

# Evidence of synextensional deposition of the Pickhandle and Jackhammer formations in the northern Calico Mountains, central Mojave Desert, California

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## Abstract

The precise timing of extension in the central Mojave metamorphic core complex (CMMCC) is unclear. Previous thermochronology studies suggest that extension occurred between ~21 - 17.5 Ma, while stratigraphic studies suggest that extension was active between ~24 - 19 Ma. These previous stratigraphic interpretations imply that the timing of initial extension in the CMMCC is related to the depositional age of the volcanic and coarse-grained volcanioclastic deposits of the early Miocene Pickhandle Formation, inferred to represent synextensional supradetachment basin deposits. However, direct stratigraphic evidence of synextensional deposition has not yet been documented for this formation; therefore, the relation between deposition and inception of extension in the CMMCC warrants further investigation.

The Calico Mountains of the central Mojave Desert, CA are located on the hanging wall block of the Waterman Hills detachment fault in the CMMCC. New geologic mapping in the northern Calico Mountains has found direct evidence of synextensional deposition of the Pickhandle Formation and underlying Jackhammer Formation in an intra-hanging-wall half-graben basin bounded on the east by a high-angle NW-trending, SW-dipping normal fault. The Jackhammer Formation is deposited on nonmylonitic basement composed of Paleozoic metasedimentary and metavolcanic rocks and Mesozoic plutonic rocks. It is composed of fluviaily-reworked tuff and lapilli tuff that transitions eastward into a welded ignimbrite, tuffaceous sandstone, and local conglomeratic sandstone, mafic lava flows, avalanche breccia, and lacustrine limestone. In the Calico Mountains, the Pickhandle Formation is deposited conformably over the Jackhammer Formation. It consists of a lower section of dacitic volcanioclastic breccia with a local dacitic block and ash flow deposits and an upper section of tuffaceous sandstone, conglomeratic sandstone, and fluviaily-reworked tuff and lapilli tuff. Evidence of growth strata indicates synextensional deposition of both formations, including sedimentary and volcanic deposits that thicken and coarsen toward the basin-bounding normal fault to the east with some deposits thinning on the half-graben footwall, fanning bedding dips that decrease upsection, and internal angular unconformities.

