The following slides are at Cape Royds on Ross Island (north of McMurdo Base) and of the “dry valleys”
Ross Ice Shelf, melt ponds & Royal Society Range: 78° S Lat.
Cape Royds, southernmost Adelie colony
“lift-off mat”, Cape Royds, Antarctica
Don Juan Pond (saturated calcium chloride)
Taylor Valley, Antarctica
Taylor Valley; seep from glacier with *Nostoc*
Canada Glacier, Taylor Valley, Antarctica (source of Fryxell Stream)
Fryxell Stream (freezes daily), and Fryxell Lake (always ice-covered)
Nostoc in Fryxell Stream; freezes and thaws every 24 hr
Cyanobacterial mat at 10 m in Lake Fryxell; receives ~1-2% of surf. light
Overturned Antarctic iceberg with microalgae in the ice
Predatory Leopard Seal, Antarctica
The following few slides are from Svalbard (islands north of Norway at 78° N. Latitude
Sea ice, Svalbard (or Spitsbergen), 78° N Lat.
Glacial runoff, fjord in Svalbard (78° N. Lat.)
Nostoc in Svalbard bog (mosses and flowering plants)
Dry *Nostoc*, Svalbard bog
Cyanobacterial mounds with saxifrage (Svalbard, 78° N. Lat.)
Cyanobacterial crust, Svalbard (with scytonemin)
RESULTS OF EXPERIMENTS ON SUB-ZERO METABOLISM IN HETEROTROPHIC BACTERIA
Fig. 4. Rates of respiration and incorporation into biomass during incubation of *Sporosarcina* sp. B5 and *Chryseobacterium* sp. V3519-10 in brine and ice. Rates were calculated for Phase I (the first 14 days of incubation) and for Phase II (the remaining 36 days of incubation). Rates were calculated as the slope of the line of best fit for data from duplicate samples; the standard deviation of the slope is also shown.
Fig. 6. Rates of macromolecule syntheses during Phase I (the first 20 days of incubation) of *Sporosarcina* sp. B5 and *Chryseobacterium* sp. V3519-10 in brine and ice. Rates were calculated as the slope of the line of best fit for data from duplicate samples; the standard deviation of the slope is also shown.
Table 1. Calculated growth rates at -5°C.

<table>
<thead>
<tr>
<th>Organism</th>
<th>Media</th>
<th>Specific growth rate (day⁻¹)</th>
<th>r²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sporosarcina sp. B5</td>
<td>Ice</td>
<td>0.016 ± 0.008</td>
<td>0.55</td>
</tr>
<tr>
<td></td>
<td>Brine</td>
<td>0.033 ± 0.019</td>
<td>0.47</td>
</tr>
<tr>
<td>Chryseobacterium sp. V3519-10</td>
<td>Ice</td>
<td>Not determined</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Brine</td>
<td>0.016 ± 0.006</td>
<td>0.81</td>
</tr>
</tbody>
</table>
Metabolic Activity of Permafrost Bacteria below the Freezing Point
E. M. Rivkina et al. (2000)
FIG. 1. Incorporation of $^{14}$C-labeled acetate by the native bacterial population in Siberian permafrost over a 550-day period. Because of the very low counts, we calculated the curves for $-15$ and $-20^\circ$C by using equation 1. For all data the limit of error (2σ) was less than 5%.
FIG. 2. Minimum doubling times of the bacterial population in permafrost at different temperatures. Symbols: ●, data calculated from data in Fig. 1; ○, data calculated by means of equation 1.
FIG. 3. Levels at which bacterial growth reaches a stationary phase (Fig. 1), measured amounts of unfrozen water, and calculated thicknesses of unfrozen water films in permafrost (18) plotted versus temperature. The similarity of the curves suggests that the stationary phase is reached as a result of a diffusion barrier in the thin film of water, the thickness of which depends on temperature.
Characterization of Viable Bacteria from Siberian Permafrost by 16S rDNA Sequencing
T. Shi et al. (1997)
Fig. 1. Soil temperatures at the surface and at 14 m depth (permafrost) at the collecting site from August 1990 to August 1991, measured by thermistors in a drill hole and recorded each day at midnight with a Campbell 21X (Logan, Utah) datalogger. (McKay, Chyba, and Meyer unpublished data).
Table 1. Description of wells drilled

<table>
<thead>
<tr>
<th>Well no.</th>
<th>Date</th>
<th>Location</th>
<th>Suite/age/notes</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/90</td>
<td>Aug. 1990</td>
<td>Middle part of Bolshaya Chukocha River, right bank</td>
<td>Olyor, 1.8–3 my&lt;sup&gt;a&lt;/sup&gt;</td>
<td>All samples inoculated in the field</td>
</tr>
<tr>
<td>3/89-35A</td>
<td>Aug. 1989</td>
<td>Middle part of Bolshaya Chukocha River, right bank</td>
<td>Yedoma, 30,000–40,000 y,&lt;sup&gt;b&lt;/sup&gt; ice content 38%</td>
<td>1055</td>
</tr>
<tr>
<td>1/89-34</td>
<td>Aug. 1989</td>
<td>Middle part of Bolshaya Chukocha River, right bank</td>
<td>Alas, 2,000–5,000 y, ice content 42%</td>
<td>1308</td>
</tr>
<tr>
<td>9/89 Kh-yu</td>
<td>Aug. 1989</td>
<td>Khoemus-Yaryakh River, right bank</td>
<td>Olyor, 3–5 my, ice content 22.2%</td>
<td>1052A</td>
</tr>
</tbody>
</table>

<sup>a</sup> my, Million years
<sup>b</sup> y, Years