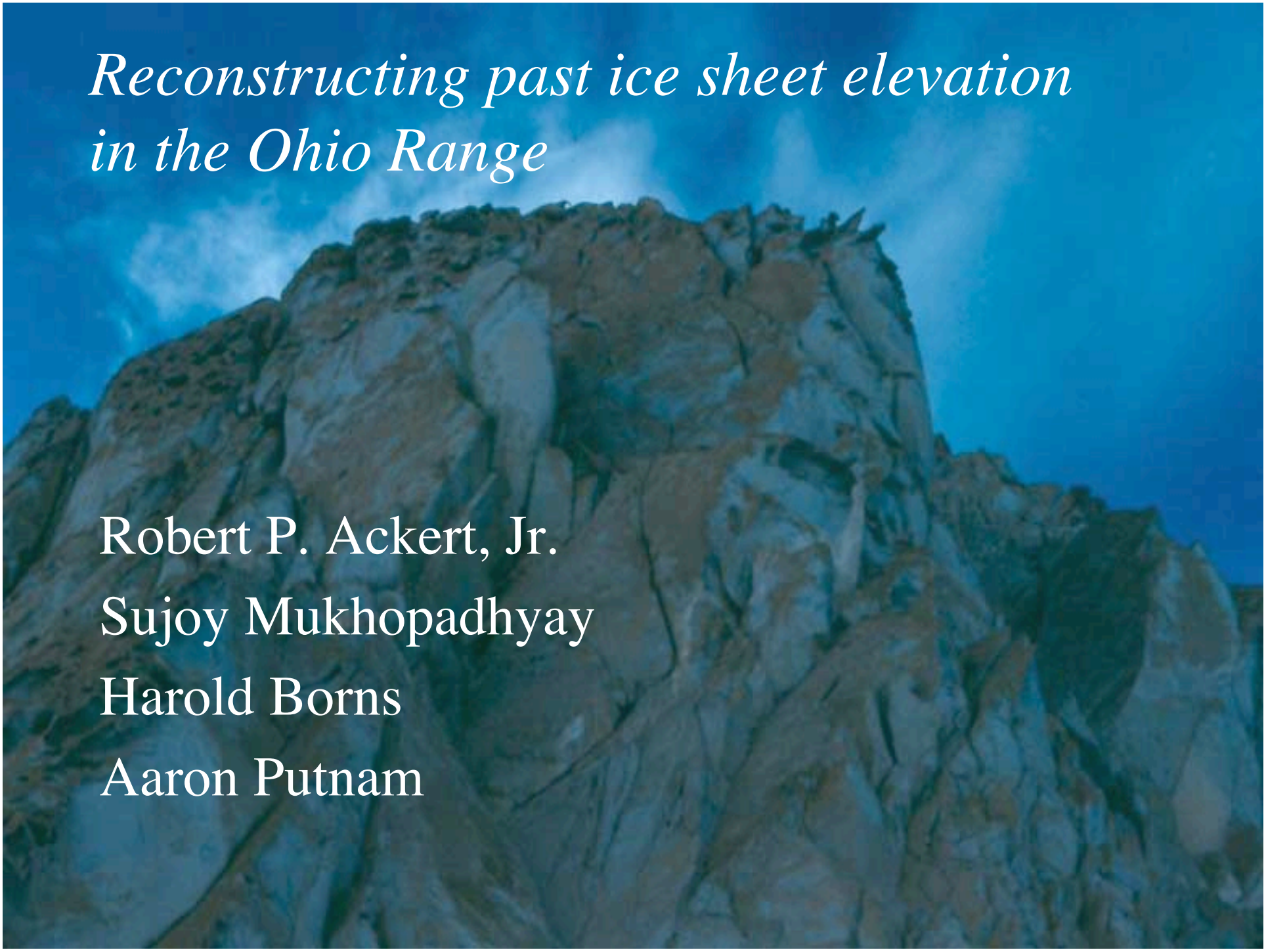


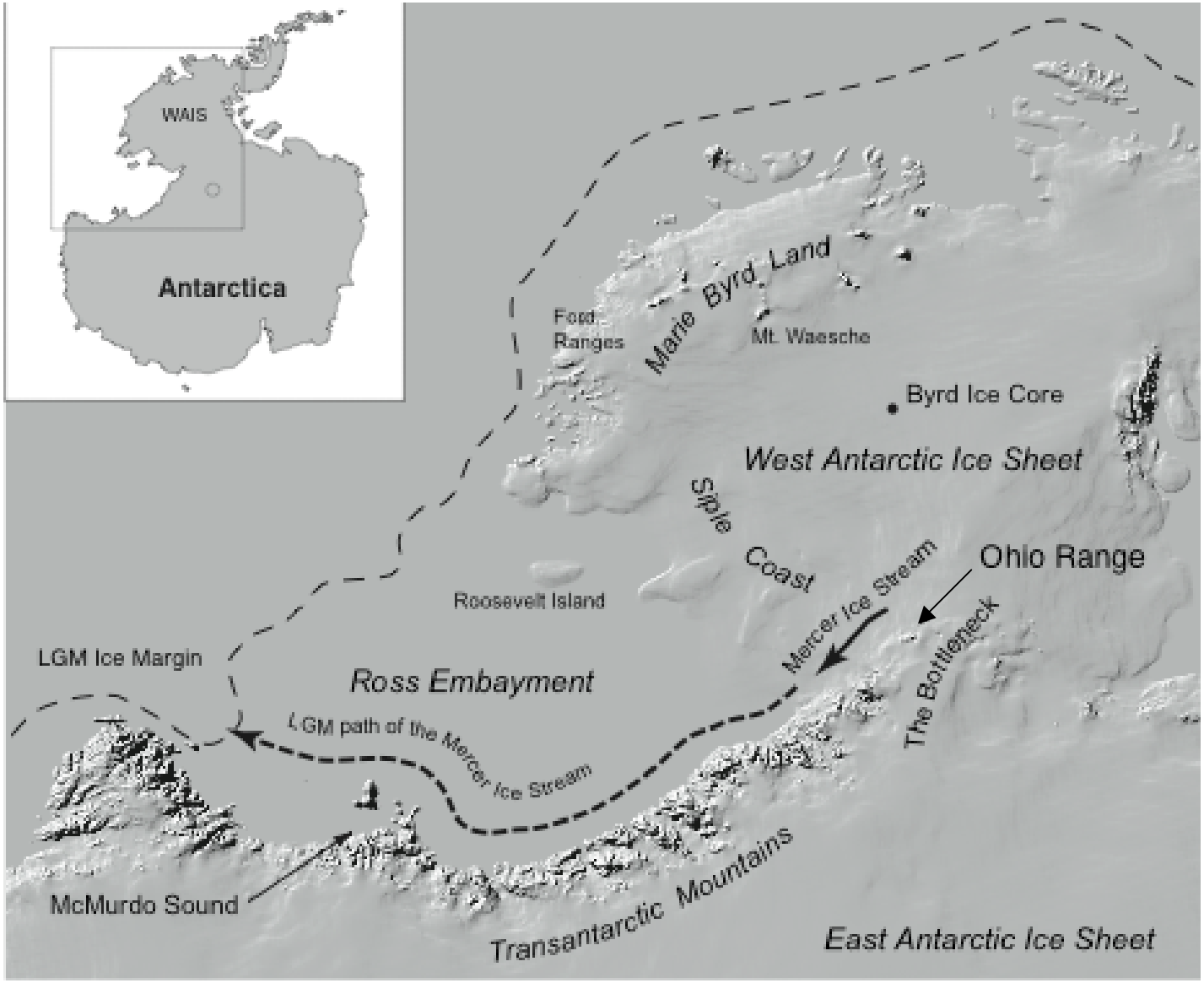
Reconstructing past ice sheet elevation in the Ohio Range