## 1. Geologic Setting

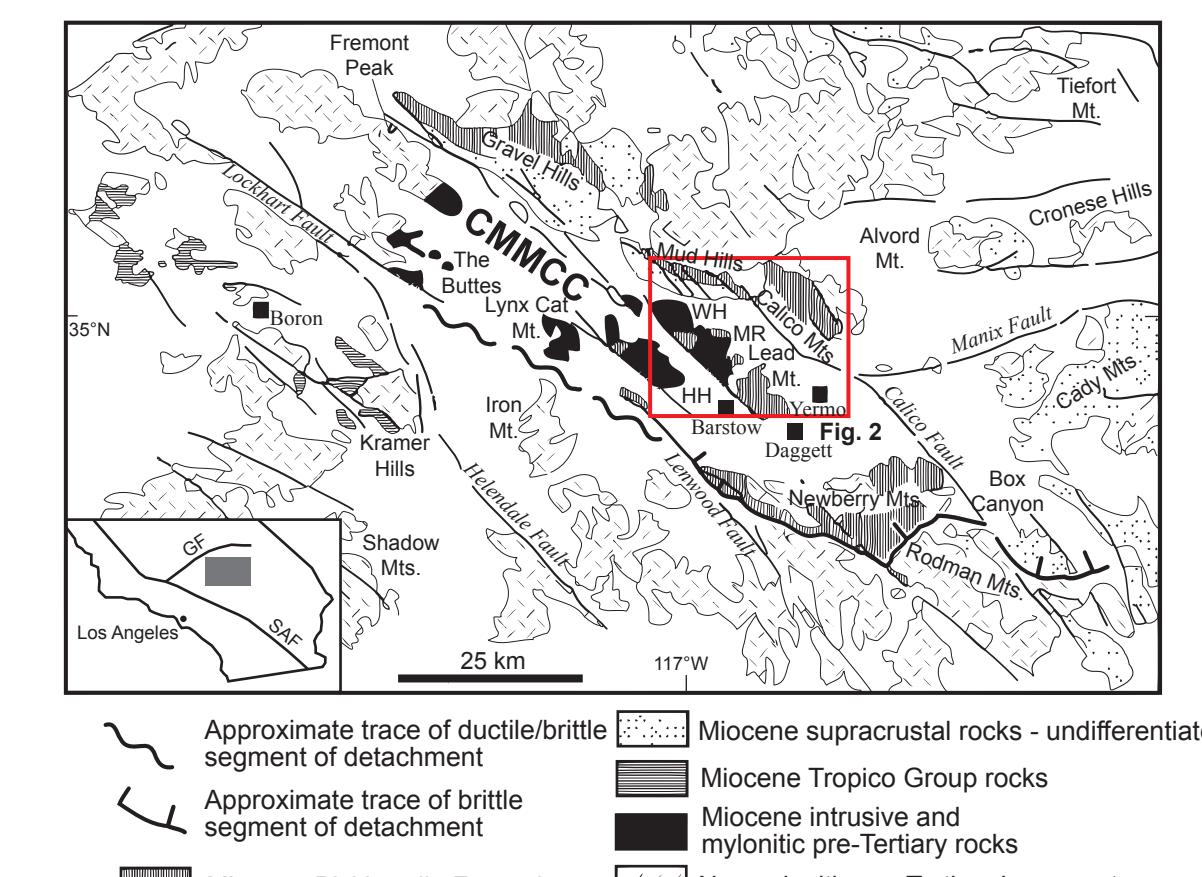
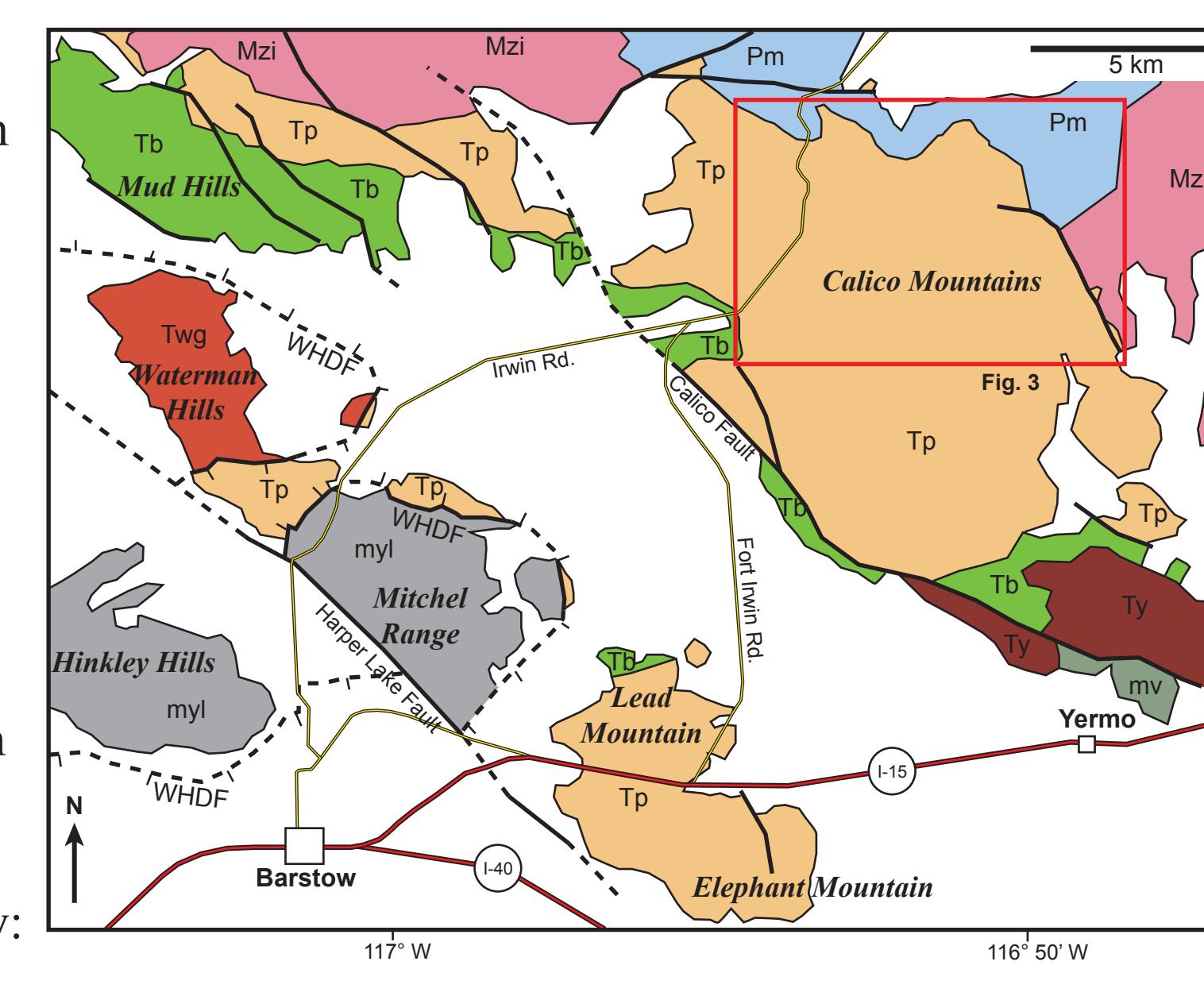


Fig. 1 (left): Regional geologic map of the central Mojave Desert showing the mylonitic and nonmylonitic segments of the Miocene extensional belt from the Buttes to Rodman Mountain. The distribution of mylonitic rocks and synkinematic intrusions from the footwall of the central Mojave metamorphic core complex (CMMCC) are shown in black and the Pickhandle Formation in the hanging wall of the CMMCC are shown with vertical striping. GF: Garlock Fault, HH: Hinkley Hills, MR: Mitchel Range, SAF: San Andreas Fault, WH: Waterman Hills (after Fletcher et al., 1995). Red box shows location of Fig. 2 (below).



