THE AUSTRALIAN NATIONAL UNIVERSITY

Nuclear Fingerprints Frozen in Time

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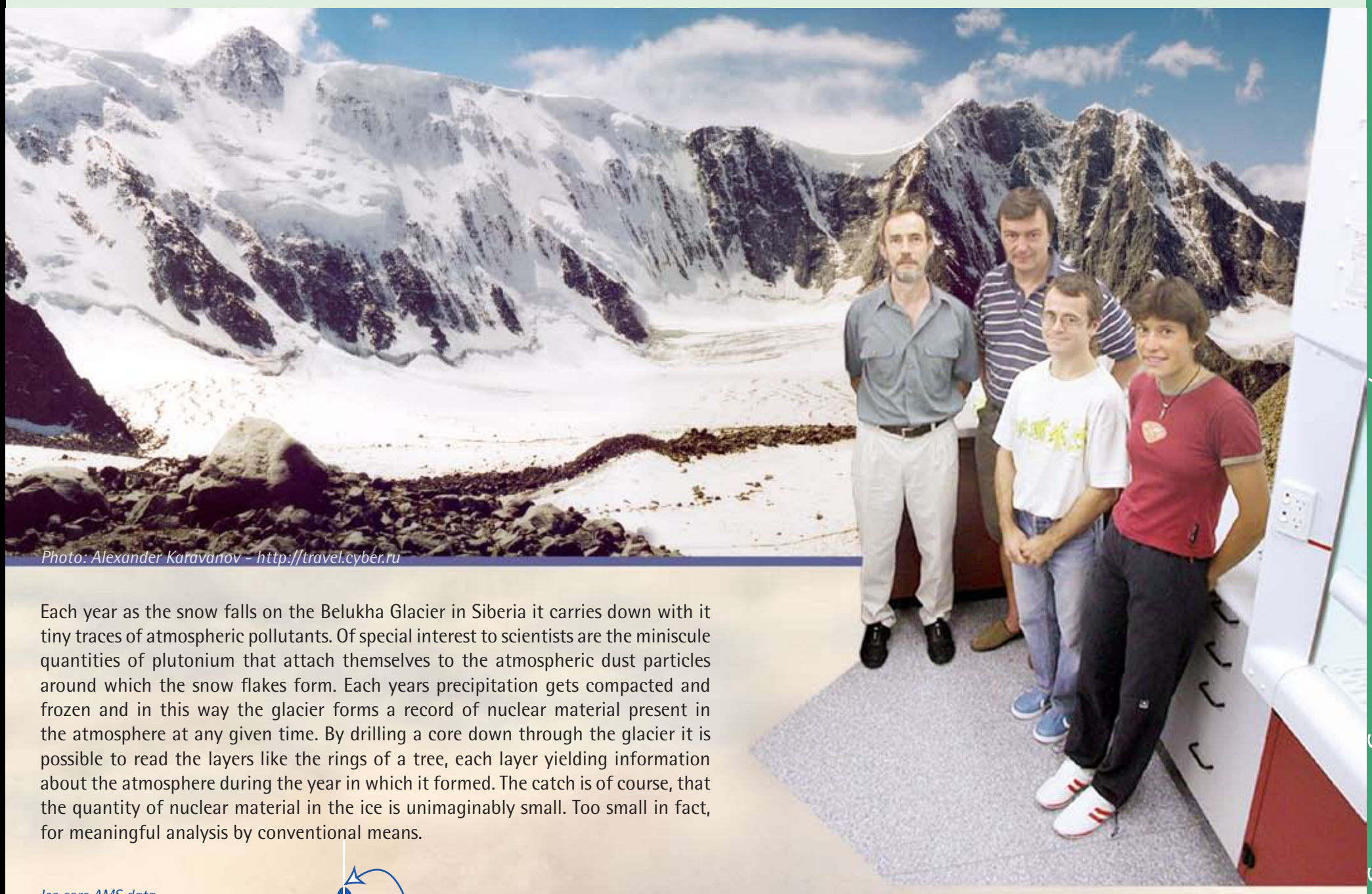
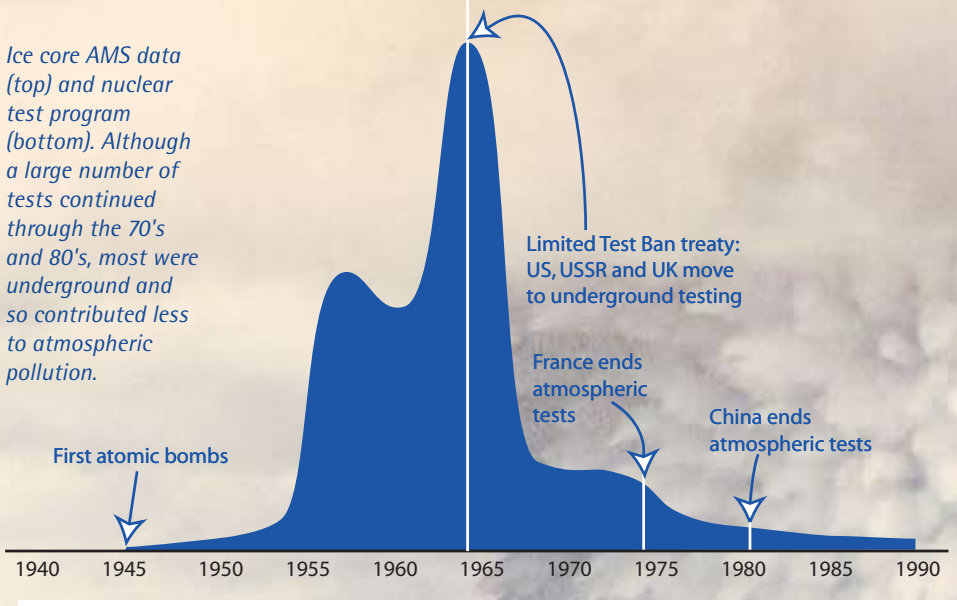
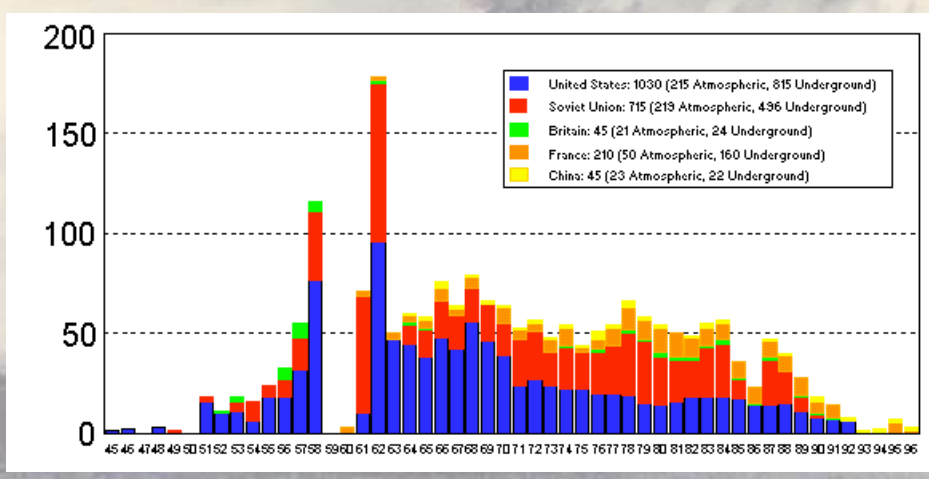