Robert P. Ackert, Jr.
Sujoy Mukhopadhyay
Harold Borns
Aaron Putnam

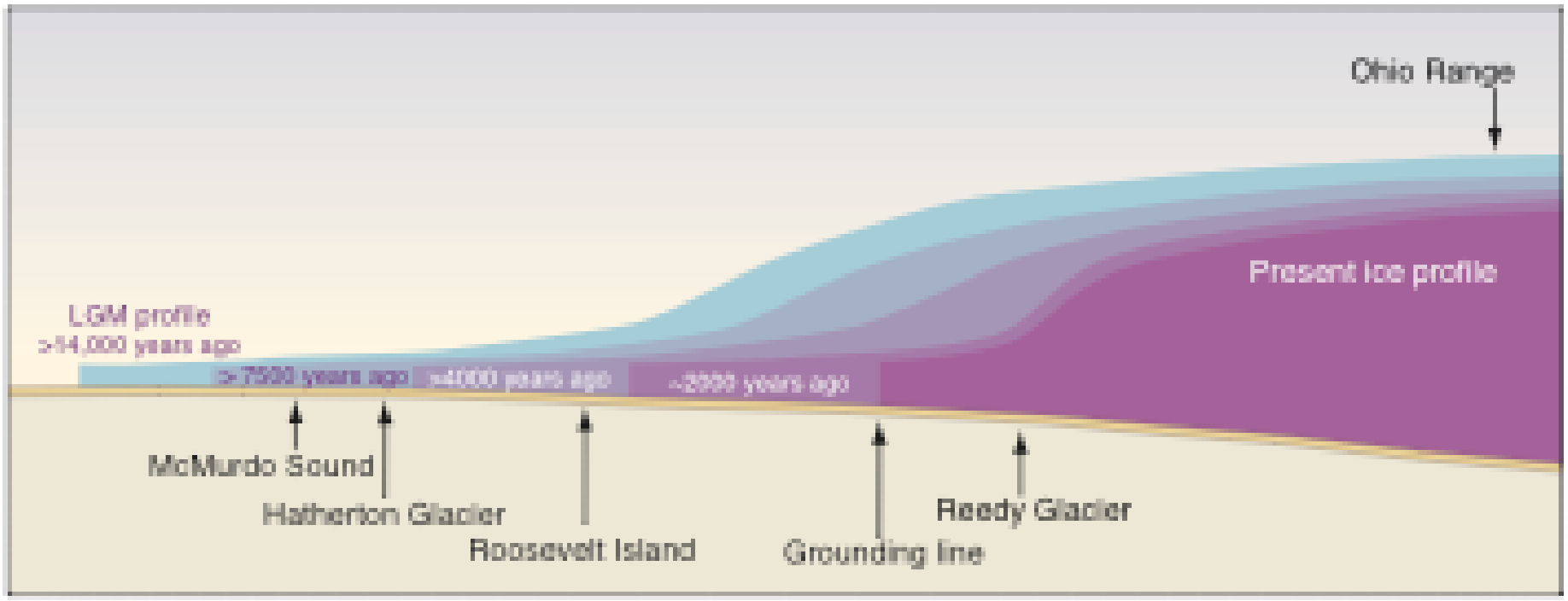
Rational and Methodology

- Constrain reconstructions of the WAIS during the last glacial maximum and subsequent recession in the interior of the ice sheet.
- Mountains that project through the ice sheet serve as dipsticks that gauge past ice elevations.
- Surface exposure dating of glacial features provide chronology of ice recession.

Near the onset area of the Mercer Ice Stream, the Ohio Range is ideally situated to record past ice elevations in this important sector of the WAIS.



