Small changes in pharmacokinetics of 5-FU and FBAL may result if there are differences in times of administration of 5-FU and its modulators in combination chemotherapy.

In conclusion, our present study documents that ^{19}F *in vivo* NMR is a useful tool to follow the pharmacokinetics and metabolism of fluorinated drugs in patients undergoing cancer chemotherapy. Such studies allow noninvasive determinations of variations in the metabolism of drugs at various organ and tissue sites of patients having various pathophysiologies and/or undergoing selected pharmacological interventions.

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Thermal structure and heat budget of Priyadarshini Lake, Schirmacher Oasis, East Antarctica

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Data on thermal structure and heat budget of Priyadarshini Lake, Schirmacher Oasis, East Antarctica are presented. Available data during the summer of the sixteenth Indian Antarctic Expedition (December 1996–March 1997) reveal that the Priyadarshini Lake was weakly stratified. The lake became unstratified as the winter period approached.

SCHIRMACHER Oasis of Antarctica is a group of low-lying hills of 50–200 m height and is interspersed with a number of freshwater glacial lakes. The available information indicates that the size of these lakes ranges from a few hectares to a few km^2 and the maximum depth of water in them ranges from a few meters to about 150 m. Depending upon their topographic setting, they occur as inland lakes, ice margins lakes or epishelf lakes. The Priyadarshini Lake, with a total water spread area of 0.75 sq km, is one of the largest lakes in the region and is closest to the Indian Station, Maitri. This lake, located about 255 m away from Maitri, is the lifeline of the Indian expedition. It supplies water to the station. It has been described as a proglacial lake[1], formed at the edge of the ice cap during the deglaciation phase. The water and sediment input to the lake is entirely through melt water during warmer periods of spring and summer. A study of Priyadarshini Lake was taken up by IIT Kanpur during the XVI Indian Antarctic expedition (December 1996–March 1997) to determine its thermal structure and heat budget.

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The thermal cycle of the Antarctic lakes can be divided into two periods: the ice-covered period and the ice-free period. In the present study, thermal data were collected during ice-free period (January–February 1997). The Priyadarshini Lake undergoes freezing in winter and melting in summer. The top 2–2.5 m of the lake freezes during the winter. The freezing of the shore area starts approximately during the second week of February and the lake freezes completely by the first week of April. The melting phase starts in the first week of November and the lake is in liquid state by the last week of December. Temperature sensors and a 10-channel digital temperature indicator were installed in the lake during the second week of January 1997 at a location close to the pump house (see S1 in Figure 1) for recording temperatures. The temperature sensors were dropped in the lake with the help of a float. Out of 10 temperature sensors, the first 6 were fixed at 0.5 m interval and the rest at 1 m interval. The depth of water column at this point was 4–5 m. A twelve-hour cycle of vertical temperature profile of the lake was established to see the gradual shifting of thermocline (zone of maximum vertical temperature variation) during the day and to select a particular time for daily observations. Plotting the vertical temperature profiles, the profile at 8.30 A.M. showed maximum variation and the same was selected for daily observations. Daily observations of vertical profile of the lake temperature were recorded for the period (15 January–18 February). These *in situ* thermal data have been further analysed to work out thermal structure and basic heat budget of the Priyadarshini Lake.

Hourly temperatures on 14 January 1997 for a 12-h period are plotted in Figure 2. The variation of temperature with depth shows that a weak thermocline developed between 1.5 m and 4.0 m. The difference in temperature of epilimnion (surface layer above thermocline) and hypolimnion (deeper layer below thermocline) is small (of the order of 1–1.9°C). The temperature of the lake surface steadily increases from morning, reaches its maximum (6.5°C) around 3 P.M. and then decreases. This is apparently in response to solar heat flux during the day. At about 3 m, the lake has the maximum temperature of 6.7°C at approximately 5 P.M. After 5 P.M. the temperature of the middle layer does not decrease significantly. At a depth of 5 m, the temperature is always slightly higher than that of the lake surface. The observed temperature inversion is apparently supported by a weak salinity variation. Earlier studies on the Antarctic Polynya[2] showed that low surface salinity was associated with the increase in temperature. Although no systematic data on salinity are available for the Priyadarshini Lake, the addition of fresh glacial melt during the summer period may lower the surface salinity, and hence support higher temperature at greater depths. Yet another possibility is that suspended sediments provided the necessary stratification. Our estimates showed that salinity in the lake varied between 2.01 and 2.03 ppt.

