Paleoenvironment of the Triassic therapsid *Lystrosaurus* in the central Transantarctic Mountains, Antarctica

GREGORY J. RETALLACK, *Department of Geological Sciences, University of Oregon, Eugene, Oregon 97403*
W.R. HAMMER, *Department of Geology, Augustana College, Rock Island, Illinois 61201*

Graphite Peak was the first place in Antarctica where Triassic fossil vertebrates were discovered. In 1967, Peter Barrett found a fragment (Barrett, Baillie, and Colbert 1968) that was later identified as the labyrinthodont *Austrobrachyops jenseni* (Colbert and Cosgriff 1974). Since then, Graphite Peak has yielded other fossil vertebrates of the Early Triassic *Lystrosaurus* fauna, including the herbivorous tusked therapsid *Lystrosaurus murrayi*, the small carnivorous therapsid *Thrinaxodon liorhinus*, and the eosuchian *Prolacerta broomi* (Colbert 1974; Colbert and Kitching 1977; Hammer 1989, 1990). *Lystrosaurus* was the dominant taxon of a cosmopolitan fauna of low diversity that survived the great extinctions at the end of the Permian (Cosgriff, Hammer, and Ryan 1982; Retallack 1995).

The habitats of *Lystrosaurus* in Antarctica have remained enigmatic because the majority of these fossils were collected from gravelly portions of ancient stream sandstones, where the bones had been transported some distance from where the animals lived (Colbert 1974). Also transported were skeletons of *Thrinaxodon liorhinus* in the flaggy upper portion of a paleochannel on Thrinaxodon col near the confluence of the Shackleton and McGregor Glaciers (locality described by Collinson and Elliot 1984; and visited by us). In contrast, discovery of a skeleton of *Lystrosaurus* on the buried soil on which it died allows a clearer idea of the paleoenvironment of this ancient reptile. These remains are in the saddle between two prominent sandstone bluffs on a low northwestern spur of Graphite Peak (85°2.99'S 172°21.65'E). Much of the skeleton is spread out over about a meter of the bedding plane (figures 1 and 2).

The skeleton is not articulated as an animal overwhelmed by catastrophic burial in a stream would be (figures 1 and 2). Instead, the bones are scattered and weathered, as if the corpse rotted on a soil and then fell apart. The bones were preserved partly in a hard green nodule that forms the lower horizon of an overlying soil similar to the one on which the skeleton lies. This kind of paleosol is common in the lower Fremouw Formation at Graphite Peak (figure 3) and in the Feather Conglomerate of southern Victoria Land, where it has been called the Dolores pedotype (Retallack, Krull, and Robinson 1995). Its drab color with berthierine nodules is evidence of a lowland seasonally waterlogged environment, and its weak development indicates soil formation for only a few hundred to a few thousand years. Fossil horsetails have been

Figure 1. Skeleton of *Lystrosaurus murrayi* in the lower Fremouw Formation at Graphite Peak, central Transantarctic Mountains, Antarctica.