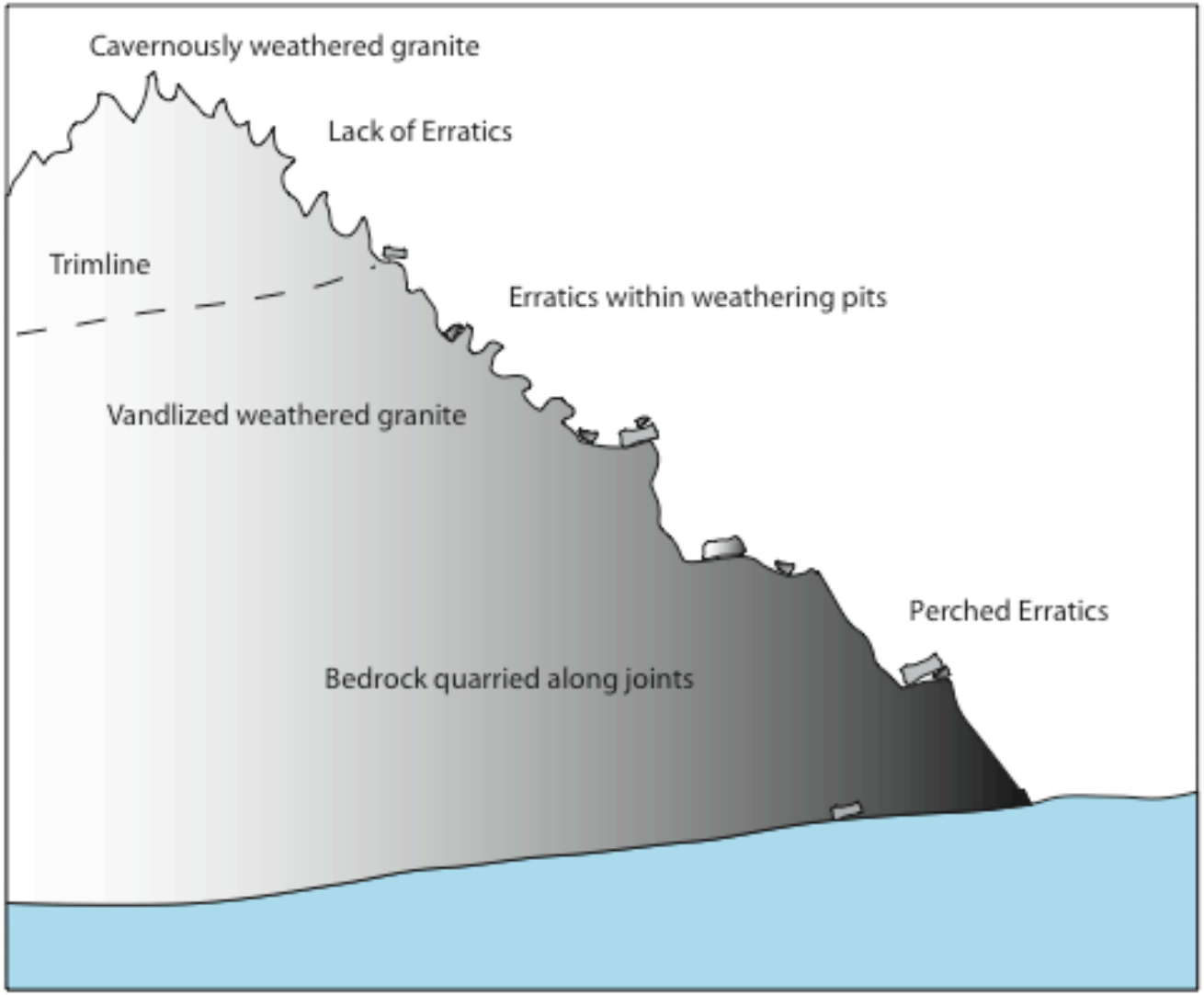
Wave of thinning



Although there are data on ice thickness and the timing of grounding line retreat along the Transantarctic Mountain front, constraints on interior ice elevations is lacking.

Dipstick Glacial Geology

Trimlines determined from erosional features and erratic limits in the Ohio Range record past ice elevations.



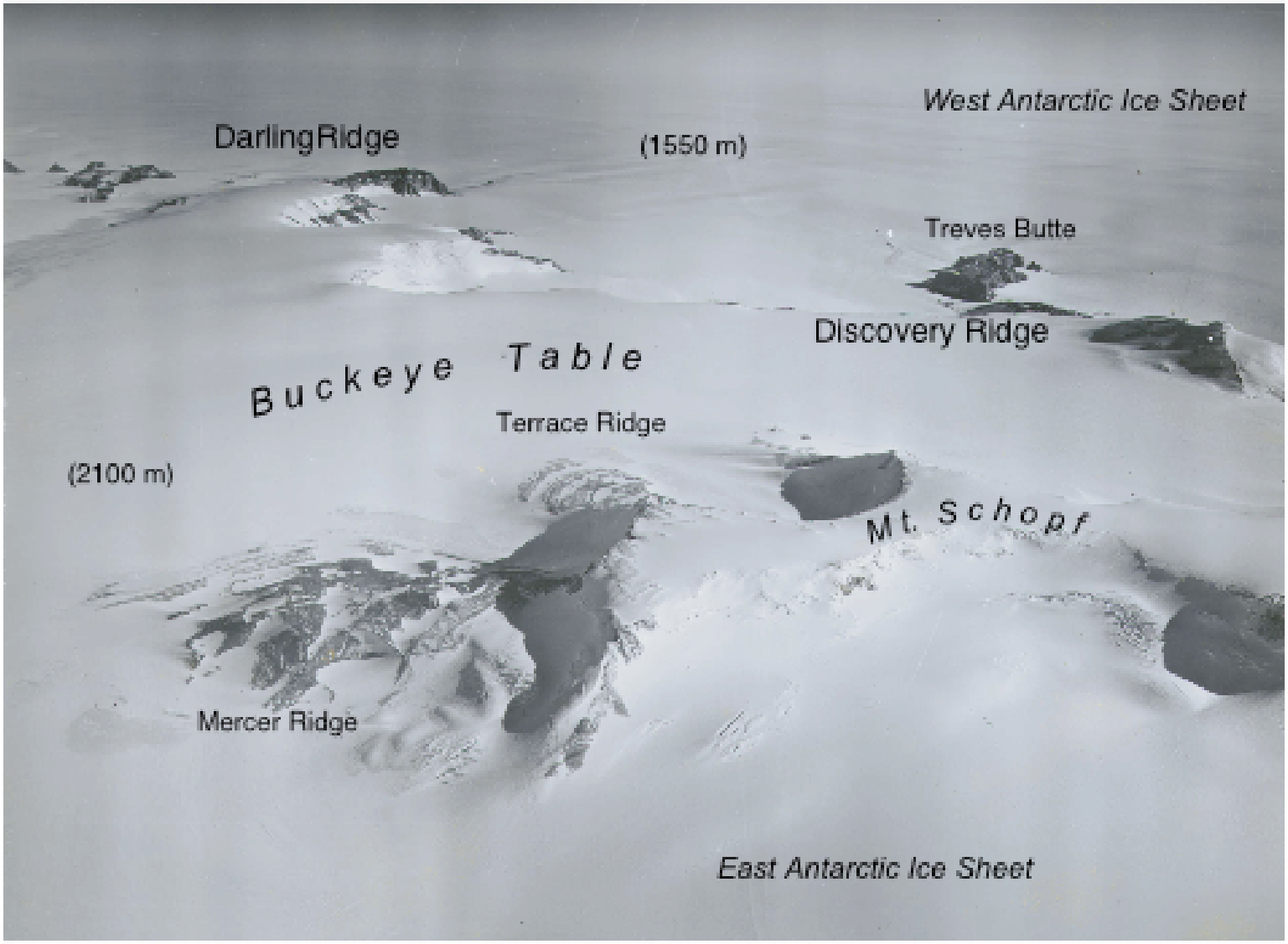
Surface exposure ages of bedrock and erratics along vertical transects on nunataks and ridges provide chronology of deglaciation.

