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Taxonomy and palaeoecology of thoracican cirripedes (Crustacea) from a Campanian rocky shoreline at Ivö Klack, southern Sweden

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ABSTRACT

An abundant and diverse fauna of thoracican cirripedes is described on the basis of over 3000 isolated valves collected from a single lens of material representing in the order of a few thousand years of Campanian time (*c.* 80 Ma), from sediment formed on and close to a rocky shoreline at Ivö Klack in southern Sweden. At least twenty-eight species are present in the fauna, belonging to scalpelliform and basal sessile taxa. Two families (Myolepadidae and Titanolepadidae) and four genera are new (*Myolepas*, *Bosquetlepas*, *Levelepas* and *Ivoelepas*), as are seven species (*Titanolepas spinifer*, *Levelepas roeperi*, *Ivoelepas nielseni*, *Arcoscalpellum scaniensis*, *Pollicipes vansyoci* and *P.* (?) *striatum*). The palaeoecology is discussed with reference to extant cirripede faunas from rocky coastal environments. It is concluded that, although many taxa lived subtidally, the pollicipedids and pollicipedid-like forms (*Capitulum*, *Pollicipes* and *Myolepas*, respectively) lived in the intertidal zone, attached to rocks in a high-energy environment. *Pachydiadema*, a large basal balanomorph species, was adapted to living attached to boulders in the intertidal zone. The remarkable diversity significantly exceeds that of any known fossil thoracican assemblage, and is unknown in similar habitats at the present day, possibly challenging Darwin's famous quip that we currently live in the 'Age of Barnacles'.

1. Introduction

The exposures at Ivö Klack in Skåne, southern Sweden, provide a profile through a rocky shoreline, where boulders of Proterozoic gneiss were encrusted by zoned epifauna (Surlyk and Christensen, 1974; Surlyk and Sørensen, 2010), then buried by bioclastic shell sands composed of the calcite skeletal elements of organisms, some of which lived on the boulders, and others in the surrounding carbonate sands and gravels. The locality probably represents a maximum water depth of 30 m, and among the diverse and abundant faunas, bryozoans, bivalves, echinoderms, serpulids and brachiopods were particularly abundant (Surlyk and Sørensen, 2010; Sørensen and Surlyk, 2010, 2011a,b; Sørensen et al., 2012). Withers (1935) described numerous thoracican cirripede species from Ivö Klack, based on material sent to him by the Danish palaeontologist Kristian Brünnich Nielsen. Subsequently, Carlsson (1953) reviewed the Late Cretaceous and early Palaeocene cirripedes from southern Sweden, but added little to Withers' account, and re-used many of his photographs.

The kaolinite quarry at Ivö Klack ceased to be worked in the 1960s, and the exposures of Cretaceous bioclastic limestones have overgrown progressively ever since. However, a few years ago the German palaeontologist Dr Martin Röper (Solnhofen) found a pocket of soft material between large gneiss boulders, on the wooded slope representing the old back wall of the quarry (Figs. 1, 2). We were informed of this locality, and directed to it, by Manfred Kutscher (Sassnitz, Rügen). This locality is here referred to as the Röper Lens. The preservation of material in this lens is exceptionally good; there is little calcite overgrowth, and many of the smaller fossils are perfectly preserved. It probably represents very little time and thus provides a snapshot of biodiversity. Cirripedes proved to be so abundant and diverse that we embarked on a taxonomic and palaeoecological study of the material picked from large, new samples.

The potential interest of a Late Cretaceous rocky shoreline from the point of view of cirripede evolution is considerable, since the intertidal and shallow subtidal habitat is one in which balanomorphs have dominated from the Palaeogene to the present day. Indeed, Withers (1935) described an Ivö Klack species as the oldest balanomorph, *Catophragmus* (*Pachydiadema*) *cretaceum*, which he thought to be closely related to the extant *Catophragmus* (*Catophragmus*) *polymerus* (Darwin, 1851) known from Australia

