

This paper was published in the *U.S. Antarctic Journal* v. 30(5), p. 5-7. Although this was the review issue for 1997, it was not published until 1999.

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## A Jurassic prehnite vein intruding the Permian–Triassic boundary at Graphite Peak, Antarctica

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The Permian-Triassic boundary was the greatest of all mass extinctions both on land and in the sea (Retallack 1995). In the central Transantarctic Mountains, this boundary has been placed at the conformable contact between the Buckley and overlying Fremouw Formation (Barrett, Elliot, and Lindsay 1986). This placement, based on paleontological and lithological criteria, has been recently confirmed by carbon isotopic analysis of kerogen across this boundary (Krull et al. 1996). This interval was cleared of scree on Graphite Peak (figures 1 and 2A) in search of event deposits that might reveal what happened at this greatest of all life crises. At one location (85°3.0'S 172°21.7'E), the basal Fremouw Formation was a distinctive claystone breccia with shocked quartz grains, which provide evidence of large asteroid or comet impact (Retallack, Seyedolali, et al. 1996). At another locality 200 meters (m) along strike (85°2.9'S 172°21.1'E) in the basal Fremouw Formation, is a distinctive rock that is the subject of this report (figures 1 and 2).

This intriguing rock is friable and sooty with dark green spherulites up to 2 millimeters in diameter of prehnite. In thin section, these spherulites dominate the texture of the rock (figure 2B). Mineral identification was confirmed by x-ray diffraction and by Cameca electron microprobe analyses (table). A count of 500 points indicated that this rock (R2087) had 68.6 volume percent prehnite, with common opaque grains and

matrix (15.8 percent), and small amounts of quartz (8 percent), calcite (4.2 percent), clay (2.0 percent), andradite garnet (0.8 percent), and feldspar (0.6 percent).

The prehnite-rich layer is 13 centimeters (cm) thick, shows crude lineation comparable to bedding, and coarsens in grain size upward. The uppermost 3 cm is indurated with prehnite, whereas the lower 10 cm is friable with soot. This layer is not quite parallel to bedding (figure 2A). Above it, is the basal sandstone of the Fremouw Formation with a distinctive Dolores paleosol comparable to one found at the base of the Fremouw Formation in the main section 200 m to the east (Retallack, Krull, and Robinson 1996). The light gray sandstone and olive cherty underclay below the prehnite layer also can be correlated with beds below the uppermost coal of the Buckley Formation 200 m to the east.

Prehnite veins, cement, and nodules are commonly associated with the Jurassic (165–180-million-year-old) Ferrar Dolerite in the central Transantarctic Mountains and probably formed at temperatures of at least 300°C (Barrett et al. 1986). Although this example from Graphite Peak has some features similar to a sedimentary deposit, its mineral composition indicates formation as a thin strata-concordant vein. Its black color and friable sooty nature may have resulted from alteration of the uppermost coal seam of the Buckley Formation. This seam may have provided a plane of weakness for this

**Electron microprobe analysis of minerals in a vein near the Buckley–Fremouw Formation contact, Graphite Peak, Antarctica**

Mineral	Silica (SiO <sub>2</sub> )	Titania (TiO <sub>2</sub> )	Alumina (Al <sub>2</sub> O <sub>3</sub> )	Ferrous oxide (FeO)	Manganese oxide (MnO)	Magnesia (MgO)	Lime (CaO)	Soda (Na <sub>2</sub> O)	Potash (K <sub>2</sub> O)	Total
Prehnite	43.91	0.06	24.01	0.52	0.16	0.06	26.60	0.01	0.01	95.34
	44.11	0.03	24.03	0.51	0.05	0.01	26.77	0.03	0	95.54
	44.20	0.01	23.86	0.43	0.05	0.03	26.99	0.08	0	95.64
	43.65	0.08	24.21	0.41	0.06	0	26.98	0	0.02	95.40
Andradite	37.78	0.05	21.59	29.04	0.76	6.56	3.74	0.21	0.01	99.54
	38.49	0.15	21.46	26.85	0.66	6.23	6.91	0.02	0	100.77