Perched Boulders

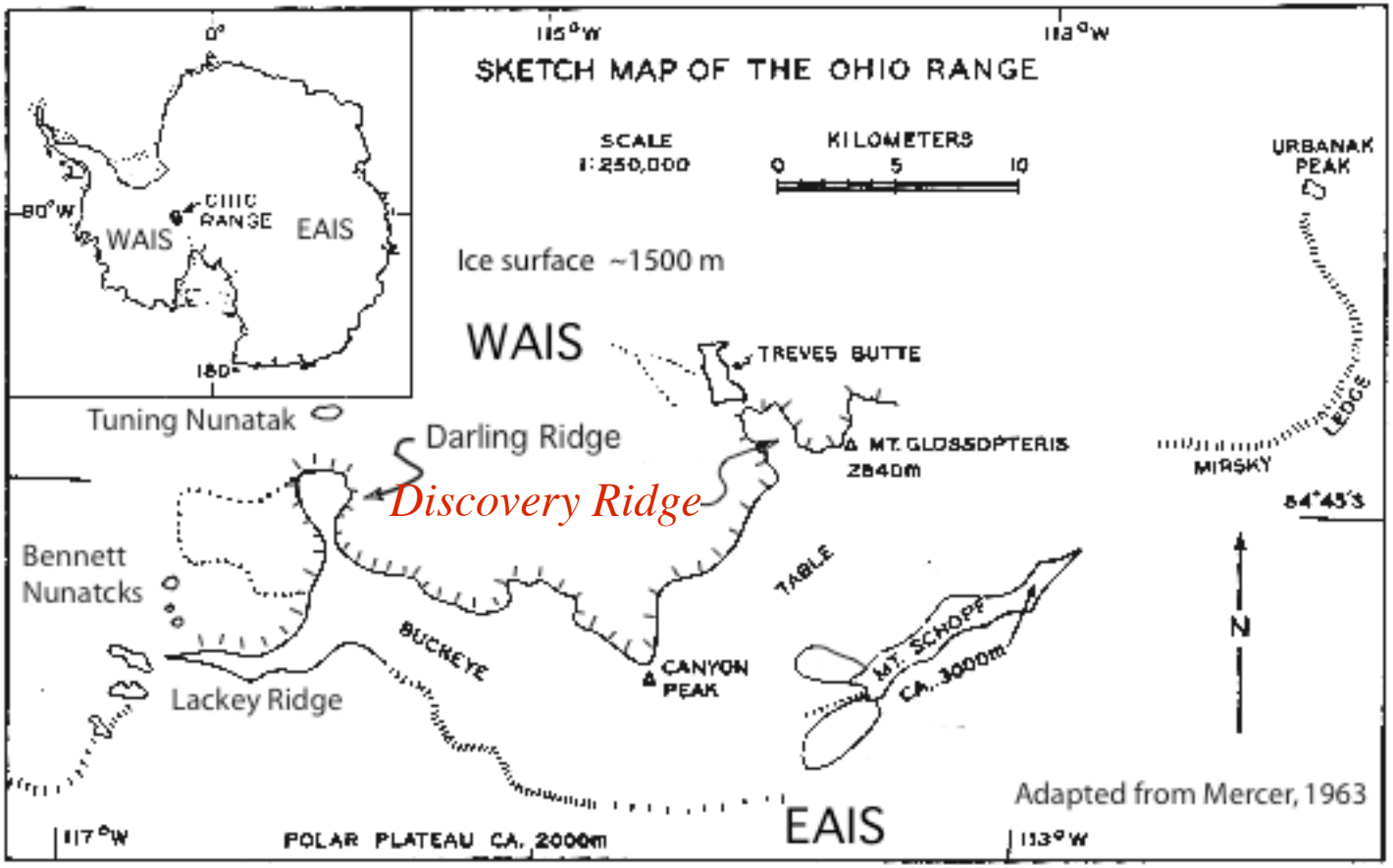
Perched Erratics at Bennett Nunataks indicate relatively recent ice recession.

Vandalized bedrock

The most delicate weathering features have been broken off by cold based ice.



Oblique Air Photograph of the Ohio Range looking to the North. Ice elevations at the base of the escarpment are controlled by WAIS rather than local ice flow.



Mercer (1963) describes erratics 60 m above WAIS surface at Discovery Ridge.

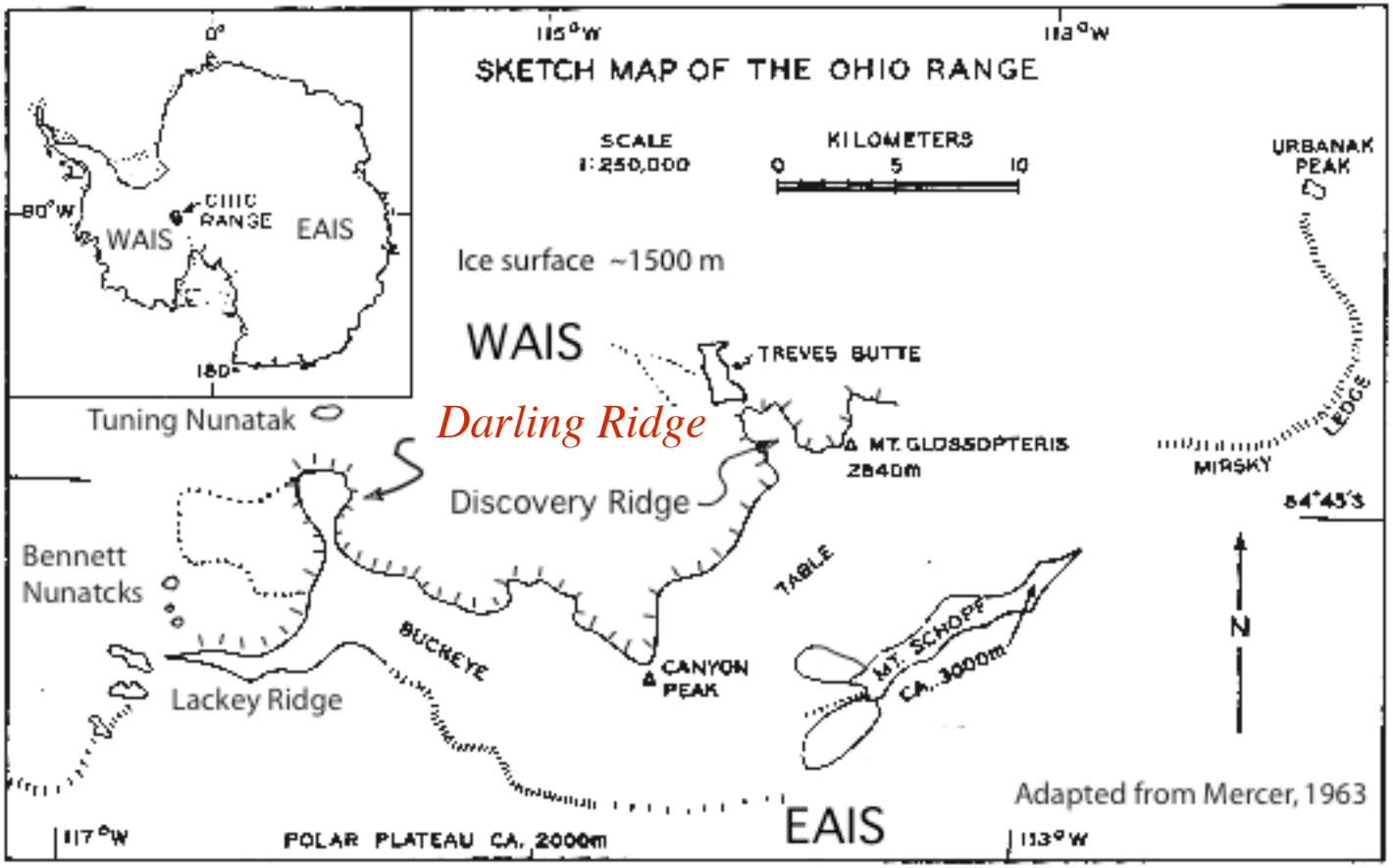
Discovery Ridge with large erratic. Ice cored moraines occur in ablation areas in the lee of prevailing winds.

Lower Bench of Discovery Ridge with Erratics. Elevation is 1720m.
Surface is exhumed peneplain.