## REFERENCES CITED:

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McCulloch, T. H., 1960, Geologic map of the Lane Mountain quadrangle, California: U.S. Geological Survey Open-File Report 60-95, scale 1:48,000.

Singleton, J. S., and Gans, P. B., 2008, Structural and stratigraphic evolution of the Calico Mountains: Implications for early Miocene extension and Neogene transpression in the central Mojave Desert, California: Geosphere, v. 4, no. 3, p. 459-479.

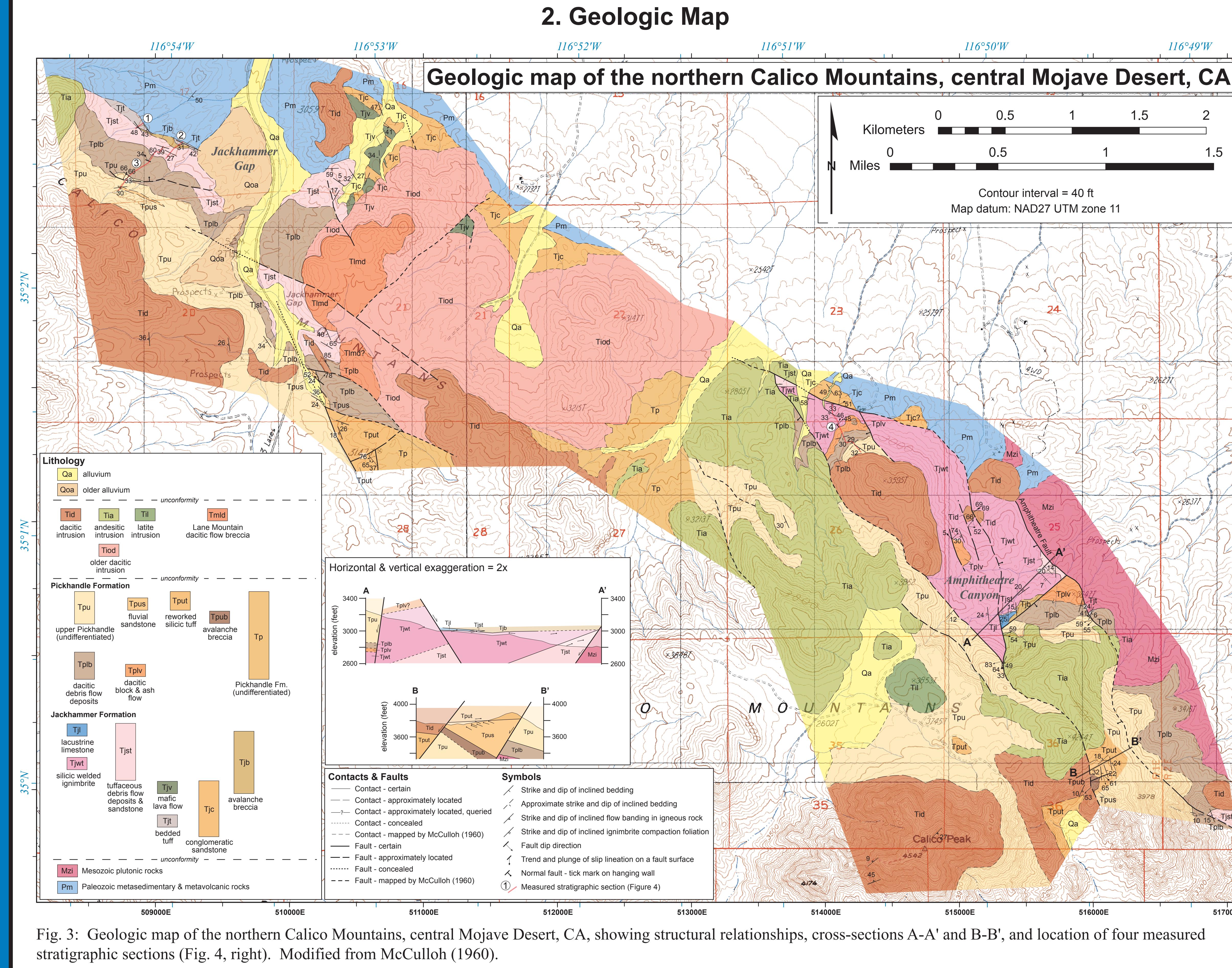


Fig. 3: Geologic map of the northern Calico Mountains, central Mojave Desert, CA, showing structural relationships, cross-sections A-A' and B-B', and location of four measured stratigraphic sections (Fig. 4, right). Modified from McCulloch (1960).