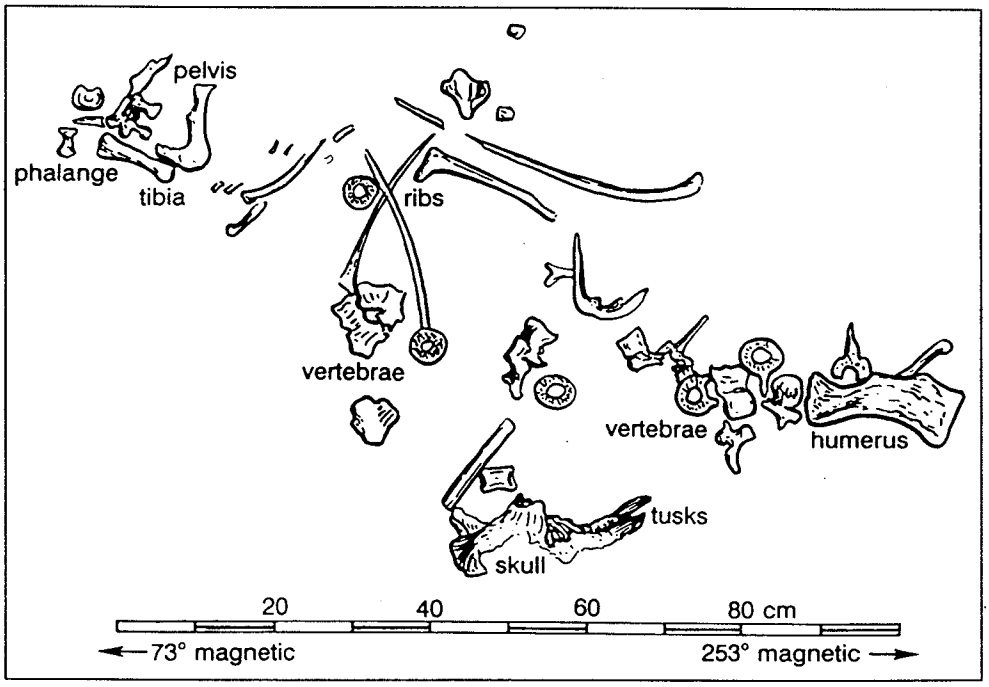

Figure 2. Scale drawing of skeleton of *Lystrosaurus murrayi* in the lower Fremouw Formation at Graphite Peak, central Transantarctic Mountains, Antarctica. (cm denotes centimeter.)

Reprinted from the *U.S. Antarctic Journal* v. **31**, no **2**.
This was the review issue for 1996, but was issued in 1998.