During 15 January 1997 to 18 February 1997, temperature was recorded daily at 8.30 A.M. The data have been plotted in Figure 3. In general, the lake cooled during this period. Towards the end of the period, the surface water of the lake was close to freezing (0.6°C), whereas the deeper layers of water were still well above 1°C.

As winter approached (5 February onwards according to our data), the lake water column becomes vertically

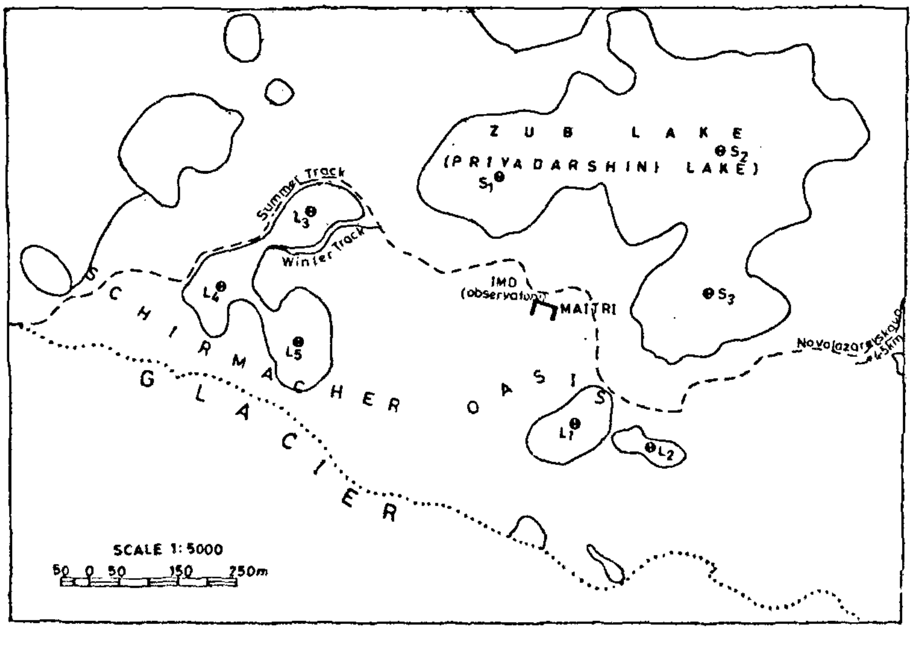

Figure 1. Study area and sampling locations.

homogeneous and the thermal stratification was destroyed. Keeping in view the transition of the lake from stratified to unstratified condition, the heat budget has been computed for both the cases.

We use surface water temperature, thermocline depth and hypsometric curve for stratified lakes in order to correct for decrease in area with depth. For the *stratified case*, the heat content can be expressed as[3],

$$\Sigma H_S = T_{SfC} \cdot D_{th}/2.$$

By taking half of the thermocline depth the linear hypsometric term is included. Using Birge's definition of thermocline (an imaginary plane within the lake located at a level intermediate between the two depths where the temperature variation is the greatest) the average thermocline depth is taken as 2.75 m (ref. Figure 2) for hourly variation of temperature and 3.25 m (ref. Figure 3) for daily variation of temperature and these values are used for further computation of heat storage terms during mid-summer period till 5 February.

From 5 February onwards the heat budget of the Priyadarshini Lake has been treated as unstratified. For the *unstratified case*, the heat content per unit area is taken as the product of the surface water temperature and mean depth[3] (volumetric heat capacity is 1.0 cal/cm^3):

$$\Sigma H_S = T_{SfC} \cdot D(\text{cal/cm}^2).$$

The morphometric data and hypsographic curve (Figure 4) of the Priyadarshini Lake have been generated from bathymetric map[1] of the lake basin. The mean depth, which comes out as 2.12 m was computed by dividing the lake volume by its surface area.

Diurnal variation of heat storage for the stratified condition (14 January) is plotted in Figure 5. This shows that the heat content increases from the morning till 6 P.M. and then decreased. The profile shows its maxima at 2 P.M., as the surface temperature gradually increases with the increase in intensity of the incoming solar radiation. The plot of daily heat content variation from

