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## CHEMICAL PROFILES FROM SNOW PITS AND SHALLOW FIRN CORES AND SNOW ACCUMULATION ON CAMPBELL GLACIER (NORTHERN VICTORIA LAND, ANTARCTICA)

**ABSTRACT:** CAPRIOLI R., GRAGNANI R., GUGLIELMIN M., SMIRAGLIA C., PROPOSITO M. & TORCINI S., *Chemical profiles from snow pits and shallow firn cores and snow accumulation on Campbell Glacier (Northern Victoria Land, Antarctica)*. (IT ISSN 0391-9838, 1997).

The chemical composition of snow and firn samples from the Campbell Glacier (Northern Victoria Land) was studied to evaluate the accumulation rate of snow and to investigate the chemical contribution from some different emission sources (marine biogenic activity, sea and crustal). Snow and firn were collected from snow pits and by coring at three sites (74°41' S-164°30' E; 74° 15' S-164°04' E and 73 45' S-163° 20' E), located respectively at 50 m (on the floating glacier tongue), 800 m and 1560 m a.s.l., during the 1994-95 Italian Antarctic Expedition.

Analyses of Na<sup>+</sup>, K<sup>+</sup>, Mg<sup>++</sup>, Ca<sup>++</sup>, CH<sub>3</sub>SO<sub>3</sub><sup>-</sup> (Msa), Cl<sup>-</sup>, NO<sub>3</sub><sup>-</sup>, SO<sub>4</sub><sup>=</sup> were performed by ion chromatography (Dionex 2020i). The separations were obtained with ion-exchange columns Dionex AS5 (NaOH 5 10<sup>-4</sup> N and NaOH 3 10<sup>-2</sup> N eluents) and Dionex CS12 (methane sulfonic acid 20 mM eluent) for anions and cations respectively. H<sub>2</sub>O<sub>2</sub> was analyzed by an electrochemical detector (Antec mod. «Decade»).

Samples from the Campbell Glacier Tongue are characterized by a high level of sea salt and in the upper part of the firn layer a high concentration of nss SO<sub>4</sub><sup>=</sup> is present. The concentration of sea salt decreases with increasing distance from the coast and with altitude. The differences in the chemical composition of firn at the sites at 800 m and 1560 m altitude could be explained by coupling fractionation of chemical species and air masses of different origin.

Msa, H<sub>2</sub>O<sub>2</sub>, nss SO<sub>4</sub><sup>=</sup>, NO<sub>3</sub><sup>-</sup> and nss Ca<sup>++</sup> profiles show fairly good seasonal cycles. 10-11 and 14-17 years have been identified at the sites of 800 m and 1560 m altitude respectively. The accumulation rate ranges between 150-170 kg m<sup>-2</sup> y<sup>-1</sup> and 150-180 kg m<sup>-2</sup> y<sup>-1</sup> at the first and the second of these two sites.

**KEY WORDS:** Snow, Firn cores, Ion chromatography, Chemical composition, Accumulation rate.

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**RIASSUNTO:** CAPRIOLI R., GRAGNANI R., GUGLIELMIN M., SMIRAGLIA C., PROPOSITO M. & TORCINI S., *Profili chimici da trincee di neve e carote di nevato superficiale per lo studio dei tassi di accumulo sul Ghiacciaio Campbell (Terra Vittoria Settentrionale, Antartide)*. (IT ISSN 0391-9838, 1997).

È stato effettuato lo studio della composizione chimica (Na<sup>+</sup>, K<sup>+</sup>, Mg<sup>++</sup>, Ca<sup>++</sup>, CH<sub>3</sub>SO<sub>3</sub><sup>-</sup> (Msa), Cl<sup>-</sup>, NO<sub>3</sub><sup>-</sup>, SO<sub>4</sub><sup>=</sup>) in campioni di neve e firn prelevate in tre stazioni (A - 74°41' S-164°30' E; B - 74° 15' S-164°04' E e C - 73 45' S-163° 20' E) localizzate sul Campbell Glacier (Antartide) a diversa altitudine (50, 800 e 1560 m).

Nella stazione costiera il contributo di sali di origine marina è molto consistente soprattutto in coincidenza di forti mareggiate. Procedendo verso l'interno e con l'aumento della quota il contributo dello spray marino si attenua anche se permane ben riconoscibile anche al sito C.

Le differenze quantitative, tra le diverse specie chimiche, riscontrate nei campioni della stazione B e C sono da interpretare prendendo in considerazione sia le reazioni chimiche e i processi di frazionamento che intervengono quando masse d'aria di origine oceanica penetrano all'interno del continente, sia considerando masse d'aria di differente origine.

Le variazioni della concentrazione Msa, H<sub>2</sub>O<sub>2</sub>, nss SO<sub>4</sub><sup>=</sup>, NO<sub>3</sub><sup>-</sup> e nss Ca<sup>++</sup> mostrano marcati andamenti stagionali che permettono di stimare in 10-11 anni e in 14-17 anni l'età della parte più profonda delle carote prelevate rispettivamente nel sito B e C. La velocità di accumulo varia da 150-170 kg m<sup>-2</sup> y<sup>-1</sup> a 150-180 kg m<sup>-2</sup> y<sup>-1</sup> rispettivamente per il sito B e C.

**TERMINI CHIAVE:** Neve, Carote di firn, Cromatografia ionica, Composizione chimica, Velocità di accumulo.

## INTRODUCTION

In the last few years there has been growing interest in the study of the polar ice-sheet and in the reconstruction of interrelationships between the chemistry of the atmosphere and the paleoclimate (Legrand & alii, 1988; Dansgaard & Oeschger, 1989; Khalil & Rasmussen, 1989). Moreover, studies on the Antarctic ice-sheet mass balance are very relevant to understanding the relationship between global warming and sea level change.

The chemical composition of snow and firn samples, from the Campbell Glacier (Northern Victoria Land), was