

# HAWK'S HEUGH

OS Grid Reference: NT790714

## Highlights

Hawk's Heugh in Border is the only place where British examples of the antiarch *Remigolepis* have been found, and it is therefore important for comparison with sites in East Greenland and Australia that have also yielded this genus. It is also intriguing as a pointer to the possibility of finds of early tetrapods, because elsewhere *Remigolepis* is associated with tetrapod remains.

## Introduction

Hawk's Heugh, on the coastline some 10 km south-east of Dunbar, falls within an extensive, continuous sequence from Upper Devonian to Lower Carboniferous. The geology of the vicinity has been described by George *et al.* (1976). Prof. Sir Frederick Stewart discovered there in 1957 a large bone of *Remigolepis*, an antiarch described originally from Greenland by Stensiö (1931), and this was taken as a hint that tetrapod remains also might occur there, since *Remigolepis* is associated with similar tetrapod remains in Greenland (Andrews, 1978). However, the chances of finding tetrapods in the Pease Bay Beds are small because the fish-bearing bed itself is thin and poorly exposed. There is some doubt locally as to the position of the base of the Carboniferous System and also as to whether the *Remigolepis* horizon might be younger than Devonian. A field guide to the vicinity was provided by Grieg and Davies (Allen and Williams, 1978; Figure 8.7).

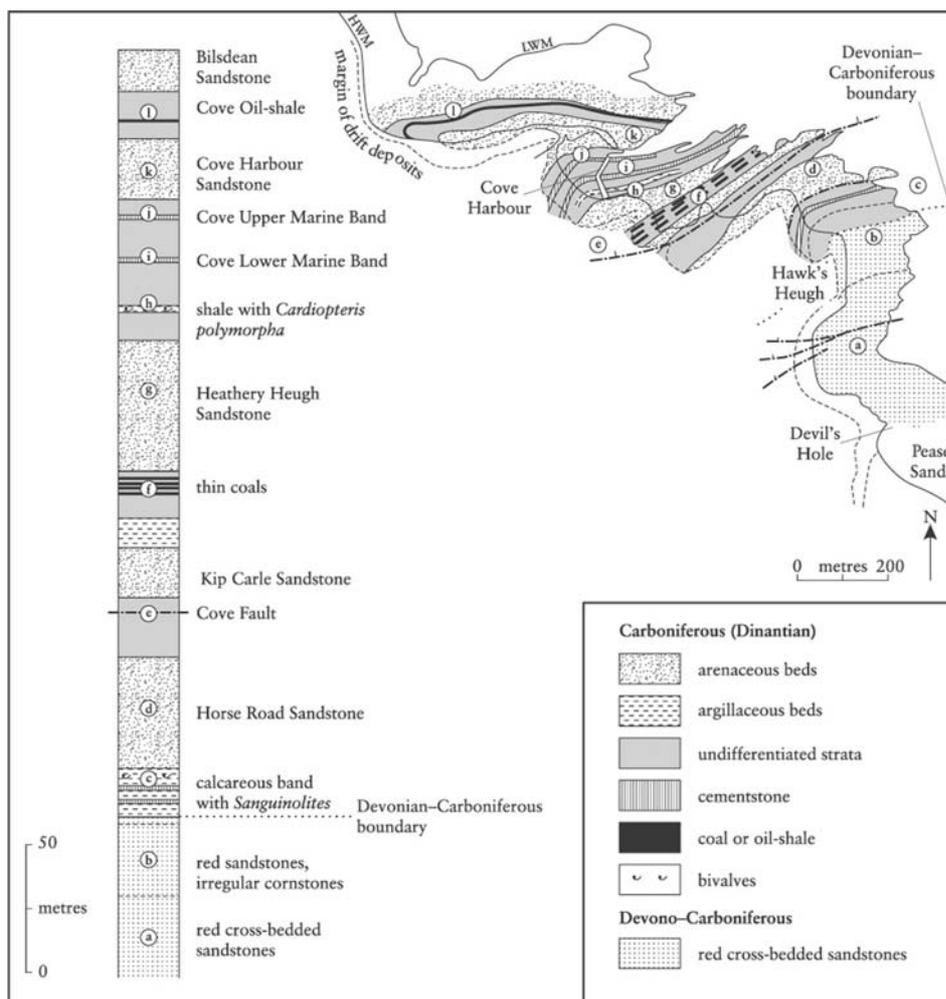


Figure 8.7: Geological sketch map and section of the Hawk's Heugh (GCR site) coastline (after Grieg and Davies, 1978).

