

THE STRATIGRAPHY OF THE PENARTH GROUP (LATE TRIASSIC) OF THE EAST DEVON COAST

R. W. GALLOIS



Gallois, R.W. 2007. The stratigraphy of the Penarth Group (late Triassic) of the east Devon coast. *Geoscience in south-west England*, **11**, 287-297.

The cliff and foreshore exposures in the Devon part of the Dorset and East Devon Coast World Heritage Site expose an unbroken late Triassic to early Jurassic succession. The change from the terrestrial, red-bed facies of the Triassic Mercia Mudstone Group to the fully marine conditions of the Jurassic Lias Group takes place via the Penarth Group, a succession of mudstones, siltstones and limestones deposited in lagoonal and sheltered shallow-marine environments of varying salinities. The Penarth Group as currently defined is divided into the Westbury Formation overlain by the Lilstock Formation, based on type sections in the Severn Estuary area. The lithology and sedimentology of the Westbury Formation strata exposed on the east Devon coast are closely comparable with those of the type area, but those of the Lilstock Formation are not. It is therefore proposed on lithological and historical grounds that this formation should be replaced by a Cotham Formation overlain by a White Lias Formation. This would reinstate, without any change in their original definitions, two of the oldest formally defined stratigraphical names in the British Phanerozoic. All three formations are lithologically distinctive, and are separated from their neighbours by erosion surfaces that represent non-sequences. Those at the bases of the Westbury and Cotham formations are overlain by pebble beds rich in vertebrate remains ('bone beds'). The Cotham Formation is a highly condensed succession comprised of thinly interbedded mudstones and limestones with ripple trains, stromatolites, desiccated surfaces and slumped beds, the last of which have been attributed to earthquakes or a bolide impact. The limestones of the White Lias Formation exposed on the east Devon coast are sedimentologically complex with channels, slumps and desiccated surfaces. The position of the Triassic-Jurassic boundary is currently under review. Possible positions include the base of the Cotham Formation, a horizon within the formation, the base of the White Lias, the base of the overlying Blue Lias Formation or a horizon within the Blue Lias Formation.

92 Stoke Valley Road, Exeter, EX4 5ER, U.K.
(E-mail: gallois@geologist.co.uk).

INTRODUCTION

The Triassic rocks of southern England were divided by Warrington *et al.* (1980) into groups on the basis of gross lithology (Table 1). In ascending order the Sherwood Sandstone Group (pebble beds and sandstones), Mercia Mudstone Group (mudstones and silty mudstones) and Penarth Group (thinly interbedded mudstones, limestones and sandstones). At the base of the succession the unfossiliferous Aylesbeare Group (predominantly mudstones), a name adopted from Smith *et al.* (1974), was thought at that time to encompass the Permian-Triassic boundary but is now thought to be largely Triassic in age.

In southern England the Penarth Group sediments mark a transition from the hot deserts of the Permo-Triassic that had lasted for over 100 million years, to the predominantly marine sedimentation of the Jurassic-Cretaceous that was to last for another 135 million years. The group comprises thinly interbedded mudstones, siltstones and limestones that were deposited in lagoonal and restricted-marine environments that ranged from slightly saline to fully marine. The succession is highly condensed, contains numerous sedimentary breaks, and is bounded by erosion surfaces that can be traced throughout south-west England. It represents about 3 million years of sedimentation that span the mid and late Rhaetic Stage.

The most complete extant exposures of the Penarth Group in Britain are cliff and foreshore outcrops on the south Wales coast around Penarth, on the north Somerset coast between Watchet and Lilstock, and on the Devon coast (Figure 1). The

cliffs of the east Devon coast contain the most complete exposures of the Triassic succession in the British Isles, and the best exposure of the terrestrial facies in Europe. The succession dips steadily eastwards, mostly at 01° to 03°, and is overlain with marked unconformity by an almost horizontal sheet of mid-Cretaceous Gault and Upper Greensand formations with the result that the Triassic rocks are overstepped in a westerly direction (Gallois, 2006). The Penarth Group outcrop is confined to the most easterly part of the coast where it is exposed on the foreshore and in cliffs 400 m W of Culverhole Point [272 893] (referred to here as Culverhole), at Charton Bay [SY 299 899 to 302 900] and at Pinhay Bay [SY 313 903 to 321 908]. The full thickness of the group was proved in the Lyme Regis (1901) Borehole [SY 3361 9299] (Warrington and Scrivener, 1980) and the Charmouth No. 16 Borehole [SY 3656 9308] (Ivimey-Cook, 1973; Warrington, 2005), *c.* 3 and *c.* 5 km NE of Pinhay Bay respectively, and in hydrocarbon-exploration boreholes throughout the Wessex Basin (Lott *et al.*, 1982).

Group	Type section/area	Thickness, type area	Thickness, east Devon
Penarth	Penarth, South Wales	16 m	18 m
Mercia Mudstone	East Devon coast	450 m	450 m
Sherwood Sandstone	Sherwood Forest, Notts	up to 400 m	180 m
Aylesbeare	East Devon coast	500 m*	500 m

Table 1. Component groups of the Triassic rocks of the British Isles (after Warrington *et al.*, 1980). *lowest part possibly Permian.