# PALEOSOLS: TRACES OF PAST VEGETATION

**Abstract**—Many landscapes and soils of the former Gondwana supercontinent are very old. Landscapes in central Australia are as ancient as Cambrian, exhumed from a cover of riverlain sediments (Stewart *et al.*, 1986). The thick red soils mantling the plateaus of Uganda, the Darling Scarp of Western Australia, and the hills of southern India and southern Uruguay are ancient as well, in many cases dating well back into the Tertiary period (Ollier & Pain, 1996). Some of these soils are so different from soils forming in these regions today, that they are best regarded as fossil soils or paleosols. There are other former landscapes as well, no longer out in the open air, but buried within sedimentary and volcanic successions. Paleosols can also be soils buried and preserved as partial records of landscapes of the past. They formed between the floods, landslides and volcanic eruptions that buried them.

Topics include **Mists of Gondwana** (Precambrian paleosols), **Gondwanan afforestation** (Devonian Altisols of Antarctica), **Swamps and ice** (Permian coal measures), **Mesozoic greenhouse** (soils of dinosaurs in South Africa, laterites and bauxites), **Grassland renewal** (Kenyan Miocene), **Antarctic refrigeration** (Sirius Group Pliocene).

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## Paleosols at a geological unconformity


From: Retallack (1997)

**E5**—Sometime during the interval in which these paleosols formed, occurred the Fifth Extinction, the devastation which saw the end of the dinosaurs on land and the ammonites at sea.

### Pinnacles area, Badlands National Park, South Dakota, USA

"The colourful badlands of South Dakota, of Utah's Canyonland, and of Arizona's Petrified Forest have long inspired awe. It is only in recent years that much of the picturesque red and brown mottling and banding in these sedimentary rock sequences has been recognized as a feature of buried soils."

"The red band between the steep yellow slopes below and the gentle pink slopes [above] includes two paleosols at a geological unconformity, in this case between Cretaceous marine rocks below and Late Eocene floodplain deposits above. Paleosols at such unconformities are usually very strongly developed, and represent soil development during geologically significant breaks in deposition."

– Retallack (1997)

> *"And as the natural man within loses honour, so too does nature without. We no longer feel reverence for nature, and defoliation of spirit and landscape are everywhere to be seen. . . .*
>
> *That is why what is left of the natural world matters more to life now than it has ever done before. It is the last temple on earth which is capable of restoring man to an objective self wherein his ego is transfigured and given life and meaning without end. . . ."*
>
> **– Laurens van der Post, "*Feather Fall*" (1994)**

***Greg Retallack*** can almost certainly be counted the most spirited of the paleosol (fossil soil) pioneers. Since the mid-1970s, he has travelled the length and breadth of the world—and the stratigraphic column—identifying fossil soils where before there were only sediments recognised. In his numerous publications he has painted for us a new skin to Mother Earth's changing face. The sea cliffs of Sydney were his original tramping ground, but since 1978 he has made the United States, more particularly Oregon between the Rockies and the Pacific, his home.