## Description

Reddened sandstones and pedocals of Old Red Sandstone facies alternate with sandstones, shales and limestones of the Cementstones (George *et al.*, 1976). The Upper Old Red Sandstone in Pease Bay is cross-bedded, and the grains are well rounded. There are some 350 m of red clastics in this group, the middle part of which has previously yielded scales of *Holoptychius nobilissimus* in abundance. The Old Red Sandstone passes up into the Cornstone Group, which in turn passes up into Lower Carboniferous cementstones that are rich in plant fragments.

The *Remigolepis* plate was found in a loose block of intraclast conglomerate lithologically comparable to a bed in the cliff above about 6 m below the top of the Cornstone Group at the top of the 'Old Red Sandstone'. The lithology is described as sandstone containing clay galls and lumps of dark calcareous material (Andrews, 1978). The specimen is the anterior median dorsal plate of a large individual. It is 190 mm long, compared to 140 mm in its closest relative, *R. acuta*, from Greenland (Stensiö, 1931). The animal was probably some 330 mm in overall length. *Remigolepis*, assigned to the Family Asterolepidae (Gross, 1965; Denison, 1978), is characterized by the lack of a joint in the pectoral appendage, because of which it was often assigned to its own family or even order, but this is not commonly done now (Figure 8.8).

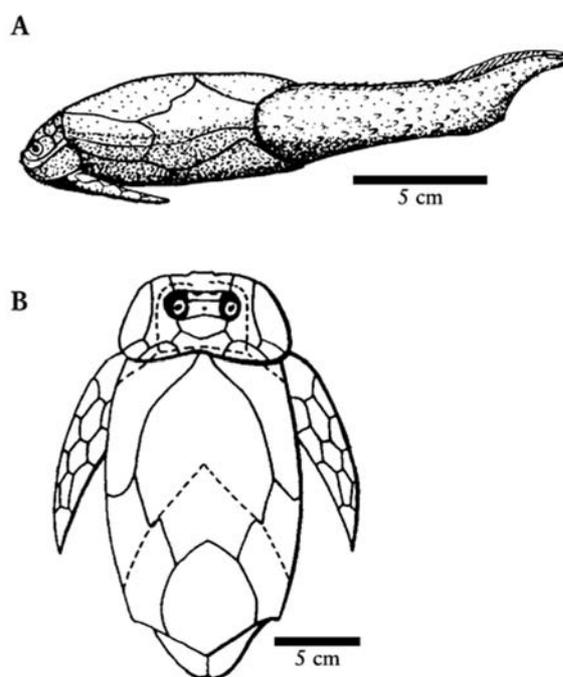


Figure 8.8: The antiarch *Remigolepis*. (A) Restoration after Ritchie (1986); (B) the carapace in dorsal aspect (after Miles, 1968).

### Fauna

Placodermi: Antiarchi: Remigolepidae

**Remigolepis** sp.

Placodermi: Antiarchi: Bothriolepidae

**Bothriolepis** sp.

Osteichthyes: Sarcopterygii: Porolepiformes: Holoptychiidae

**Holoptychius nobilissimus** Agassiz, 1839

*Holoptychius* and *Bothriolepis* also occur as fragments in this bed. This may be a very late record of *Bothriolepis*, occurring as it does in terminal Devonian beds. *Bothriolepis nielsenii* from the East Greenland *Remigolepis* Series is the stratigraphically highest *Bothriolepis* known (Denison, 1978).

## Interpretation

The age of the fish-bearing beds is not clear. The Upper Old Red Sandstone in Pease Bay, source of rare *Holoptychius* scales and of *Remigolepis*, is overlain by 17 m of cementstone and shale with cementstone conglomerate, the Eastern Hole Conglomerate, which is arbitrarily taken to be the basal unit of the Carboniferous (Craig, *in* Craig and Duff, 1975, p. 113). The problem is that no biostratigraphically clearly defined base to the Carboniferous section can be seen, and it is determined arbitrarily by the base of the lowest cementstones, a typical Lower Carboniferous facies in the area.