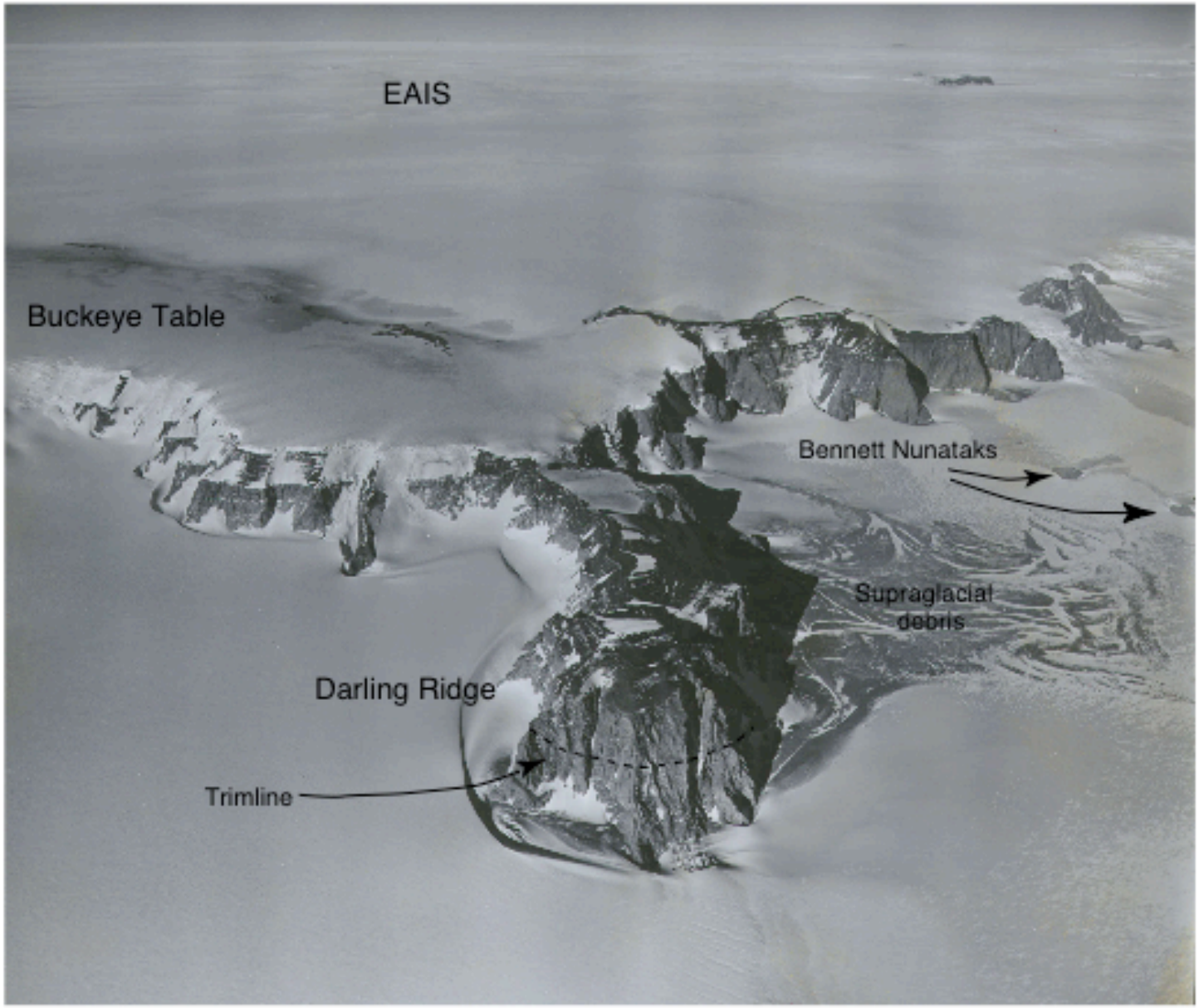
Most boulders on Discovery Ridge are of the local lithology and cavernously weathered. Fresh angular erratics also occur.

Most boulders are derived from cavernous weathered flanks of Discovery Ridge.

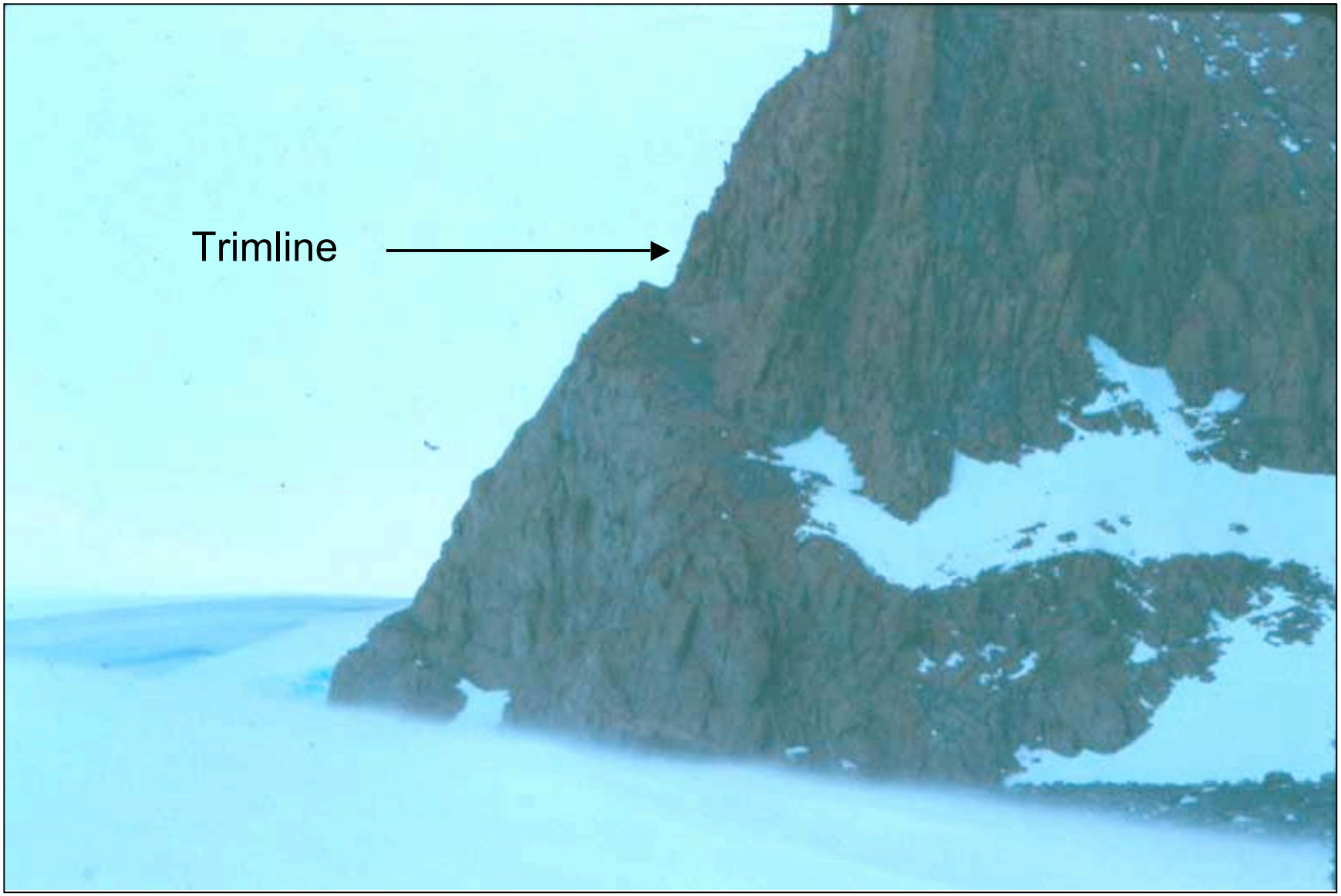
A Trimline determined by the lower limit of fragile cavernously weathered bedrock on Discovery Ridge and the adjacent Treves Butte, occurs at ~1760m.



