

# Cryogenian glacial topography across a carbonate shelf break, Otavi Group, Fransfontein Ridge, Kunene Region, Namibia

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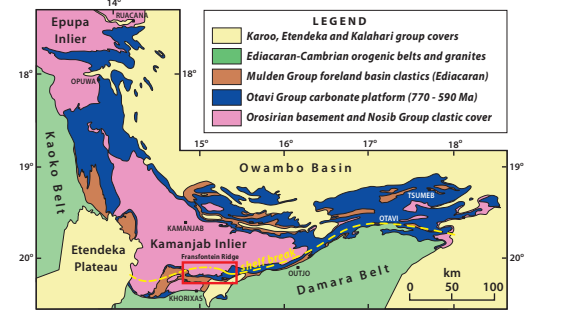


Fig. 1. Location of Fransfontein Ridge (red box) and approximate shelf break (yellow line) in the upper Otavi Group.

**ABSTRACT**  
A Neoproterozoic carbonate shelf break is exposed in oblique cross-section on Fransfontein Ridge, northern Namibia, where a new fence diagram has been constructed from 64 measured sections. The Otavi Group is a <2.4-km-thick carbonate platform succession that was deposited between 770 and 590 Ma on the southwest promontory of the Congo craton. It is exposed in an arcuate 600-km-long fold belt. The carbonate platform was glaciated twice during the Cryogenian, and regionally extensive erosion surfaces beneath the respective glacial deposits (Chuos and Ghaub formations) divide the carbonate succession into three subgroups (S1 to S3). Subsidence of the platform occurred in two stages, the first in response to north-south crustal stretching and the second to post-rift cooling. The rift-to-drift transition occurred in the middle of S2 (Abenab Subgroup), during the nonglaciated interlude. After the transition, a south-facing shelf break developed, dividing a shallow-water platform in the north from a distally-tapered foredeep and basin in the south.

We studied shelf-break development on Fransfontein Ridge through mapping, closely-spaced measured sections and stable isotope chemostratigraphy. To our surprise, the development and location of the shelf break are not structurally controlled: no significant growth fault intersects our transect. Instead, the dominant control on S2 stratigraphy and sedimentation was <1.8 km of local paleotopography on the older glacial surface, which is underlain by crystalline basement in this area. The location of the shelf break is dictated by >0.5 km of local paleotopography, which ramps across the 0.3-km-thick upper S2 carbonate platform (Ombaatie Fm) on farm Kranspoort 475 with a cut-off angle of 8 degrees in the line of section. Preservation of <1.8 km of local paleorelief on the older glacial surface, inferred from stratigraphic onlap relations, is consistent with a nonglaciated medial Cryogenian epoch (S2) of short duration.

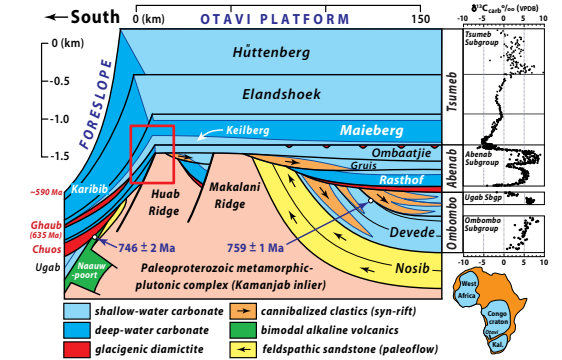


Fig. 2. Abenab and lower Tsumeb subgroup shelf break (red box) in a restoration of the Otavi platform in the Kunene Region, Namibia. Composite inorganic carbon isotope record from the platform is shown (right).

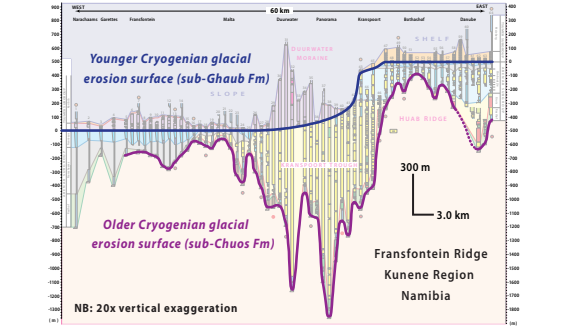


Fig. 3. Cryogenian glacial erosion surfaces beneath the Chuos (magenta) and Ghaub (blue) formations.

