

Eastern Australia intraplate volcanism

Eastern Australia hosts 67 intraplate mafic volcanoes along a 3800 km zone extending from Queensland to Tasmania and encompassing a total magma volume of $\sim 20,000$ km³ (Shea et al. (2022, ESR) (Fig. 1a). Basaltic fields occur on thin lithosphere (<110 km) near the coast and potassic leucitite fields occur on thicker lithosphere (>125 km) in central inland areas (Fig 1b). This volcanism is comparable to other large igneous provinces yet was formed over a prolonged period beginning ~ 100 Ma. Three age-progressive volcanic chains erupted simultaneously, mainly through the Tasmanides, linked to rifting from Antarctica and Zealandia. Rifting accelerated around 40 Ma, correlating with increased volcanic activity around 34 Ma.

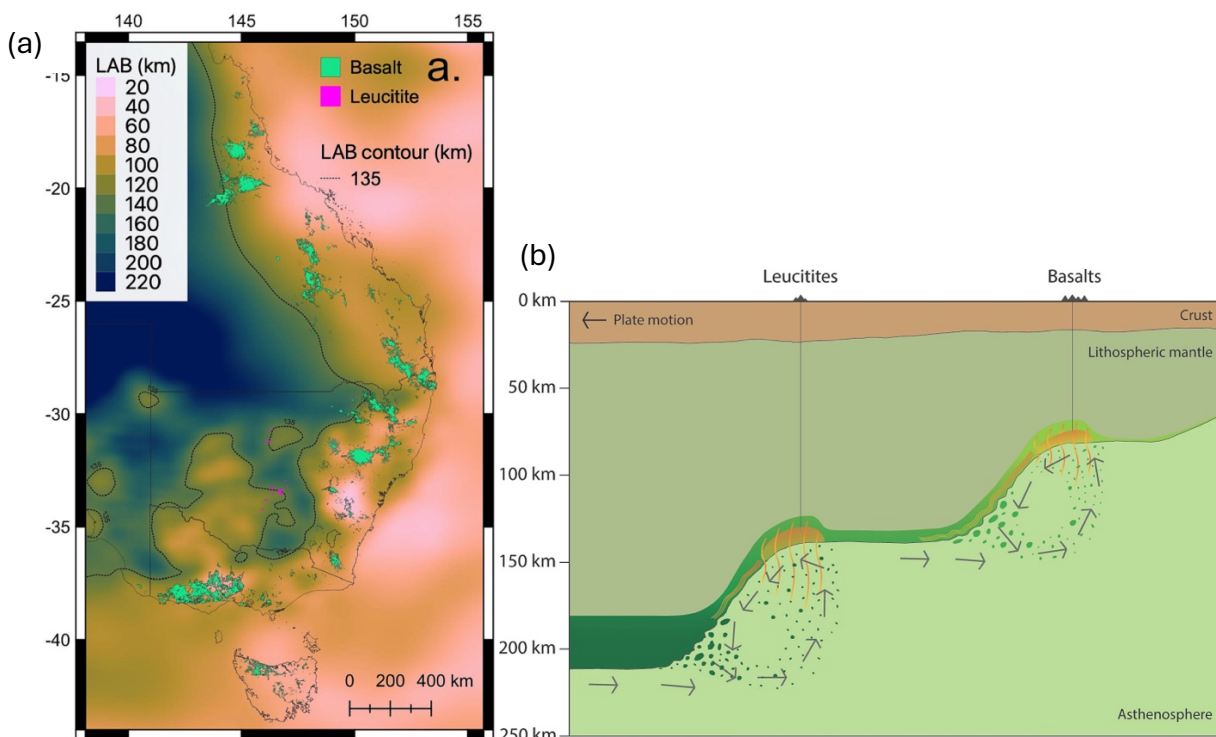


Figure 1 (Shea et al., 2022 Earth-Science Reviews). (a) Map of intraplate volcanic provinces showing the depth of the lithosphere-asthenosphere boundary (LAB) (b) Metasomatism and partial melting at steps in the LAB.

The terms “lava field” and “central volcano” have been applied broadly in Eastern Australia. The central volcanoes are mostly basaltic with some felsic flows from central vents, while lava fields are exclusively basaltic, formed from dyke and pipe swarms. However, improved data reveal classification overlaps, as some lava fields and central volcanoes share similar structures, chemistry, and melt source depths (Jones et al., 2020, Lithos). The ‘leucitite suite’ has distinct high potassium chemistry and has deeper sources (Fig. 1).