Trimline on Darling Ridge occurs at 1750 m. Erratics occur on the peaks of Tuning and Bennett Nunataks.

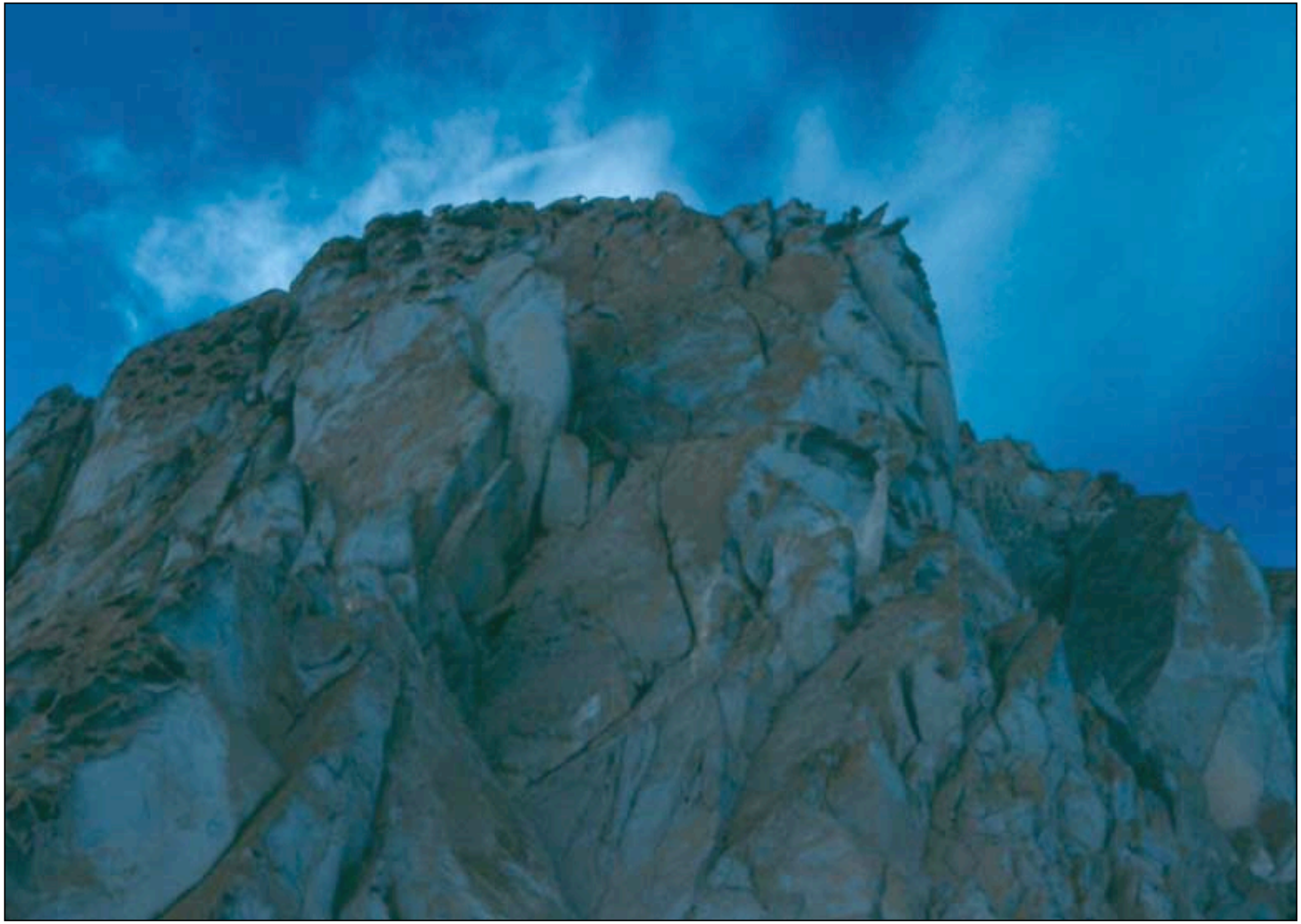


Oblique Air Photograph of Darling Ridge looking to the South



Erratics occur to the top of a Flat iron on Darling Ridge (1730m). An erosional trimline occurs about 20m above.

Striated erratics are derived from tillites in the sedimentary rocks overlying the granite basement rocks.



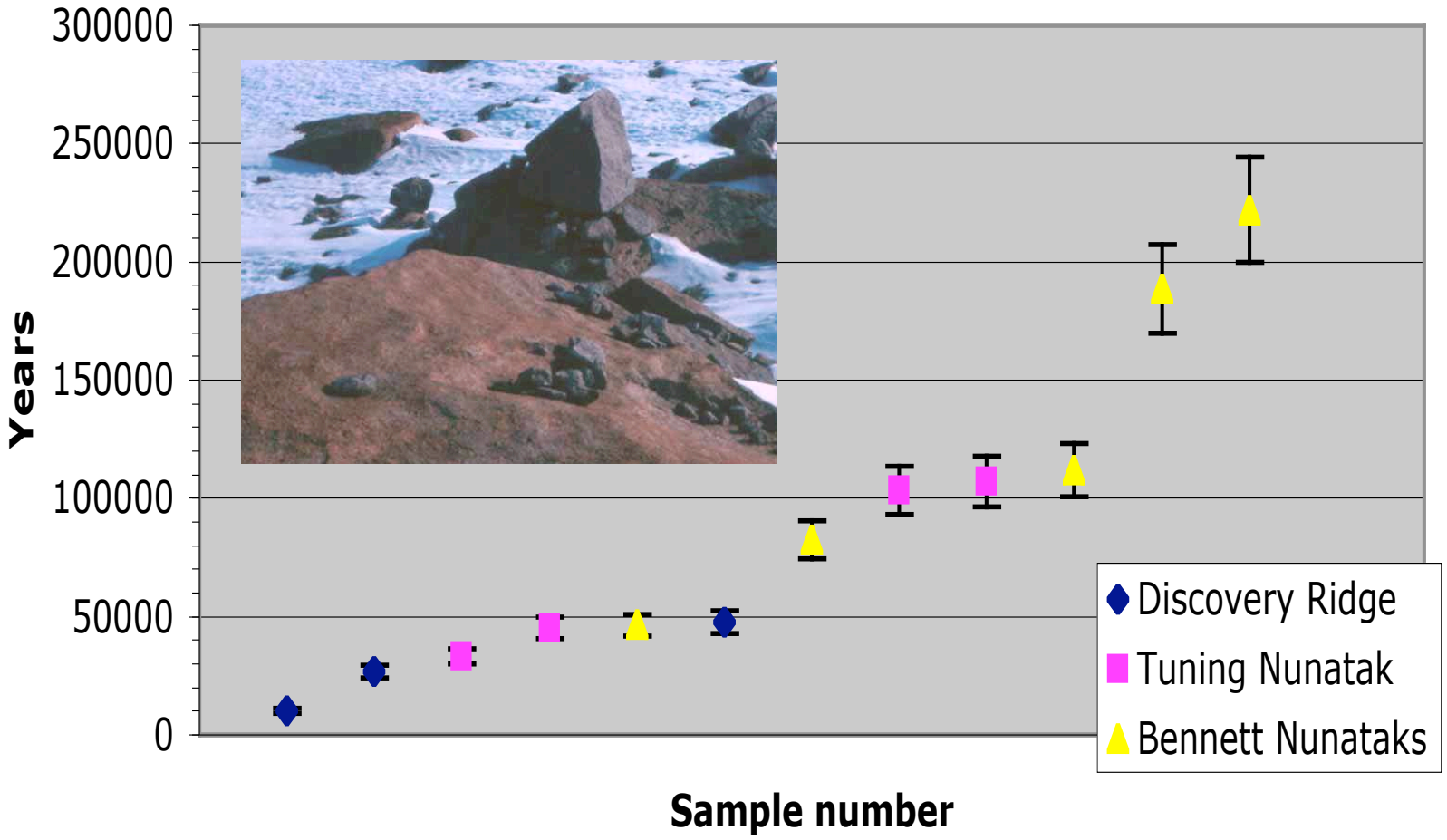
Delicate horns (tafoni) are preserved ~20 m above the top of the Flatiron at Darling Ridge at 1750 m.