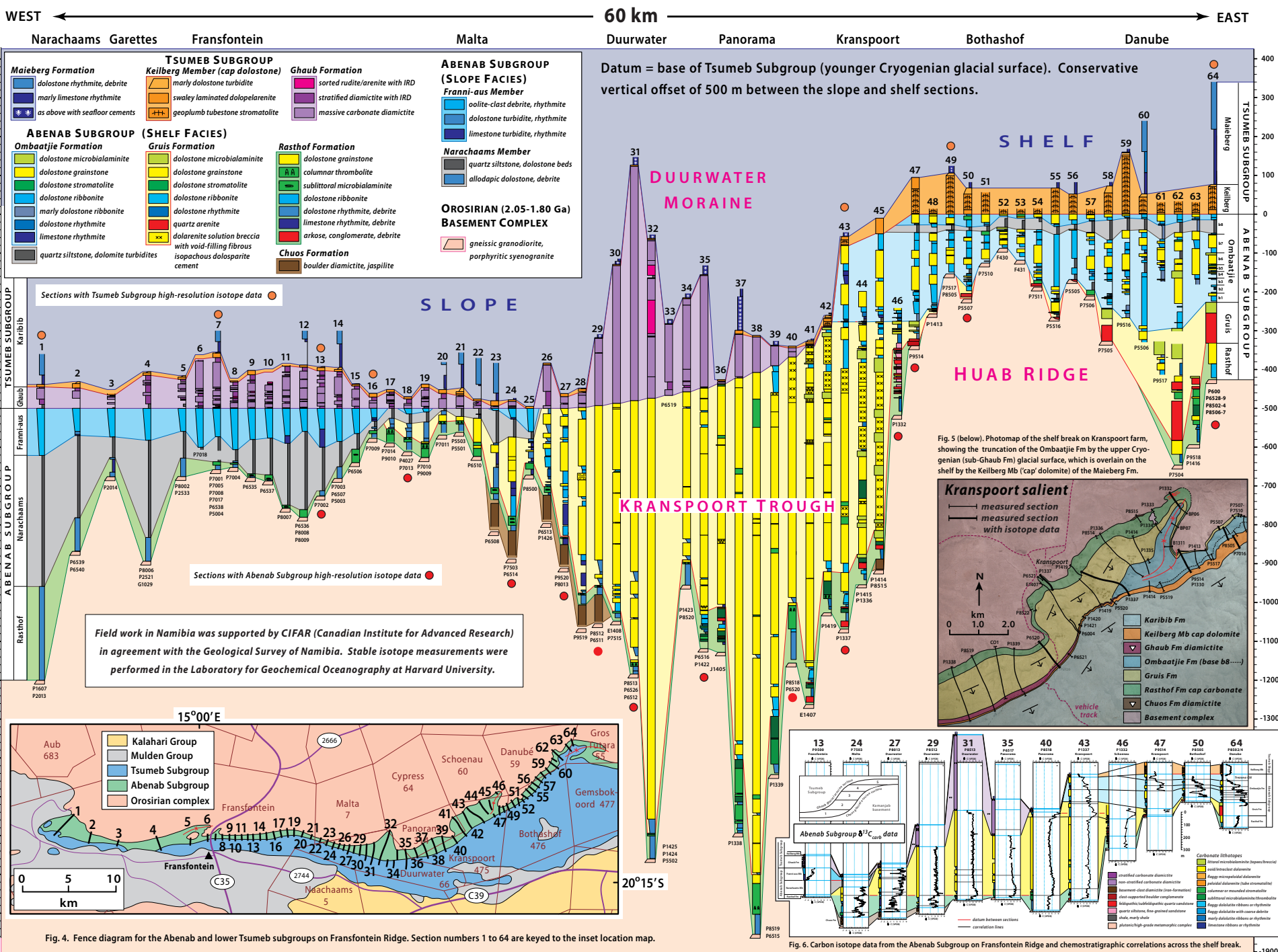


Fig. 4. Fence diagram for the Abenab and lower Tsumeb subgroups on Fransfontein Ridge. Section numbers 1 to 64 are keyed to the inset location map.

Datum = base of Tsumeb Subgroup (younger Cryogenian glacial surface). Conservative vertical offset of 500 m between the slope and shelf sections.