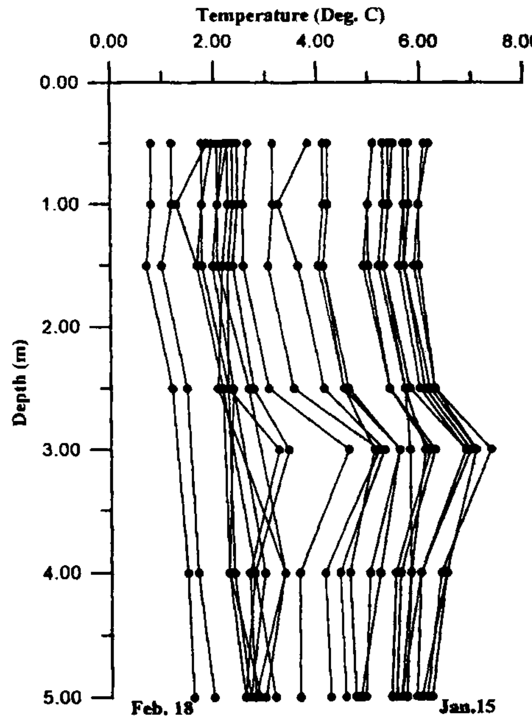

Figure 3. Daily variation of temperature with depth from 15 January to 18 February 1997.

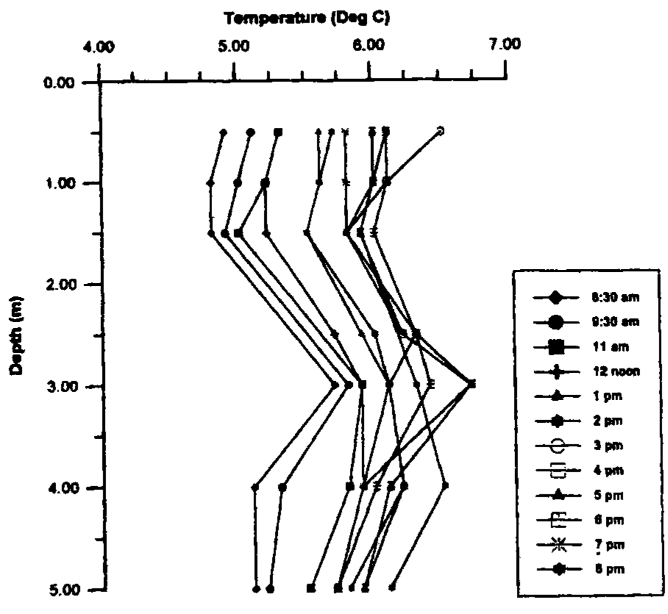

Figure 2. Diurnal variation of temperature with depth recorded on 14 January 1997.

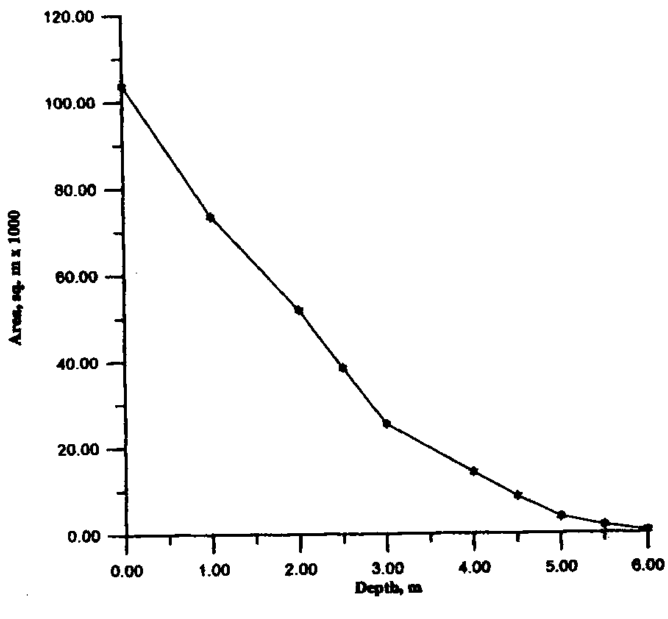

Figure 4. Hypsographic curve for the Priyadarshini Lake, Antarctica.