Striation and chatter mark on weathering rind on summit of Tuning Nunatak.

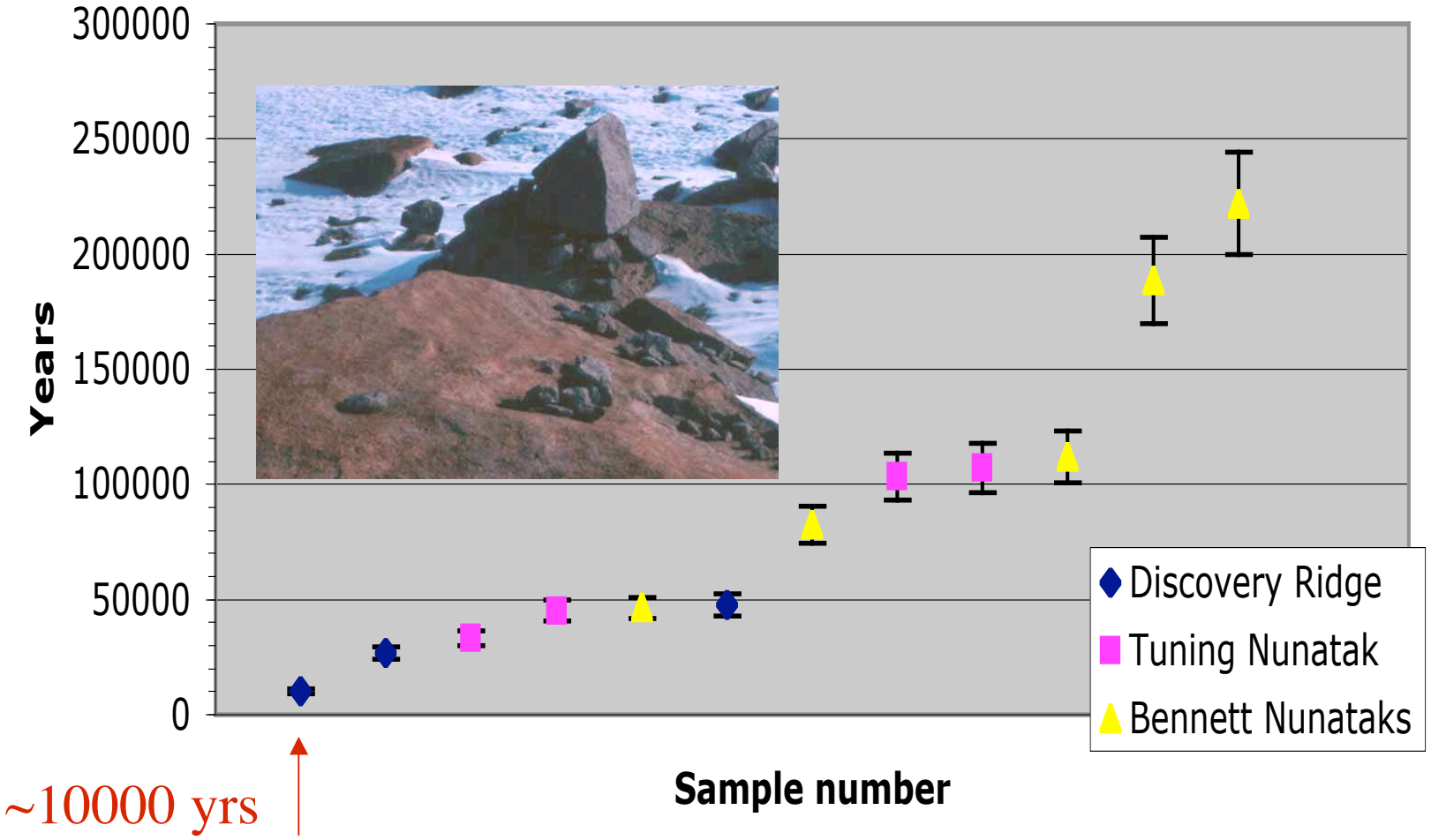
Surface Exposure Dating

- SED is based on the build up of rare isotopes (^{3}He, ^{10}Be, ^{36}Cl) in rocks exposed to cosmic rays.
- Production is an exponential function of rock depth; limited to upper 2m of rock.
- Where subaerial erosion rates are low and erosion by cold-based ice minimal, prior exposure of erratics and bedrock is anticipated.
- The youngest exposure ages are best estimate of the most recent ice recession.