Photo: Alexander Karavanov - http://travel.cyber.ru

Each year as the snow falls on the Belukha Glacier in Siberia it carries down with it tiny traces of atmospheric pollutants. Of special interest to scientists are the miniscule quantities of plutonium that attach themselves to the atmospheric dust particles around which the snow flakes form. Each years precipitation gets compacted and frozen and in this way the glacier forms a record of nuclear material present in the atmosphere at any given time. By drilling a core down through the glacier it is possible to read the layers like the rings of a tree, each layer yielding information about the atmosphere during the year in which it formed. The catch is of course, that the quantity of nuclear material in the ice is unimaginably small. Too small in fact, for meaningful analysis by conventional means.



Ice core AMS data (top) and nuclear test program (bottom). Although a large number of tests continued through the 70's and 80's, most were underground and so contributed less to atmospheric pollution.



To overcome this difficulty, scientists at the Australian National University have perfected the technique of accelerator mass spectrometry (AMS) using the powerful 14UD Accelerator to measure traces of plutonium with unprecidented sensitivity. This technique is so sensitive that if you were to dissolve a particle of plutonium the size of a single grain of salt in Sydney Harbour it could be readily detected by sampling a few liters of the water.

This work is performed in collaboration with scientists at the University of Berne in Switzerland, who drilled the ice core and carried out the delicate chemistry to extract the few plutonium atoms from the ice. The concentrated samples were then shipped to Australia for AMS analysis. By measuring plutonium concentration at different depths in the glacial core, it has been possible to construct a year by year record of the quantity introduced into the atmosphere as a result of global nuclear testing and accidents such as Chernobyl. The resulting curves of plutonium concentration match well the history of atmospheric testing carried out across the world.

It's not just the ability of AMS to detect fantastically small traces of nuclear material that makes it so appealing in a range of security and environmental applications. The technique also reveals which particular isotopes are present and in what ratios. Armed with this information, scientists are able to infer the source of any contamination, be it weapons testing, power plants or illegal weapons manufacture or smuggling.