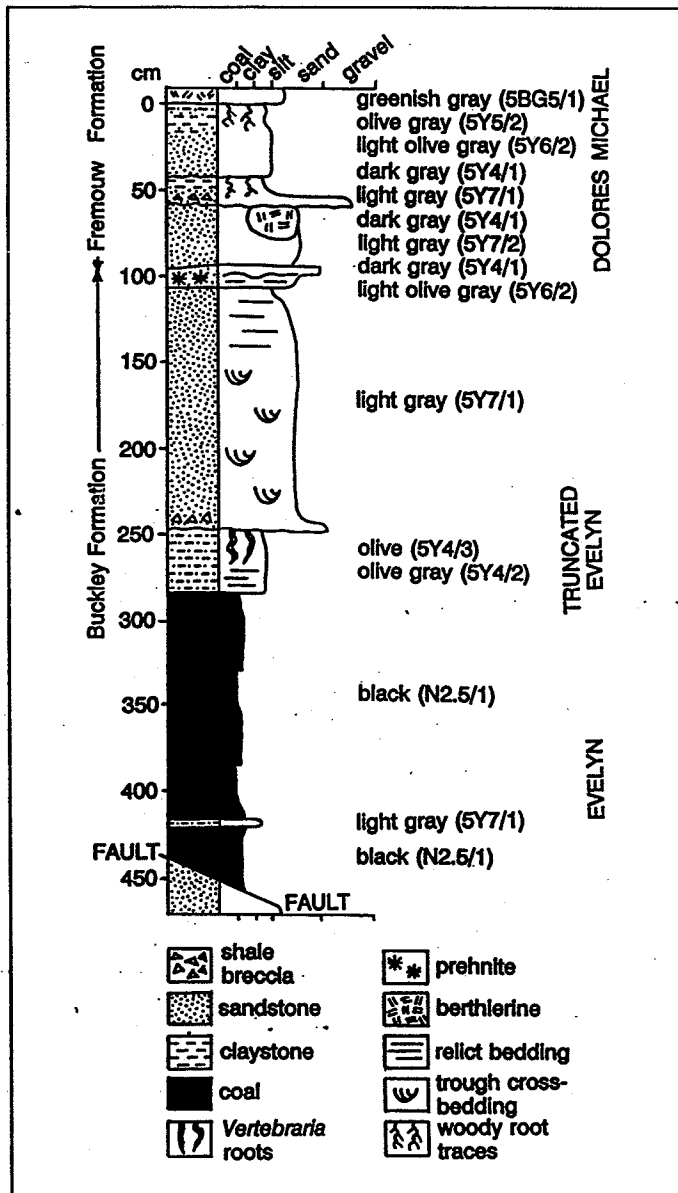


Figure 1. Measured section of the Buckley–Fremouw Formation contact on Graphite Peak, showing an unusual prehnite vein concordant with the boundary. Paleosol names follow terminology of Retallack, Krull, and Robinson (1996).

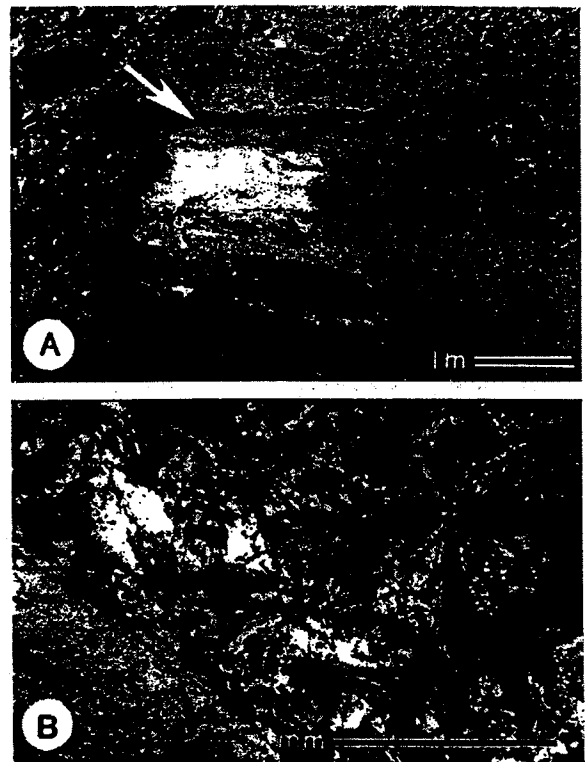


Figure 2. Field photo (A) and photomicrograph under crossed nicols (B) of prehnite-vein near the boundary of the Buckley and Fremouw Formations at Graphite Peak, Antarctica. The subhorizontal prehnite vein is at the white arrow (A) in a vertical section that has been cleared of scree and swept clean with a broom. Bar scales are 1 m (for A) and 1 mm (for B).

hydrothermal vein from a nearby sill and small-scale (10-m throw) normal fault visible on the western flank of the ridge here. The Permian–Triassic sequence in this ridge below Graphite Peak dips at 18°S and is both floored and capped by large sills of Ferrar Dolerite.

I thank David Elliot and Kevin Kililea of the Shackleton base camp of 1985–1986. Evelyn Krull, Scott Robinson, and Shaun Norman helped with fieldwork, and David Elliot offered useful petrographic advice. Work was funded by National Science Foundation grant OPP 93-15226.

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