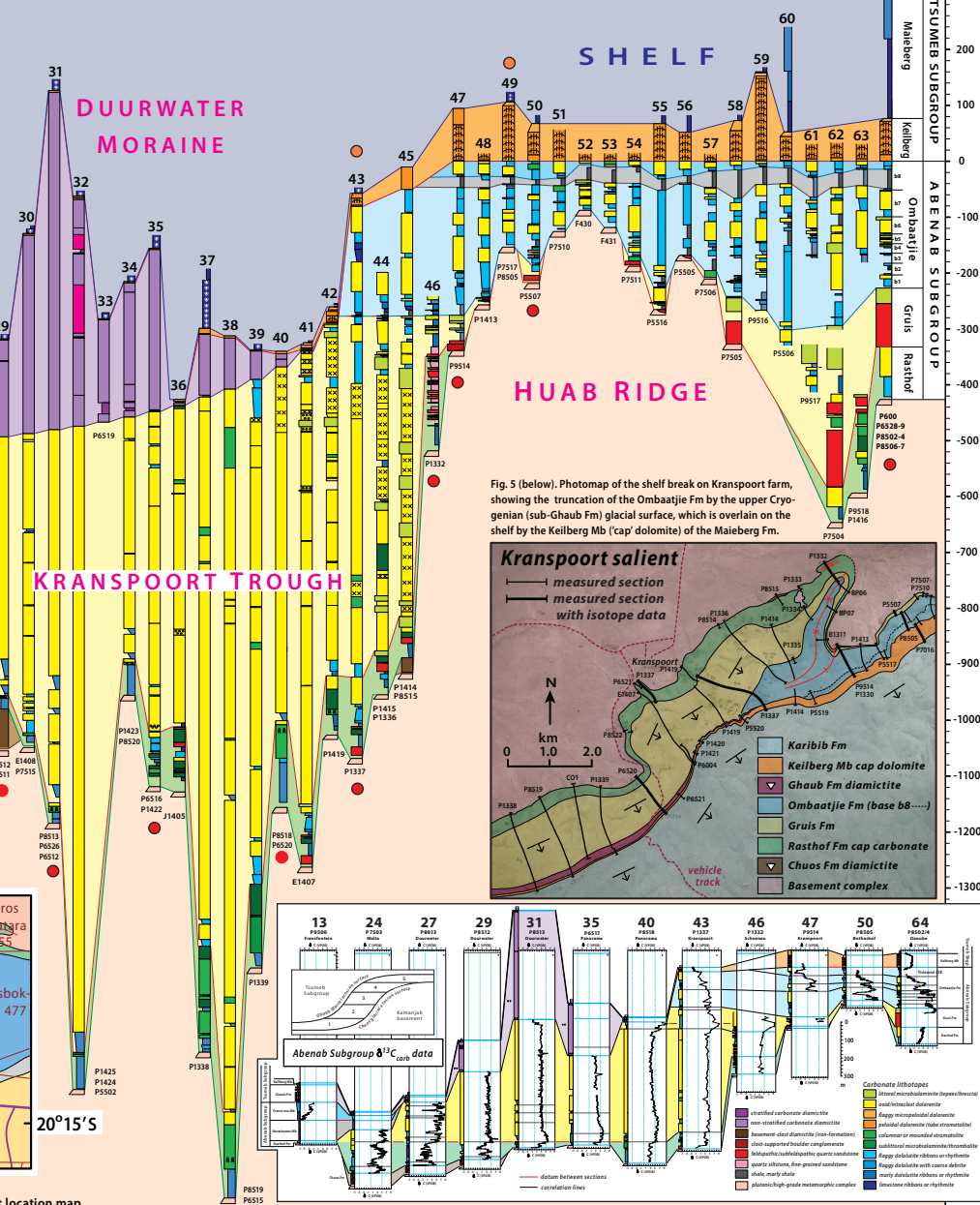


Fig. 5 (below). Photomorph of the shelf break on Kranspoort farm, showing the truncation of the Ombaatie Fm by the upper Cryogenian (sub-Ghaub Fm) glacial surface, which is overlain on the shelf by the Keilberg Mb (cap dolomite) of the Maieberg Fm.

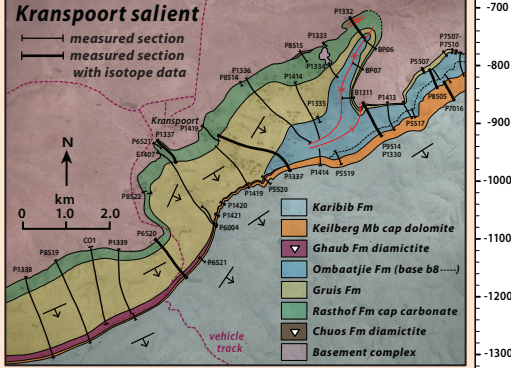


Fig. 6. Carbon isotope data from the Abenab Subgroup on Fransfontein Ridge and chemostratigraphic correlations across the shelf break.