determining the timing and patterns of denudation along the rift flank. The patterns of denudation along the WAR flank are striking in their consistency. Denudation events are recognized in the Late Jurassic-Early Cretaceous, Early Cretaceous, Late Cretaceous, Early Cenozoic (initiated in the Eocene and also in the Oligocene).

Jurassic tholeiitic magmatism associated with the initial stages of Gondwana break-up occurs along the TAM from the Pacific coast across Antarctica to the Dufek Massif. In nearly all locations studied to date along the TAM thermal effects accompanying Jurassic magmatism have completely annealed fission tracks in apatites and partially reset $^{40}Ar/^{39}Ar$ feldspar ages. The Late Jurassic-Early Cretaceous denudation event is recognized in the EWM, the Thiel Mountains and southern TAM. This event, particularly strong in the EWM may be related to translation of the EWM which did not reach its present location until ~110 Ma, about when this denudation event ceased. An Early Cretaceous denudation event recorded in northern Victoria Land is likely related to initial separation between Australia and Antarctica. Other Cretaceous denudation events along the TAM are most likely related to the main period of extension within the WARS, thought to be accommodated on low-angle detachment faults. The most pronounced rift-flank related phase of denudation recognized along the TAM begins in the Early Cenozoic and varies in magnitude at the front of the TAM from 4-9 km. Initiation of Early Cenozoic denudation youngs towards the south, and decreases in magnitude with distance away from WARS. In the Shackleton Glacier denudation initiated in the Oligocene may be related to the change in stress regime from orthogonal to dextral strike-slip that resulted in block tilting within the faulted TAM Front. A key question to address with respect to development of the rift flank is whether significant Cenozoic denudation along the TAM has occurred along the northwestern flank of the EWM. While, thermochronologic data from the EWM does permit a significant component of post-Early Cretaceous denudation, forward modeling permits both Late Cretaceous and Cenozoic events. The geomorphic contrasts between the TAM and the northwest flank of the EWM suggests however, that significant Cenozoic rift flank formation (as displayed by the TAM) ceases at the southern end of the Ross Embayment.

Fitzgerald, P.G. & Baldwin, S.L. (2003, this volume): Tracking the West Antarctic rift flank.-

Episodic Cenozoic denudation in the Shackleton Glacier area of the Transantarctic Mountains: a record of changing stress regimes?
(oral p.)

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The Transantarctic Mountains (TAM) define the western flank of the Mesozoic-Cenozoic West Antarctic rift system. The Shackleton Glacier in the central TAM is one of the major outlet glaciers through which ice of the East Antarctic Ice Sheet flows to join the Ross Ice Shelf. We present new apatite fission track (AFT) data from three vertical profiles on the western side of the Shackleton Glacier at Mts Speed (800 m relief), Wasko (800 m relief) and Franke (1250 m relief). With the exception of a few samples with retentive Cl-rich grains yielding older ages, all three profiles are characterized by AFT ages between ~40 and ~25 Ma. The AFT age versus elevation patterns are systematic, with older ages occurring at higher elevations. In general, samples with AFT ages >~30 Ma have confined track length distributions (CTLDs) with means <14 μm and standard deviations >1.5 μm indicative of a significant period of time spent within an apatite partial annealing zone (PAZ). In contrast AFT ages generally less than ~30 Ma have CTLDs with means >14 μm and small standard deviations indicative of more rapid cooling. Although these AFT data do not constrain the area's thermal history prior to 40 Ma, they do indicate a period of relative thermal stability prior to 30 Ma was replaced by more rapid cooling in the Oligocene. We can interpret these results in the context of previous work done east of the Shackleton Glacier. There, near Cape Surprise, AFT analyses on samples collected in a number of vertical profiles reveal the base of an exhumed apatite PAZ at ~40 Ma (MILLER et al. in prep.). Collectively, the AFT data from both sides of the Shackleton Glacier indicate the transition from a period of relative thermal and tectonic stability to a period of faster cooling at 40 Ma, most likely due to an increase in the rate of denudation. This was followed by another, shorter period of relative thermal and tectonic stability until another pulse of cooling and denudation began at ~30 Ma. We relate this episodic thermal and denudation history to the changing stress regime along the front of the TAM in the Eocene and Oligocene.

Geomorphic and structural studies near Cape Surprise (MILLER et al. 2001) indicate the presence of two fault sets, normal faults oriented generally parallel to the TAM Front and normal faults oriented at a high angle to the TAM Front. Kinematic analysis of lineated fault surfaces on these sets suggest orthogonal extension was followed by dextral transtension, consistent with data from elsewhere along the TAM. Asymmetric drainage patterns within the TAM Front between the Shackleton and Liv Glaciers suggest down-to-the-northwest block tilting and the formation of half-graben along faults striking nearly perpendicular to the range, and possibly related with the transition to dextral transtension. The onset of increased denudation at ~40 Ma is associated with orthogonal extension and faulting that accompanied Eocene rock uplift and base level change along the front of the TAM. On the west side of the Shackleton Glacier, Mts Speed, Wasko, and Franke appear to define the southeasterly flank of a now-dissected down-to-the-northwest tilted crustal block lying within the TAM Front. The AFT data from either side of the Shackleton Glacier indicates that a major transverse fault defines the path of the Shackleton Glacier, further evidence for segmentation along the TAM. We suggest that the onset of rapid denudation at ~30 Ma recorded on the west side of the glacier is a result of block tilting accompanying the transition from orthogonal extension to dextral transtension. This change in stress regime has been previously constrained as occurring at ~30 Ma by SALVINI et al. (1997) from studies in the Victoria Land Basin.

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Evidence for a continuation of the late Neoproterozoic Darling Fault Zone of western Australia to the Pacific margin of East Antarctica

(poster p.)

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The Darling Fault extends north-south for 1000 km along the western margin of the Australian craton and its curvilinear trace dominates magnetic and gravity images of the region. Its present morphology reflects Mesozoic rifting, but it reactivated an older structure known as the Darling Fault Zone developed during Neoproterozoic transcurrent movement. This movement juxtaposed the Archaean Yilgarn craton and Mesoproterozoic Albany-Fraser orogen with several late Mesoproterozoic to Neo-proterozoic gneissic blocks exposed along the western edge of Australia, which are collectively called the Pinjarra Orogen (FITZSIMONS 2003). East of the fault zone, there was no pervasive tectonism or magmatism after 1130 Ma and rocks have TDM Nd model ages older than 1.8 Ga, but rocks to the west have evidence of magmatism and deformation at 1100-1000, 750-700 and 550-500 Ma and TDM Nd model ages of 2.2-1.1 Ga.