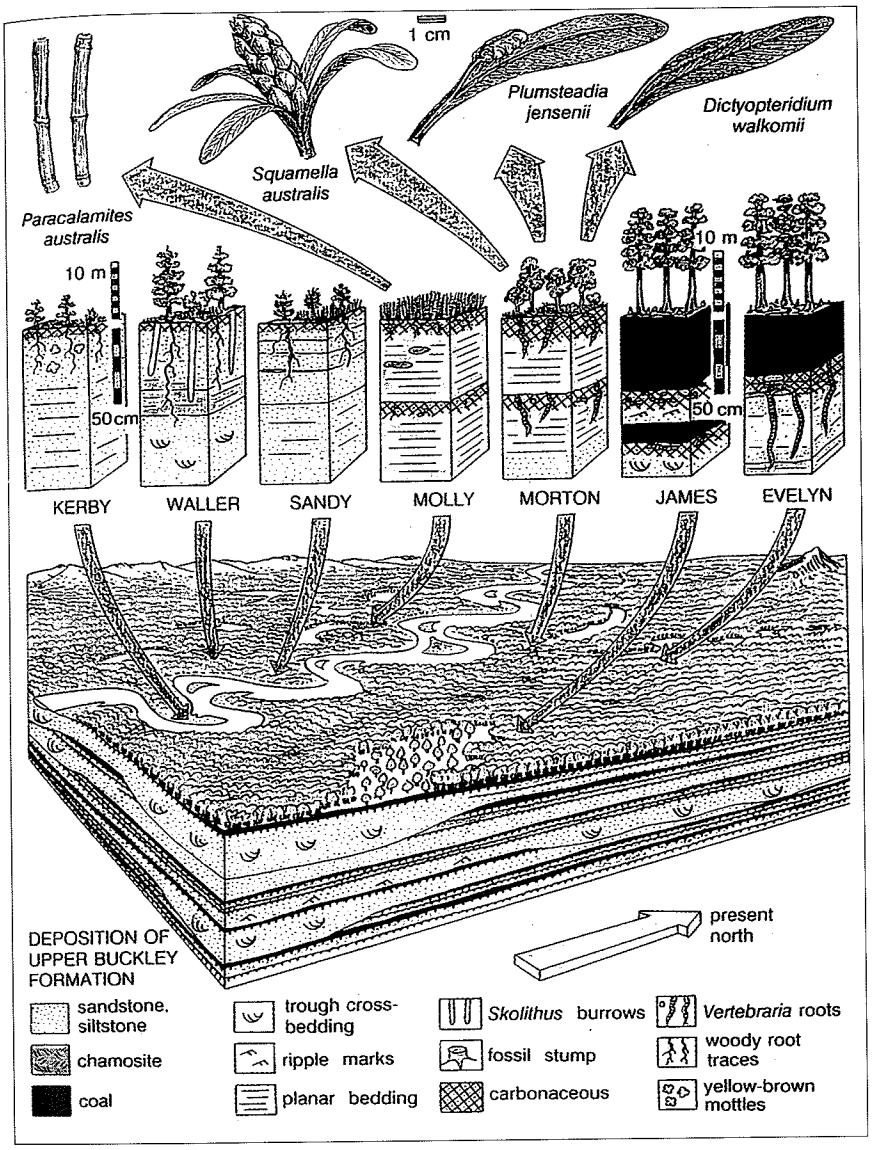


Fig. 1 A reconstruction of soils of the Late Permian Buckley Formation on Graphite Peak in the central Transantarctic Mountains. Comparable swampy lowlands formed a broad high-latitude belt in the Gondwana supercontinent during the Late Permian (from Retallack & Krull, 1998).

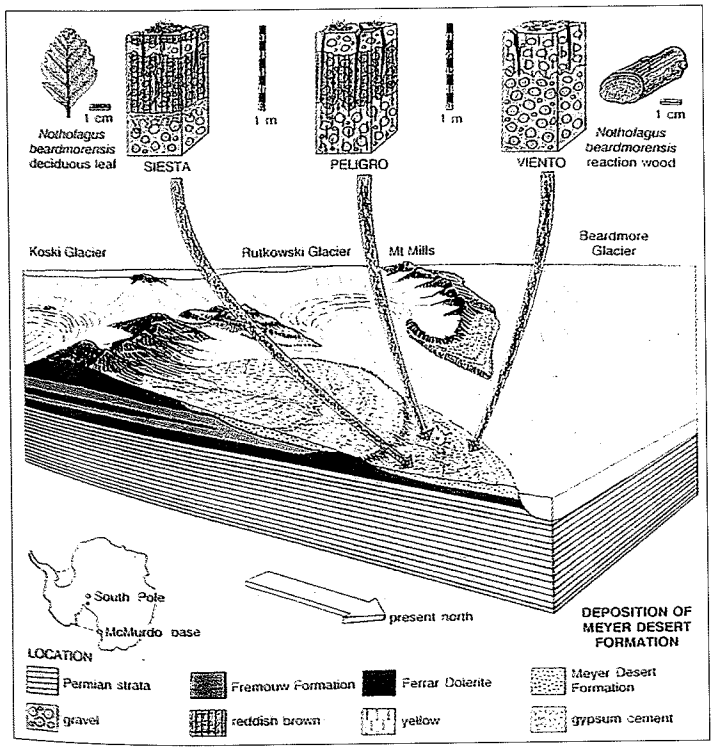


Fig. 2 A reconstruction of paleosols and paleoenvironment of the Dominion Range, central Transantartic Mountains, during the Pliocene (3 Ma). Prostrate shrubs of *Nothofagus beardmorensis* (Hill *et al.*, 1996) were the last known woody plants on the Antarctic continent (from Retallack & Krull, 1998). (See pp. 86–87.)

*"The future of our children depends on our ability to learn to live in harmony with nature and each other. Sustainable development means that we cannot continue to satisfy our own needs at the expense of those of future generations."*

**– Gro Harlem Brundtland, former Prime Minister of Norway, in *"Save the Earth"* (1991)**