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Structure of the New England Orocline (eastern Australia): evidence from magnetic fabrics

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The late Paleozoic New England Orogen in eastern Australia is characterised by orogenic-scale curvatures (oroclines), but the exact oroclinal structure is controversial. In the northern part of the system, the Texas and Coffs Harbour oroclines form a Z-shaped structure, which is strongly supported by structural data. In the southern part, however, the structure of the Manning and Nambucca oroclines is less obvious, and therefore, the existence of these oroclines has been questioned by a number of authors. Geological evidence supporting the existence of these oroclines includes the curvature serpentinites and Early Permian granitoids, the arrangement of forearc basins, and limited paleomagnetic data. However, direct structural observations are ambiguous and do not verify or disprove the existence of the Manning-Nambucca oroclines.

Anisotropy of the Magnetic Susceptibility (AMS) has been used to test the existence of the Manning and Nambucca oroclines and to confirm the curvature in the Texas-Coffs Harbour oroclines. AMS has classically been used in structural studies to evaluate the amount of conformity between magnetic and crystallographic fabrics. We sampled 79 evenly distributed sites (807 standard specimens), ranging in age from Late Devonian to Carboniferous. We focussed on relatively weakly deformed forearc basin rocks, which included fine-grained metasedimentary rocks suitable for an AMS study.

Rock magnetic analyses (including low temperature AMS studies) suggest a dominant paramagnetic signal, meaning that AMS data can be interpreted in terms of finite strain orientation. In rocks belonging to forearc basin terranes, the magnetic lineations follow the oroclinal trend. Directional data obtained in the Texas-Coffs Harbour oroclines (Mount Barney, Emu Creek and previous published data) support the orogenic curvature. Data obtained in the southern oroclines (Manning-Nambucca) are generally also in agreement with the oroclinal structures. Our results, therefore, provide an additional independent constraint supporting the existence of the debated ear-shaped oroclinal structure.