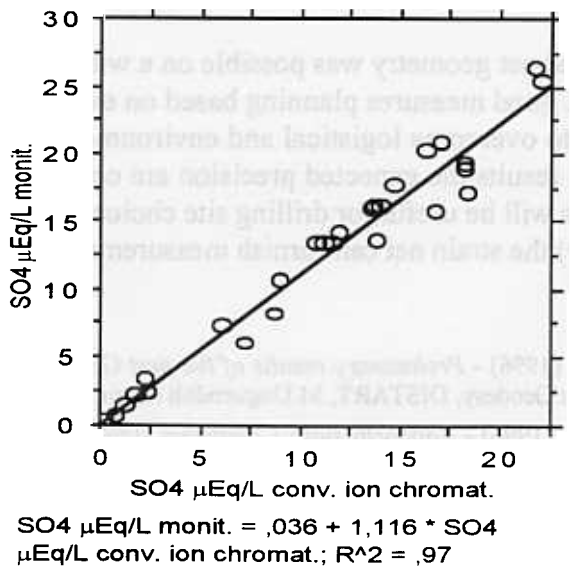

Figure 1 - Scattergramm between the results performed by conventional ionic chromatography and by the present method.

The error range is between 14.9 and 6%. In Figure 2 the results obtained with the conventional method are compared with those obtained with the monitoring procedure. The correlation coefficient is very significant confirming the validity of the monitoring SO_4 concentration method in ice cores.

Thanks to the utilization of a new generation of chromatographic system the performance of the method will possibly be improved.

Acknoledgements

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References

DELMAS T. J. M., LEGRAND A.J., ARISTARAIN & ZANOLINI F. (1985) - *Volcanic deposits in Antarctic snow and ice.* J. Geophys. Res., 90, 901-920.

HAMMER, C.U. (1977) - *Past volcanism revealed by Greenland ice sheet impurities.* Nature, 270, 482-486.

HAMMER, C.U. (1985) - *The influence on atmospheric composition of volcanic eruptions as derivates from ice-core analysis.* Annals of Glaciology, 7, 125-129.

MOOR J. C., NARITA H. & MAENO N. (1991) - *A Continuous 770- Year Record of Volcanic Activity From East Antarctica.* Journal of Geophysical Research, 96, 17353-17359.

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Atmospheric Dust Concentration Record from Hercules Névé Firn Core (Northern Victoria Land, Antarctica)

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During the IX Italian Antarctic Expedition (PNRA), a 20.50 m deep firn core has been drilled on the Hercules Névé (73° 06' 22''S - 165° 27' 47''E, 2960 m a.s.l., 100 km inland) in the Transantarctic Mountains (Northern Victoria Land, Antarctica). The area is situated on the ice devide between the Evans Névé, flowing Northward into the Rennick Glacier, and the Meander Glacier, flowing South-eastward into the Ross Sea. The site is not under the influence of katabatic winds, and because it is only 100 km from the coast, the Hercules Névé area appears a very good site for investigating the change with time of the relative influence of local and long distance dust sources.

Firn core were decontaminated under clean air (class 100) bench and processed in a clean room at Laboratoire de Glaciologie e Geophysique de l'Environnement (Grenoble, France). A total of 380 samples have been prepared. Dust concentration an size distribution have been done by using a Coulter Counter TAII instrument.

The total mass of the atmospheric insoluble dust represent about 15% of the aerosol load. Most of insoluble dust originates from continental areas where erosion is dominant. The continuous dust record from Hercules N., display sharp differences between the upper 14.8 m and the bottom part (14.8 to 20.50 m). The background of volume dust concentration of the upper part is quite homogeneous with values below $1.5x10^{-7}$ gg^{-1} of water. Some spikes reach maximum values of $3x10^{-7}$ gg^{-1} of water. In this part the particles volume distribution size show a relative maximum around 0.9 μm while a second maximum occurs for particles larger than 14 μm. Below 14.8 m the records shows higher values in both background concentration, from $1.5x10^{-7}$ gg^{-1} to $3x10^{-7}$ gg^{-1}, and spikes, 7. $5x10^{-7}$ gg^{-1}. Since, the dust concentration for particles 0.8 to 1.4 μm, remains the same over the whole record, the variability of the total mass concentration appears linked to change in the contribution of the large particles.

In the first 15 m of records which is thought to cover the last 60-70 years, the dust concentration shows a homogeneous atmospheric dynamic in term of particles transport and deposition. The presence of a bimodal volume distribution may be related for the mode around 0.9 microns, to the long distance aeolian dust, and for the coarse mode to the local dust sources, respectively. Our results suggest that the atmospheric dynamics with a more turbulence and more transport has occurred during the past.