

## DEVONIAN RIFT-RELATED SEDIMENTATION AND VARISCAN TECTONICS – NEW DATA ON THE LOOE AND GRAMSCATHO BASINS FROM THE RESURVEY OF THE NEWQUAY DISTRICT



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The geological resurvey of the Newquay District (Geological Survey Sheet 346) has resulted in stratigraphical and structural revision. The Devonian successions form part of the Looe and Gramscatho basins and broadly young to the south throughout the area. Deposition of the green to purple mudstones and sandstones of the Whitsand Bay Formation (Dartmouth Group) had initiated by the latest Lochkovian and was conformably succeeded by the sandstones, mudstones and bioclastic limestones of the Bovisand Formation (Meadfoot Group). The newly defined Trendrean Mudstone Formation (Meadfoot Group) is dated as mid-Emsian or younger on the basis of palynological studies. These three formations respectively record the transition from lacustrine/fluviol through shallow marine to outer shelf/slope depositional environments during Lower Devonian rifting and the development of the Looe Basin. The lowermost part of the Gramscatho Basin succession is represented by the undated Grampound Formation (Gramscatho Group) that has a faulted contact with the underlying Looe Basin succession. It predominantly comprises mudstone but includes sandstone-dominated 'packets' (Treworgans Sandstone Member) consistent with an outer shelf and/or slope depositional environment along the northern margin of the Gramscatho Basin. The conformably overlying Porthtowan Formation (Gramscatho Group) comprises mudstones and sandstone-mudstone couplets and is entirely deep marine. Variscan primary deformation (D<sub>1</sub>) resulted in isoclinal folding and an associated axial planar cleavage throughout both successions. The 'Watergate Bay Antiform' of earlier workers is discounted; the associated outcrop geometry of the Dartmouth and Meadfoot groups is thrust-controlled. D<sub>2</sub> deformation is developed around Porth Joke (Looe Basin succession) and intensifies southwards towards the Gramscatho Basin, probably in response to the NNW thrusting of the northern 'parautochthonous' margin of the Gramscatho Basin over the southern margin of the Looe Basin. An anomalous 900 m wide zone of steeply dipping S<sub>2</sub> cleavage around Penhale Point is interpreted as primarily reflecting reorientation by a large-scale southwards-verging monoformal F<sub>3</sub> fold. The structural complexity within the boundary zone possibly reflects a pre-Devonian basement fault influence upon: (i) the transition from shelf to deep marine depositional environments during the Lower-Middle Devonian, (ii) Variscan thrust juxtaposition (D<sub>1</sub> and D<sub>2</sub>) of the Looe and Gramscatho basin successions, and (iii) D<sub>3</sub> post-Variscan extensional reactivation and reorientation of earlier fabrics.

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### INTRODUCTION

The Newquay district (Figure 1) is largely underlain by low-grade regionally metamorphosed Devonian sedimentary rocks assigned to the Looe and Gramscatho Basin successions (Leveridge and Hartley, 2006). It lies almost entirely within the parautochthon of the SW England Variscan belt, to the north of the Carrick Thrust (Holder and Leveridge, 1986). In the original resurvey, four lithostratigraphical units of Devonian age were defined; the Dartmouth Beds, Meadfoot Beds and Staddon Grits (all Lower Devonian), and the Ladock Beds/Grampound Grit (Reid and Scrivenor, 1906). In addition, the large-scale Watergate Bay antiform was proposed to account for stratigraphical repetition and there was recognition of the complexity of outcrop scale folding, cleavage and faulting (Reid and Scrivenor, 1906).

Most subsequent work on Devonian sedimentation and Variscan tectonics has primarily focussed on the southern third of the district that corresponds to the Gramscatho Basin (e.g. Holder and Leveridge, 1986). In contrast to areas along strike in SE Cornwall, Plymouth and South Devon, relatively little has been published on the northern two-thirds of the district that

corresponds to the Looe Basin; exceptions include Sanderson (1971), Henley (1974), Holdsworth (1989), the unpublished PhD of Steele (1994), and data contained within province-scale syntheses, e.g. Dearman *et al.* (1971), Hobson (1976), Shackleton *et al.* (1982), Hobson and Sanderson (1983) and Coward and Smallwood (1984).

The resurvey of the Newquay Sheet was undertaken between 2003-2006 and complements the earlier extensive investigation of the Looe Basin, undertaken as part of the resurvey of the Plymouth Sheet (Leveridge *et al.*, 2002), and the Gramscatho Basin, undertaken as part of the resurvey of the Falmouth and Mevagissey sheets (Leveridge *et al.*, 1990; Leveridge, 2006). The purpose of this contribution is to summarise some of the new data pertaining to the Devonian successions, including stratigraphical and structural revisions, which have emerged during this re-survey. These findings are then discussed in the wider context of Devonian basin development and Variscan tectonics in SW England (e.g. Leveridge and Hartley, 2006).