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Interactive
Comment

Interactive comment on “Culturable bacteria in Himalayan ice in response to atmospheric circulation” *by* S. Zhang et al.

S. Zhang et al.

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Referees 1 gave a number of useful suggestions for improving the manuscript. Basically we agree with the referees that our initial results are reasonable but somewhat immature because we have only four samples to focus on. In fact, we are currently experimentalizing more samples from both the Himalayan and the other Tibetan glaciers, and try to develop our initial conclusions. Hereafter we address their specific comments in the same order as in the review:

Question 1:

The size of the population (stated as 7.0 CFU ml-1) within the “most heavily populated core section” is incredibly low and would have a high probability of arising from air contamination during sampling.

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Response:

In our lab, a routine experimental protocol has been set up to study glacial microorganisms, and the results were appeared in varied journals (Xiang et al., 2004; 2005a; 2005b; Zhang et al., 2001, 2002, 2003). To make sure that the inner part of ice core was free from contamination, we investigated changes in the concentrations of culturable bacteria from the outside to the inside of a 10cm ice core sample from 40.20 m-40.30 m of the 40.87 m ice core. The result showed that bacterial concentrations are fairly stable when three successive veneer layers (about 0.01 m) were chiseled off, indicating that external contamination has not penetrated to the inner part. The approach verified, to a certain extent, the authenticity of the microbiological results obtained from the ice core samples.

In addition, the sterile double distilled water used to rinse the 4 samples was collected in this research and was inoculated onto R2A and PYGV media as control. The results demonstrated undetectable level of contamination by the above procedures employed.

Question 2:

The authors offer no data to show that the core they use actually has a level of resolution sufficient to discriminate within levels as small as a month (or even a couple of weeks).

Response:

At the saddle of ER glacier, the present average annual net accumulation is about 500mm water equivalent as determined from snowpits and a stake accumulation network established during a reconnaissance in May 1998. For an 80.4m ice core recovered at 6450 m of ER glacier, Kang et al. (2002) counted 152 annual layers by the high-resolution (average 12 samples per year) major ion records, giving an accumulation history of about 0.42-0.60 m per year for the period 1846-1997 AD. This, together with the seasonality of delta-Oxygen-18, suggests roughly duration of one year for the

0.57 m ice core section.

Question 3:

This core section contains the highest amount of dust, does not prove to me that the ice in that region formed from waters carried north by the Monsoon rains which would tend to wash such material out of the air. Rather, I see no reason why it would not be the opposite situation, that this area arose when winds were carrying particles out of the desert in which case there would be little rain to cause the dust to settle when it reached a more quiescent air around the glaciers.

Response:

This is connected to the seasonality of atmospheric circulation on the Tibetan Plateau (TP). During summer, low pressure over the surface of the plateau (Tibetan Low) induces a supply of moist and warm air from the Indian Ocean to the continent (summer monsoon), meanwhile, in the upper troposphere the Southern Asian High centers over the TP and drives air mass moving out of the plateau (Wu and Zhang, 1998; Li, 2002). Then, there is South Asian Monsoon Cell (inverse to the Hadley Cell) formed between the TP and the Indian Ocean, which transports moisture into the TP from Indian Ocean in the lower troposphere and sends air back in the upper troposphere (Zhou, 1997; Li, 2002). In winter, high pressure (Tibetan High) drives cold and dry air moving out of the plateau (winter monsoon) in the lower troposphere (Bryson, 1986; Tang, 1998). While in the middle and upper troposphere, subtropical jet streams flow south and north of the plateau. In the surface of the plateau, anticyclone is dominant in the north of the plateau, while cyclone in the south of the plateau. In the region where our ice core was recovered, precipitation is caused by moisture transported by summer Indian monsoon and/or by local moisture from short distance convective air mass during summer (June to September), and moisture is transported by westerlies during winter (October to May). Therefore, the core section containing the highest amount of dust corresponds to winter precipitation, while the summer Indian Monsoon contributes to a decrease in

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atmospheric dust loading (Kang et al., 2000).

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