The authors requested a **talk**

Quantifying Post-Glacial Emergence At Kangerlussuaq, Greenland Using 10-Be Dating Of Bedrock Forms Exposed By River Incision

Bierman, Paul [1] ; **Corbett**, Lee [2] ; **Reusser**, Luke [3] ; **Graly**, Joseph [4] ; **Finkel**, Robert [5] ; **Rood**, Dylan [6] ; **Neumann**, Thomas [7]

[1] University of Vermont
[2] University of Vermont
[3] University of Vermont
[4] University of Vermont
[5] Lawrence Livermore National Laboratory
[6] Lawrence Livermore National Laboratory
[7] NASA Goddard

When ice sheets shrink, sea- and land-levels change and the arctic landscape responds. Here, we use in situ cosmogenic exposure age dating of bedrock exposed by river incision to infer relative sea-level change and thus land emergence caused by the retreat of the Greenland Ice Sheet after the last glacial maximum. The new method we document here, rates and dates of river incision in response to deglaciation, should have wide applicability and provide important constraints on emergence rates during the mid to later Holocene. The method relies on the rapid response of glacial rivers to base level fall in the fiords to which such rivers are graded.

To constrain emergence rates, we collected seven samples from bedrock surfaces along the Watson River (N67 degrees) in Kangerlussuaq, western Greenland (Figure 1); all of these surfaces were covered and eroded by the Greenland Ice Sheet during the last glacial maximum. After local deglaciation <8.5 ky, the surfaces we sampled were covered by outwash gravels deposited by the paleo-Watson River – part of a large, continuous gravel terrace at an elevation of ~90 m at Kangerlussuaq. As post-glacial uplift continued and local sea level in Sondrestrom Fjord fell, the gravel terrace was easily incised, sequentially exposing four samples (001-004) on a bedrock rib – the equivalent of a slip off surface. The rate of terrace incision (gravel stripping and exposure of our sample sites) matched the rate of relative sea-level fall until a bedrock sill downstream was exposed 4500+/- 200 years ago (samples 005-007) providing a local base-level for the river. From then on, the Watson River incised through rock slowly cutting down only several meters and leaving the distinct, fluted, bedrock strath terrace that we dated (Figure 2).

The Watson River 10-Be data confirm the inner Sondrestrom Fjord emergence curve of Ten Brink (1974) (which we calibrated for changes in marine 14-C over time using Calib 6.0) and provide critical control for the mid-Holocene (2-7 ky) when emergence rates slowed and shell dating becomes less certain (Figure 3). The agreement of emergence data based on shell 14-C dating of marine terraces and cosmogenic dating of river-exposed rock suggests that 10-Be measured in bedrock exposed by river incision can be a robust means of understanding rates of relative sea-level change over time in response to glacial comings and goings.

Ten Brink, N. W., 1974, Glacio-Isostasy: Ne\v Data from West Greenland and Geophysical Implications: Geological Society of America Bulletin, v. 85, p. 219-228.

Fig 1.

Sample sites along the Watson River. Samples 001-004 collected down bedrock rib. Samples 005-007 collected on strath terrace. View looking north toward town of Kangerlussuaq.

Fig 2.