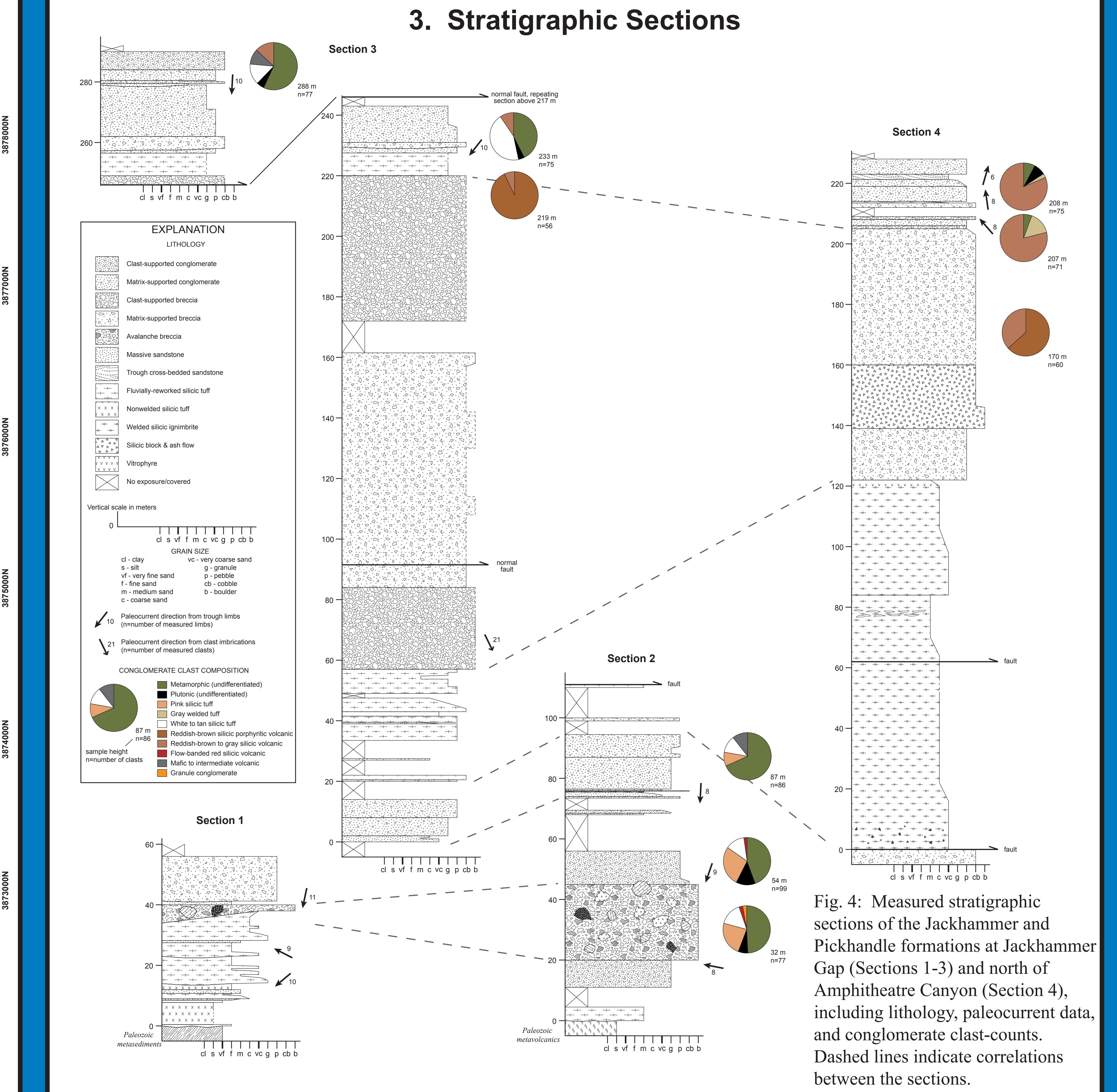


Fig. 4: Measured stratigraphic sections of the Jackhammer and Pickhandle formations at Jackhammer Gap (Sections 1-3) and north of Amphitheatre Canyon (Section 4), including lithology, paleocurrent data, and conglomerate clast-counts. Dashed lines indicate correlations between the sections.

## 4. Field photos