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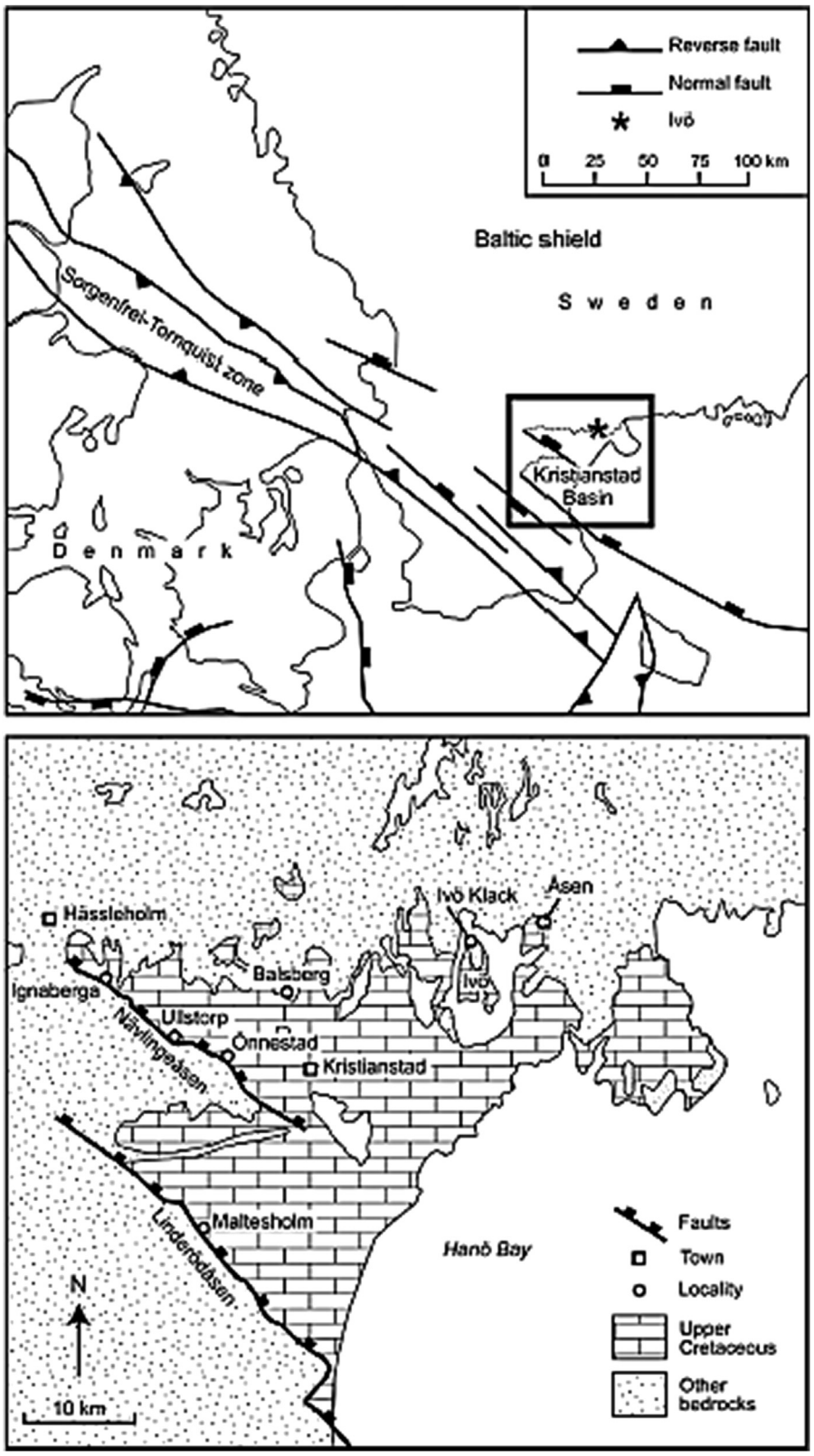

Fig. 1. Map to show position of Ivö Klack in the Kristianstad Basin (southern Sweden).

(Anderson, 1983, 1994). Using new material, Gale and Sørensen (2014) redescribed *Pachydiadema* Withers, 1935 and other taxa (*Brachylepas* Woodward, 1901; *Epibrachylepas* Gale, *in* Gale and Sørensen, 2014 and *Parabrachylepas* Gale, *in* Gale and Sørensen, 2014) relevant to the origin of balanomorphs from Ivö Klack. Gale (2014) described material of the genus *Proverruca* Withers, 1914b from Ivö Klack, as part of a wider review of fossil verrucomorphs. The present paper describes the remainder of the extensive fauna,