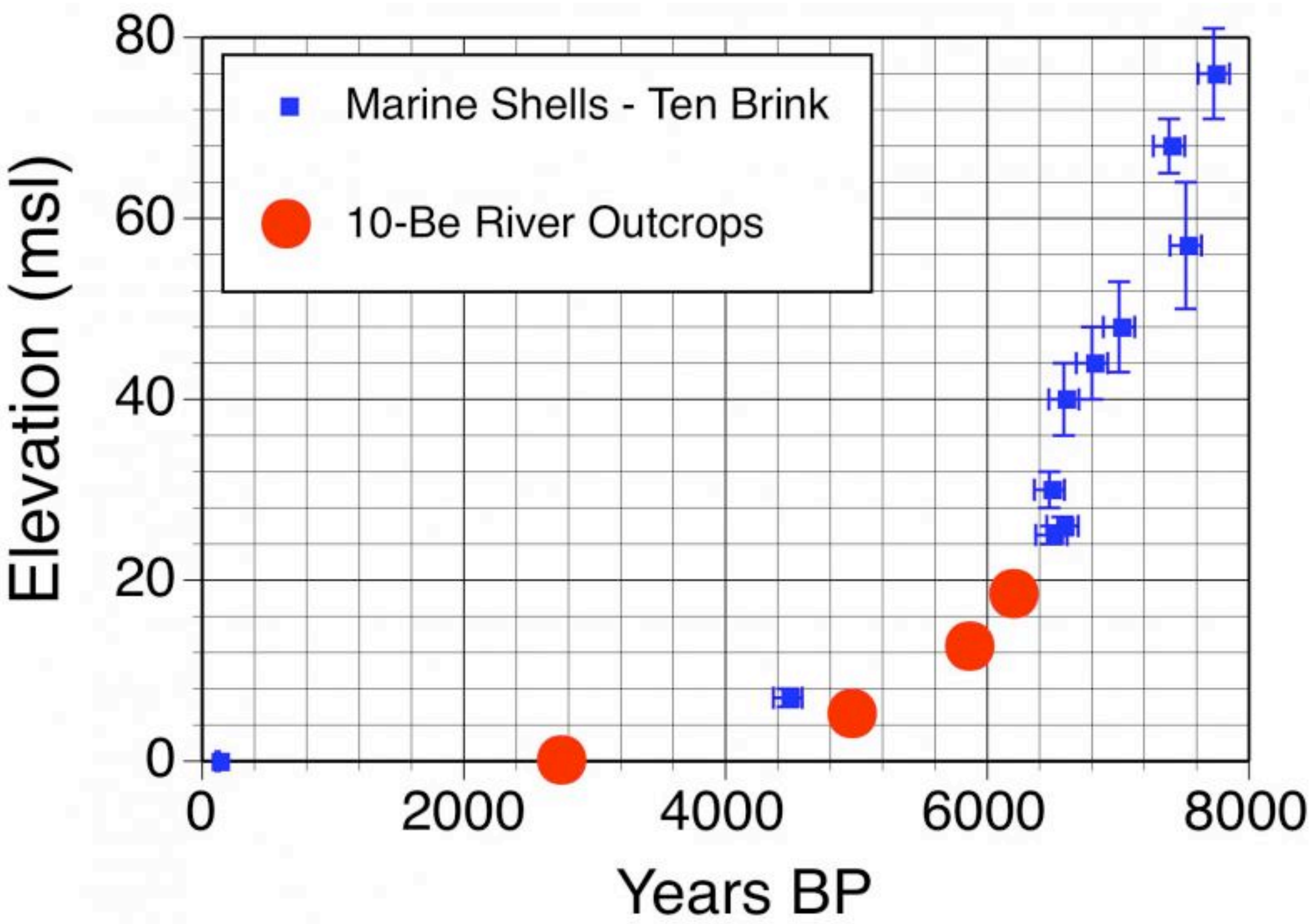
Fluted and water polished strath surface downs stream of sampled bedrock rib. Measured 10-Be concentrations indicate that the Watson River incised into this rock, isolating the strath, about 4500+/- 200 years ago (samples 005-007).

Fig 3.

Emergence curve for upper Sondrestrom Fiord combining radiocarbon-dated marine sediments of Ten Brink (1974) and new 10-Be exposure data for the Watson River.

Email us

with any inquiry



[ArcticWS@colorado.edu (mailto:ArcticWS@colorado.edu)](mailto:ArcticWS@colorado.edu) [(http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=13425&org=OPP&sel_org=OPP&from=fund)](http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=13425&org=OPP&sel_org=OPP&from=fund)

Supported by
The US National Science Foundation
[OPP- Arctic Natural Sciences Program (http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=13424&org=ARC)](http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=13424&org=ARC)

Site built and
hosted by
[INSTAAR (http://instaar.colorado.edu)](http://instaar.colorado.edu)