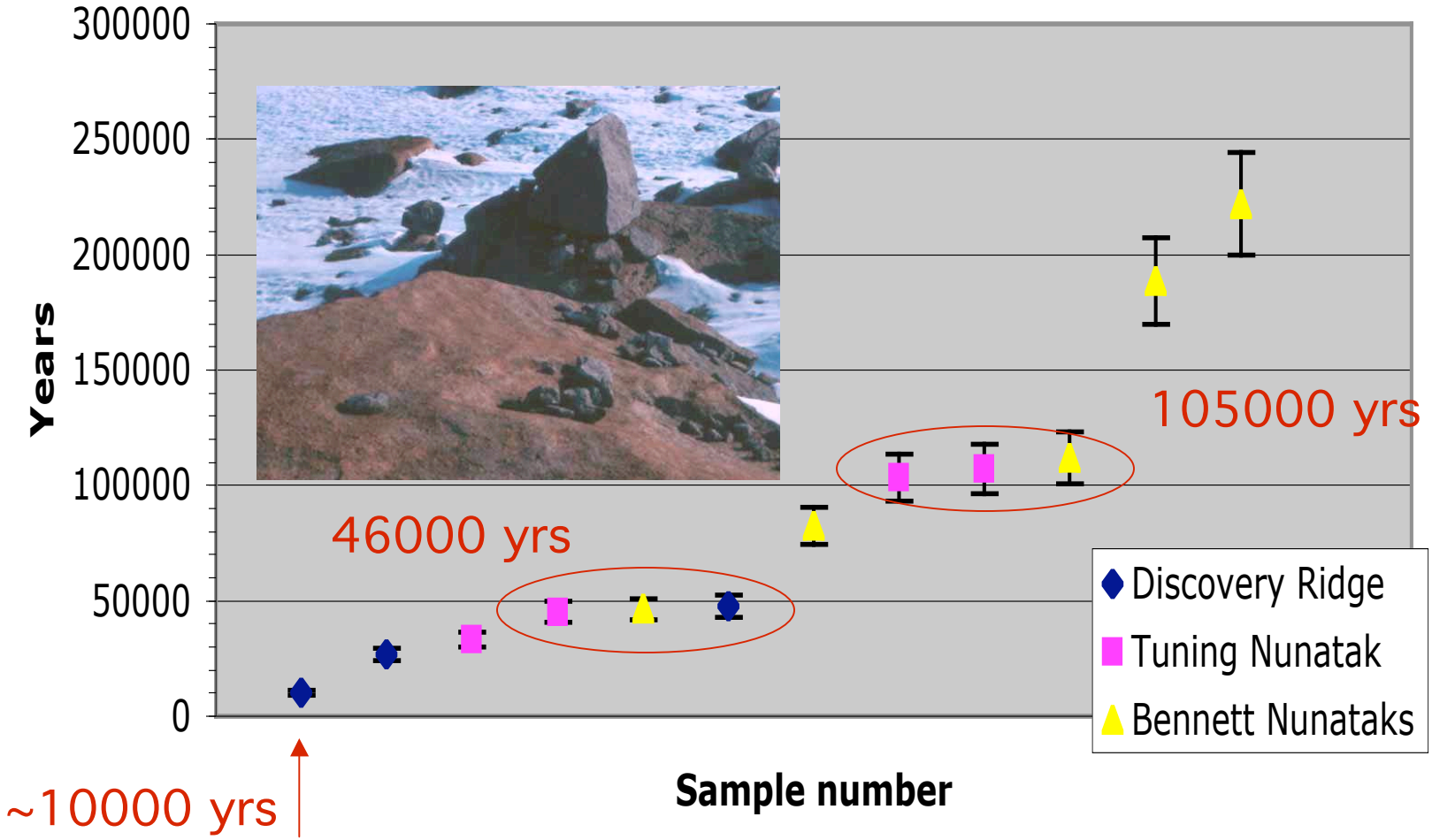
^{3}He Surface Exposure Ages of Ohio Range Erratics



^{3}He Surface Exposure Ages of Ohio Range Erratics



^{3}He Surface Exposure Ages of Ohio Range Erratics

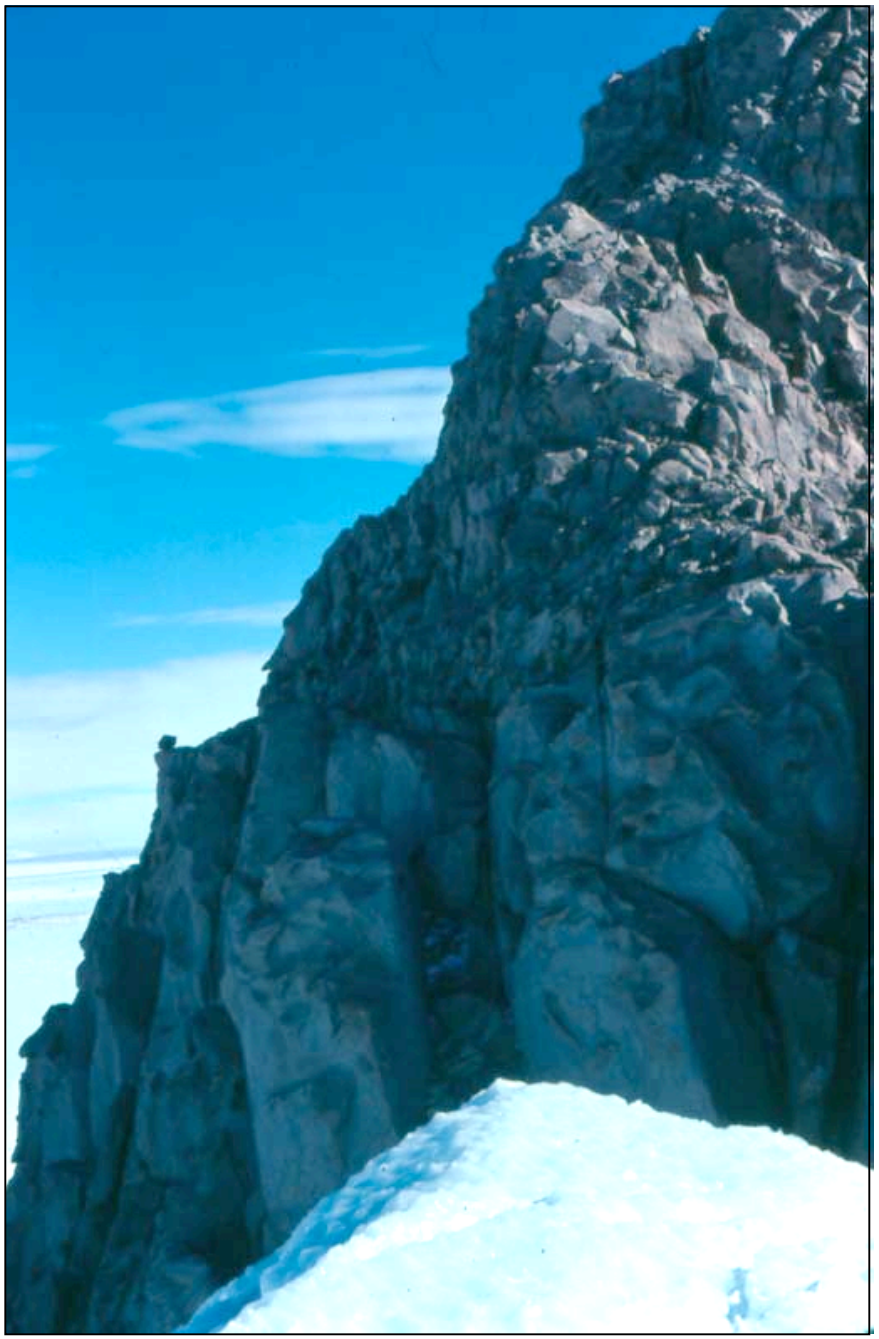


Conclusions

- Trimlines in the Ohio Range at ~1750 m record higher WAIS ice elevation.
- Preliminary ^{3}He surface exposure ages indicate ice recession by 10000 years ago.
- Clusters of older surface exposure ages suggests that earlier episodes of ice thickening have occurred.
- Ubiquitous weathered bedrock suggests that the WAIS is rarely thicker than present.

Future Work

- Measure ^{3}He in additional samples.
- ^{10}Be on selected erratics to test assumption that ^{3}He is quantitatively retained in quartz.
- Measure ^{10}Be and ^{36}Cl in bedrock samples to constrain past ice cover.



Acknowledgements

- Beth Bartel and UNAVCO
- Pilots of Ken Borel Air.