

## Searching for Missing Ice Sheets on the Tibetan Plateau

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During the International Symposium on the Qinghai-Tibet Plateau, there were lively discussions on the issue of the possible extent of former ice cover over the Tibetan Plateau. Liu Tungsheng and a number of participants presented several lines of evidence arguing that there might have been a significant quantity of ice on the Tibetan Plateau in past glacial periods, including the Last Glacial Maximum (LGM). Liu's view was based on the climatic implications of the loess-soil sequence in the areas of loess cover adjacent to the Tibetan Plateau, as well as some ice-related morphological and sedimentological features. Some evidence of erratics was also reported by Dr. Jarkel from Germany. Moreover the output of a modi-

fied Hold-ridge Biome Model, from Prof. Zhang Xinshi, indicates that the temperature on the Plateau during the LGM was 5–9 °C lower than for the present-day, therefore favorable to the development of large ice-sheets. In addition, over the last few years, an increasing number of studies have suggested that the lake levels in western China during marine oxygen isotope stage 3 were exceptionally high and that a huge lake may have existed adjacent to the Tibetan plateau region. If this was the case, the presence of these extensive water bodies would be most readily explained by the effects of ice-melt from the surrounding mountains, since the corresponding paleosol in the same region is rather weak, suggesting that precipitation

alone would have been unable to provide enough water for huge lakes.

Irrespective of the final outcome of the debate, the Tibetan ice-sheet issue deserves to attract serious attention since the surface conditions of the plateau would have had a major impact on glacial climate over a wide area and potentially even on a global scale, through modulating the latent heat and albedo as well as through any physical effects on atmospheric circulation.

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## Atlantic Transect of the European Lakes Drilling Program (AT-ELDP)

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Brief reports on work in progress were presented by members of the group. A detailed discussion followed, during which it was agreed that the basis of the Atlantic Transect will be as follows:

1. The strategy adopted will be to try to develop detailed comparison between the modern instrumental record (the last 150–200 years), and the most recent part of the sedimentary record. A multiproxy approach will be used in order to test whether regional climate changes identified in the instrumental record are also replicated in the sediments. A calibration/ transfer-function approach will then be adopted, in order to extend the record of climate variability back into the past. It was recognized that there may, however, be a limit to the period over which modern processes amenable to calibration in this way are representative of past changes. The standard ELDP strategy, of using only high resolution (< 20 year) multi-site, multi-proxy, multi core lake sediment sequences, preferably annually laminated, will also be followed.

2. The ultimate aim of the AT-ELDP will be to generate data on the effects of climate/ environmental change on human society, in this case along the Atlantic Seaboard of Europe, over the past 2 ka. The effects of changes in and over the North Atlantic Ocean will be compared with the instrumental and multiproxy sediment record, in order to try to identify what their influences were on contemporary human societies.

After the discussion of general principles, a number of more detailed points were raised:

3. The project as outlined above clearly needs the input and support of climatic historians. AT-ELDP should therefore seek, at the earliest opportunity, to enlist the support of as many colleagues with such expertise as possible.

4. The events and changes in and over the North Atlantic Ocean with which the group are concerned operate on several different timescales, from circulation and formation of NADW to annual variations in weather. However, over the past five years, phenomena such as changes in the position of the north wall of the Gulf Stream (NWGS), and in the index of the North Atlantic Oscillation (NAO), have come to the fore as proposed generators of mesoscale (submillennial, centennial, decadal) changes, especially as there is some indication that they may also be linked to solar variability.

5. In response to the question of whether signals reflecting these types of variability may be detectable, various colleagues indicated where and how they believe they have identified NAO-type influences upon the sedimentary record. In some lakes, however, the anthropogenic record may be so strong as to overprint the climatic signal. Inter-site comparisons of high resolution records (e.g. Loch Ness, N Scotland to Lough Neagh, N Ireland) could be used to evaluate this complication.

6. It was recognized that in any attempt to identify the human implications of climate variability in the past, the contrasted paradigms within the social and environmental sciences may present major problems.

7. The problems involved in correlating effectively between the sedimentary and the instrumental record are non-trivial. They include questions of dating and temporal resolution, and the required representativity and continuity of sedimentary records; in recent decades, there is also an "economic over-ride" of natural processes. Given sufficiently high resolution, calibration of records to the instrumental record was nevertheless considered achievable.

8. Members of AT-ELDP include colleagues from Iceland (Reykjavik), UK (Belfast and Plymouth), Ireland (UCD), and Spain (CSIC, Barcelona). AT-ELDP would welcome participation from new members from other European countries on the Atlantic seaboard, as well as cooperation from any historians who might be interested in such a project.

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