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Early-Middle Ordovician ridge-trench collision during the closure of Iapetus: Evidence from the Dunnage Melange tract, Newfoundland Appalachians

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The Red Indian Line marks the boundary between the peri-Laurentian and peri-Gondwanan realms in the Northern Apppalachians and delimits the main Iapetus suture. The Middle Ordovician Dunnage Melange tract occurs immediately south of the Red Indian Line in north-central Newfoundland. The genesis of the melange belt has always been contentious, because it preserves structures both suggestive of an olistostromal (e.g. pebbly mudstone) and tectonic origin (e.g. cleaved psammitic clasts). Its spatial association with the suture zone and strong lithological linkages with the Middle Ordovician arc-trench gap rocks of the Popelogan-Victoria arc (PVA) system suggest a genetic linkage to subduction processes along the leading edge of Ganderia prior to its collision with Laurentia's leading edge.

The melange hosts a variety of Middle Ordovician mafic to felsic intrusions. This investigation is focused on the Coaker quartz-feldspar porphyry that intruded the Dunnage melange. Thin sheets of the flow banded porphyry intrude cleaved black shales and are intricately folded in complex isoclinal and sheath-like geometries. The fold hinges displays a well-preserved folded trachytic texture indicative of laminar flow in partially molten state and show little intra-crystalline deformation. These relationships suggest the porphyry intruded syn-tectonically into partly lithified sediments. The age of deformation and crystallization is constrained by a new U-Pb SHRIMP age of 469 $\pm$ 3 Ma.

The porphyry contains a large variety of xenoliths and xenocrysts including variably serpentinized harzburgite, orthopyroxenite, hornblendite, garnet granulite, amphibolites, gabbro, garnet and pyroxene. The variety and composition of xenoliths suggest it was sampling lower and middle arc or continental crust that probably formed the forearc basement to the PVA. The variety of inherited zircons (ca. 489, 517, 547, 620, 655, 895, 940, 1305, 1515, 1740, 1970, 2630 Ma) confirms its affinity with the peri-Gondwanan arc system that was built upon the leading edge of Ganderia.

The geochemistry of the porphyry and xenoliths, magmatism, tectonism and melange formation in the arc-trench gap and overall enriched E-MORB-like magmatism in the arc support earlier suggestions of a ridge subduction at c. 469 Ma. The Dunnage Melange is thus interpreted as deformed forearc strata near the boundary between the accretionary wedge and the forearc basin formed during ridge-trench collision.