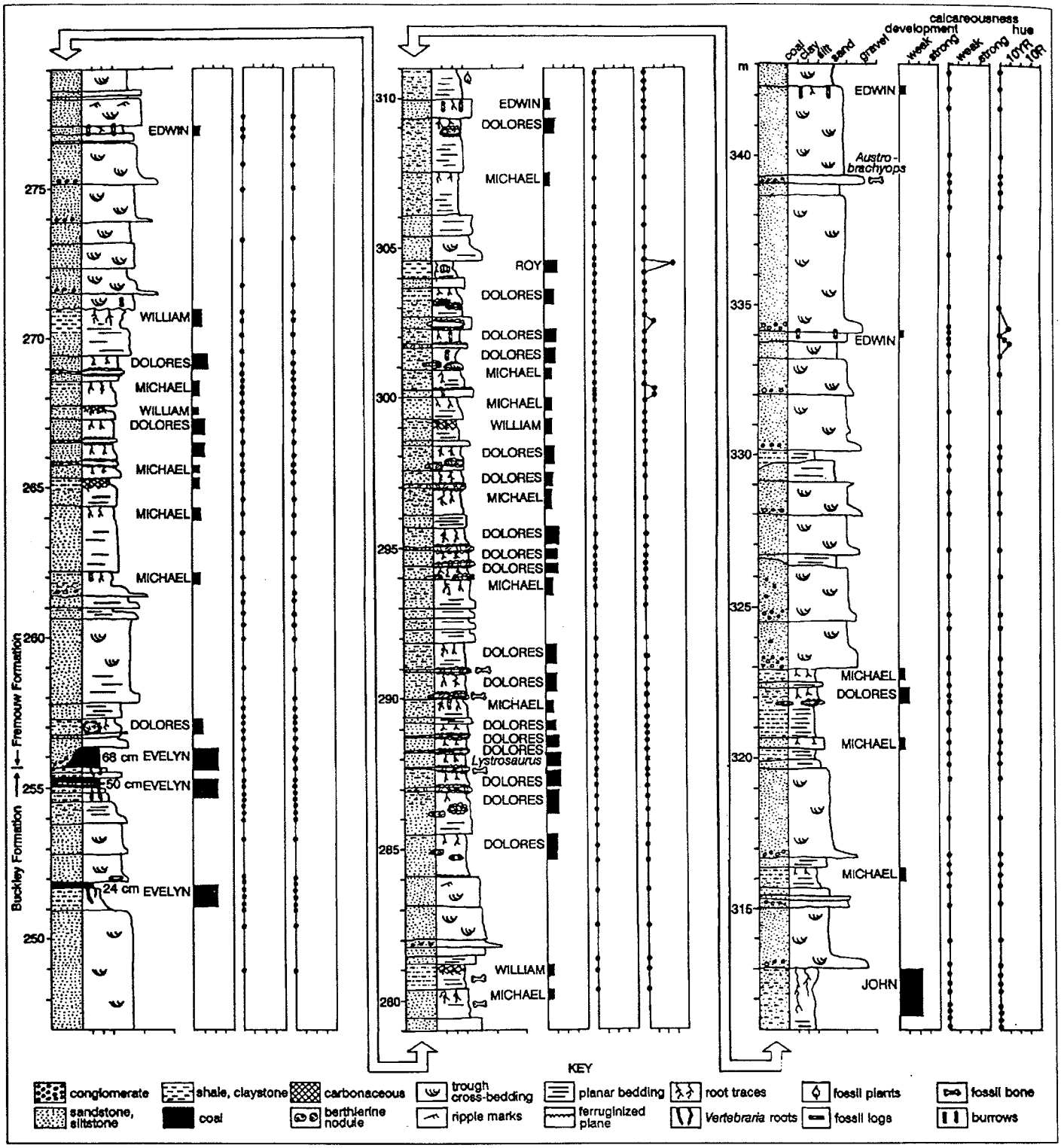

Figure 3. Location of the skeleton of *Lystrosaurus* and other vertebrate fossils in a measured section of paleosols on Graphite Peak. Hue is from a Munsell color chart. Calcareousness is from reaction with acid. Development is from relative destruction of bedding.

found in similar paleosols in southern Victoria Land (Retallack et al. 1995), but these would have been an understory to trees represented by common woody root traces. Dolores paleosols probably supported lowland colonizing woodland among forests represented by other pedotypes (figure 3).

These observations dispel a persistent notion that *Lystrosaurus* was strictly aquatic or amphibious. They support instead indications from functional morphology (King and Cluver 1991), that *Lystrosaurus* was fully terrestrial and capable of burrowing. A nonaquatic lifestyle for *Lystrosaurus* is

also supported by the absence of webbing between the toes on all plausible footprints (Watson 1960; MacDonald, Isbell, and Hammer 1991; Retallack in press). Paleosols can now be added as evidence for the habitats of *Lystrosaurus*.

Shaun Norman, Evelyn Krull, and Scott Robinson assisted in the field. The organizational efforts of David Elliot and Kevin Killilea and the skilled pilots of Helicopters New Zealand in the Shackleton base camp of 1995–1996 were also appreciated. Work was funded by National Science Foundation grant OPP 93-15228.

References

Barrett, P.J., R.J. Baillie, and E.H. Colbert. 1968. Triassic amphibian from Antarctica. *Science*, 161, 460–462.

Colbert, E.H. 1974. *Lystrosaurus* from Antarctica. *American Museum Novitates*, 2535, 1–44.

Colbert, E.H., and J.W. Cosgriff. 1974. Labyrinthodont amphibians from Antractica. *American Museum Novitates*, 2552, 1–30.

Colbert, E.H., and J.W. Kitching. 1977. Triassic cynodont reptiles from Antarctica. *American Museum Novitates*, 2611, 1–30.

Collinson, J.W., and D.H. Elliot. 1984. Triassic stratigraphy of the Shackleton Glacier area. In M.D. Turner and J.F. Splettstoesser (Eds.), *Geology of the central Transantarctic Mountains* (Antarctic Research Series, Vol. 36). Washington, D.C.: American Geophysical Union.

Cosgriff, J.W., W.R. Hammer, and W.J. Ryan. 1982. The pangaean reptile *Lystrosaurus maccaigi* in the Lower Triassic of Antarctica. *Journal of Paleontology*, 56(2), 371–385.

Hammer, W.R. 1989. *Lystrosaurus* zone (Triassic) vertebrates from the Beardmore Glacier region, Antractica. *Antarctic Journal of the U.S.*, 24(5), 40–41.

Hammer, W.R. 1990. *Thrinaxodon* from Graphite Peak, central Transantarctic Mountains. *Antarctic Journal of the U.S.*, 25(5), 26–27.

King, G.M., and M.A. Cluver. 1991. The aquatic *Lystrosaurus*: An alternative lifestyle. *Historical Biology*, 4(4), 232–341.

Macdonald, D.I.M., J.L. Isbell, and W.R. Hammer. 1991. Vertebrate trackways from the Triassic Fremouw Formation, Queen Alexandra Range, Antarctica. *Antarctic Journal of the U.S.*, 26(5), 20–21.

Retallack, G.J. 1995. Permian-Triassic extinctions on land. *Science*, 267, 77–80.

Retallack, G.J. In press. Early Triassic therapsid footprints from the Sydney Basin, Australia. *Alcheringa*.

Retallack, G.J., E.S. Krull, and S.E. Robinson. 1995. Permian and Triassic paleosols and paleoenvironments of the southern Victoria Land, Antarctica. *Antarctic Journal of the U.S.*, 30(5), 33–36.

Watson, D.M.S. 1960. The anomodont skeleton. *Transactions of the Zoological Society of London*, 29, 131–208.