



The Blackwater Intrusion of the Grampian Orogeny: Implications for the Younger Basics and the Tectonic-Metamorphic Zonation of the Grampian Terrane, NE Scotland

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The Dalradian Supergroup of NE Scotland hosts the classic Buchan low-pressure high-temperature metamorphic domain, as well as a suite of substantial ~470Myr syn-orogenic mafic intrusions (the 'Younger Basics') and a set of major, steeply-inclined shear zones which deform both the Dalradian country rocks and the Younger Basics. The Blackwater mafic intrusion is situated within one such shear zone, the Portsoy-Duchray Hill Lineament (PDHL), which runs SW inland from the coast at Portsoy and corresponds with the westernmost limit of Buchan metamorphism. Occupying a position between the Appin and Argyll Groups, the Blackwater Intrusion is emplaced at a deeper structural level than other more extensively studied Younger Basics to the East towards Aberdeen (such as the Inch Intrusion) and North along the PDHL (such as the Portsoy Gabbro). Uniquely for a Younger Basic mass, it is also in contact with older Dalradian meta-basic rocks, the somewhat enigmatic Blackwater Formation. As well as examining the Blackwater Intrusion, this study presents new evidence pertaining to the history of the Younger Basics and the PDHL, and their place within the Grampian Orogeny.

The Blackwater Intrusion has an elongate shape roughly parallel to the strike of the surrounding Dalradian rocks, covers ~9km² and mainly comprises blue-grey gabbro with scattered serpentinised ultramafic zones. Both the gabbro and serpentinite generally have massive texture, although some evidence of cm-scale modal layering (interpreted as cumulate texture) is present to the north of the intrusion. It is in contact to the east with psammites, schists and meta-basic extrusives of the Argyll Group Blackwater Formation, and to the west with the Appin Group Glenfiddich Pelite Formation.

Evidence for shearing is widespread, with sheared microstructures in pelites and meta-basites, mylonitised meta-sediments adjacent and parallel to the NW contact of the gabbro and vertical/sub-vertical NE-SW trending shear zones within the gabbro and serpentinite. Also, several apparently sheared m-scale pegmatite dykes cross-cut the gabbro, also with a NE-SW orientation. There is no evidence for significant hornfelsing adjacent to the intrusion. Collectively, this evidence suggests that the mass is largely tectonically emplaced, and that the PDHL was active both during and after emplacement of the Blackwater Gabbro.

Meta-basic rocks of the Blackwater Formation have been interpreted as pillow basalts erupted from a submarine rift associated with the breakup of Rodinia. Vesicles are abundant in some outcrops, consistent with an extrusive origin. Determination of $\delta^{34}\text{S}$ values in sulphide minerals and REE element profiles of the meta-basalts should further test the origin of these undated units. I will also present fluid inclusion data from mylonites adjacent to the intrusion and Cr-spinel-specific elemental data bearing on the nature of the original ultramafic melt composition, the mantle peridotite source, and tectonic setting of the Younger Basic bodies.