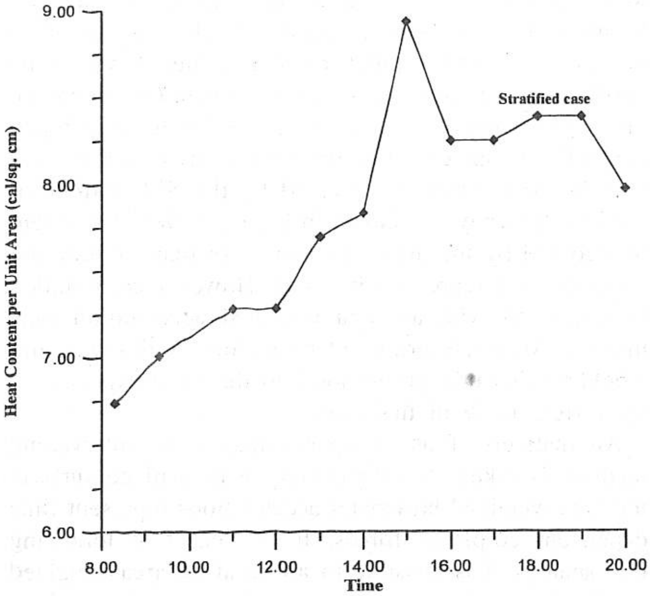

Figure 5. Diurnal heat content variation in the Priyadarshini Lake, Antarctica.

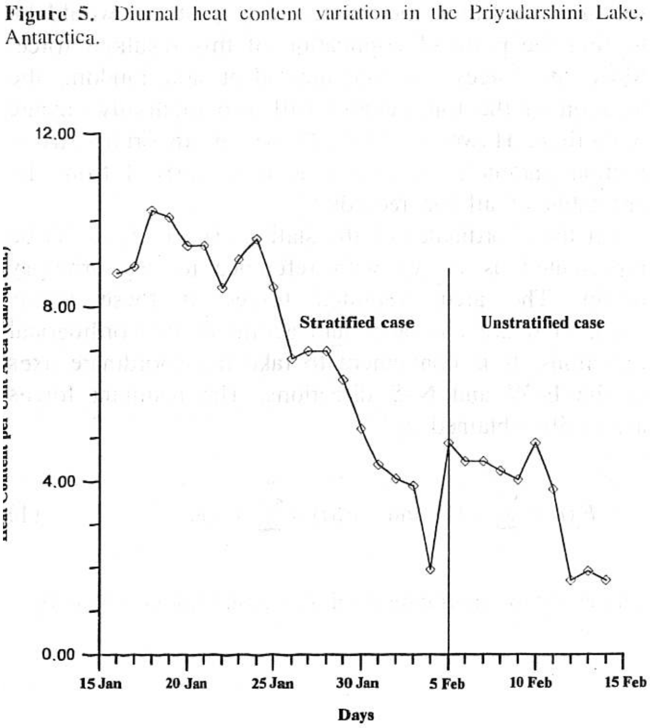

Figure 6. Daily heat content variation in the Priyadarshini Lake, Antarctica.

15 January to 15 February (Figure 6) shows that during mid-summer period, i.e. till 5 February, the heat content of the lake was quite high when it behaved as thermally stratified. From 5 February onwards, when the lake starts transforming into an unstratified condition, the heat content gradually decreased. The heat content of the water at the time of freezing becomes nearly zero

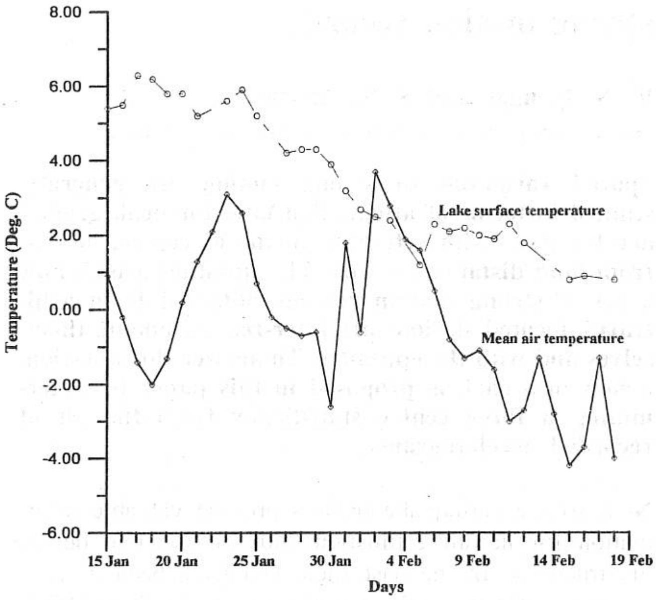

Figure 7. Mean air temperature and the Priyadarshini Lake surface temperature.

and the albedo increased sharply, thus reducing the absorption of solar radiation. The local spikes in the heat content profiles are due to fluctuations of weather condition on some days. Further, it is interesting to note that the lake surface temperature was generally higher than the mean air temperature (Figure 7). Even when the mean air temperature has dipped to subzero values, the lake surface temperature remained positive. It appears therefore that the freezing of the lake is not directly linked to variation in the mean air temperature of the region.

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