Ebor Volcano

Ashley et al. (1995, AJES) and Tapu et al. (2022, JPet) date the Ebor Volcano in northeastern New South Wales (Fig. 2) to the Miocene (ca 19-20 Ma). It erupted through the New England Orogen and includes lava flow remnants up to 400 m thick that cover 480 km² (Fig. 2). The original structure is estimated at 45 km across and 800 m high.

Tholeiitic basalts, grading to icelandite, erupted between 19.6-19.2 Ma, with later felsic domes and dykes forming around 19.0 Ma. The Crescent Complex (Fig. 2), a differentiated central intrusion, is linked to the tholeiitic suite. In a broader study of Eastern Australian volcanism, Tabu et al. (2023, Nat. Geosci.) found that waning magma flux increased the complexity of intraplate volcano feeder systems that enhance magma storage and differentiation.

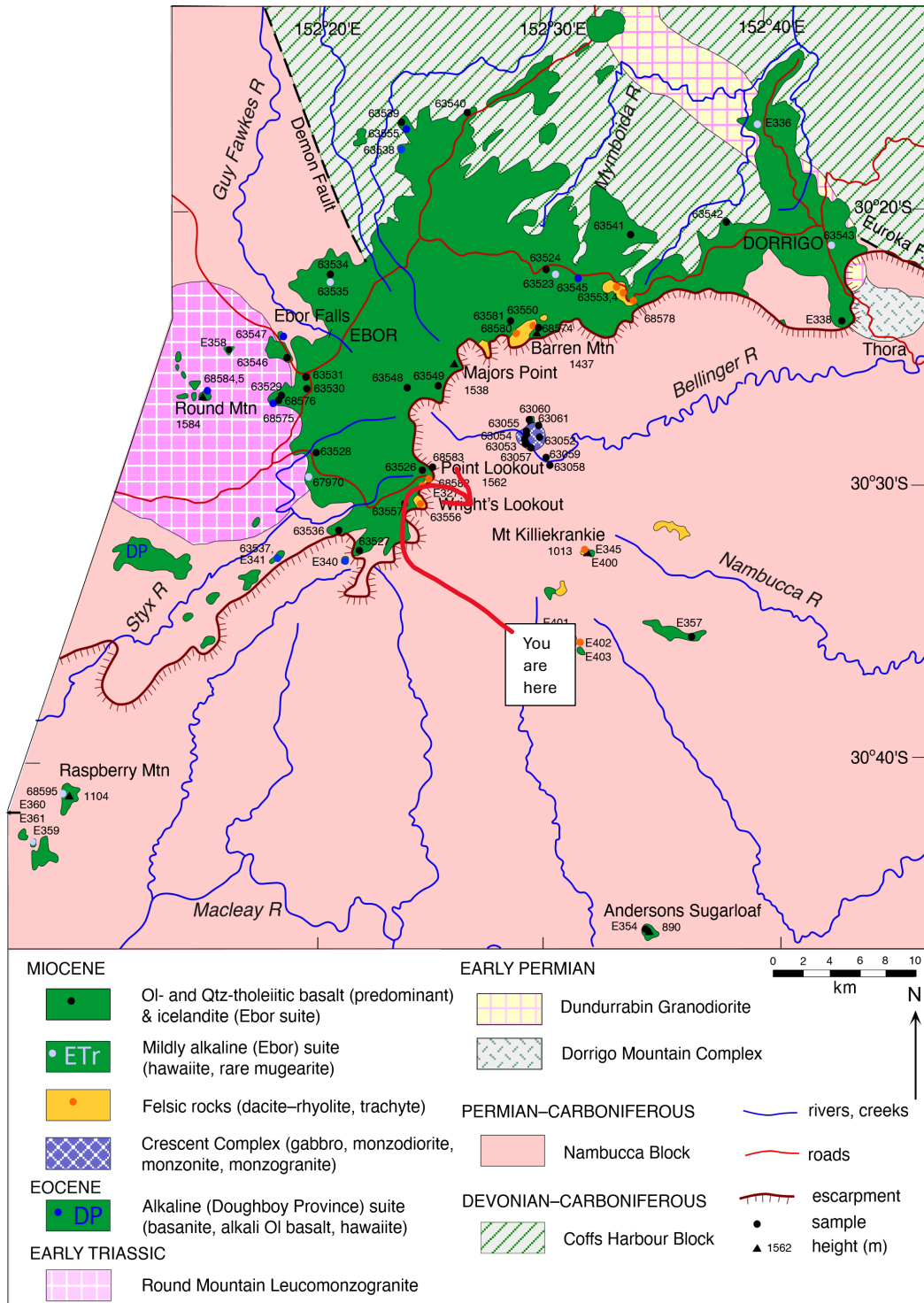


Figure 2. Geology map of Ebor Volcano (Ashley et al., 1995).