These cementstones are the lowest strata to provide miospore dates, the *Schopfites claviger–Aurorospora macra* Zone (Neves *et al.*, 1972, 1973), regarded by these authors as of 'Z-zone' age. The Horse Roads Sandstone, a 43 m thick unit, lying close above the 17 m cementstones unit on top of the Old Red Sandstone, is referred to spore zone Pa (Neves *et al.*, 1973), thus probably Tn2 or even Tn3, hence Tournaisian or lowest Carboniferous.

The *Remigolepis* from East Greenland (Stensiö, 1931) came from beds which are Famennian or Lower Carboniferous in age (Andrews, 1978). The genus is found in the uppermost Frasnian of Russia (Luksevics, 1991) and also in New South Wales (Young, 1974), where it is rather older than the type species. *Remigolepis* has been recorded in the Upper Devonian of South China (Pan *et al.*, 1980) and similar forms are known in Kirgizia (Panteleyev, 1992). Hence, the fishes from the Pease Bay Upper Old Red Sandstone tend to point to a Famennian age for the unit. All these horizons appear to be in terrigenous continental-marginal beds, primarily of freshwater origin.

## Conclusions

The Hawk's Heugh Upper Old Red Sandstone has, over the years, produced rare remains of *Holoptychius* and *Bothriolepis* indicative of Late Devonian age. The site achieved greater prominence with the report of *Remigolepis*, a unique record for Britain, and indicator of a particular facies, already noted in Greenland and Australia as bearing some of the most ancient tetrapods. The importance of the site rests in the potential for future discoveries at this coastal site, including more *Remigolepis* material.

## Reference list

- Agassiz, J.L.R. (1839) Fishes of the Upper Ludlow Rock. In *The Silurian System*, R.I. Murchison (ed.), Vol. 2, 605–7, John Murray, London.
- Allen, J.R.L. and Williams, B.P.J. (1978) The sequence of the earliest Lower Old Red Sandstone (Siluro-Devonian), north of Milford Haven, southwest Dyfed (Wales). *Geological Journal*, **13**, 113–36.
- Andrews, S.M. (1978) A possible occurrence of *Remigolepis* in the topmost Old Red Sandstone of Berwickshire. *Scottish Journal of Geology*, **14**, 311–15.
- Craig, G.Y. and Duff, P.M.L.D. (1975) *The Geology of the Lothians and South east Scotland* Scottish Academic Press, 157pp.
- Denison, R.H. (1978) Placodermi. In *Handbook of Paleoichthyology*, Vol. 2 (ed. H.-P. Schultze), Gustav Fischer Verlag, Stuttgart, New York, 128 pp.
- George, T.N., Johnson, G.A.L., Mitchell, M. *et al.* (1976) *A Correlation of Dinantian rocks in the British Isles. The Geological Society, London, Special Report 7*, 87 pp.
- Gross, W. (1965) über die Placodermen-Gattung *Asterolepis* and *Tiaraspis* aus dem Devon Belgiens und einen fraglichen *Tiaraspis* – Rest aus dem Devon Spitzbergens, *Bulletin de l'Institut royal des Sciences naturelles Belgique*, **41**, 1–19.
- Luksevics, E.V. (1991) New *Remigolepis* (Pisces, Antiarchi) from the Famennian deposits of the Central Devonian field (Russia, Tula region). *Daba un Muzejs*, **3**, 51–56. [In Russian.]
- Neves, R., Gueinn, K.J., Clayton, G., Ioannides, N. and Neville, R.S.W. (1972) A scheme of

- 
- miospore zones for the British Dinantian. *Comptes Rendus 7e Congrès pour l'Avance-ment de Stratigraphie et Géologie du Carbonifère, Krefeld*, **1**, 347–53.
- Neves, R., Gueinn, K.J., Clayton, G., Ioannides, N., Neville, R.S.W. and Kruszewaska, K. (1973) Palynological correlation within the Lower Carboniferous of Scotland and northern England. *Transactions of the Royal Society of Edinburgh*, **69**, 23–70.
- Pan, J., Wang, S.-t., Liv, S.-y., Gu, Q.-C. and Jia, H. (1980) Discovery of Devonian *Bothriolepis* and *Remigolepis* in Ningxia. *Acta Palaeontologica Sinica*, **54**, 176–85.
- Panteleyev, N. (1992) New remigolepids and high armoured antiarchs of Kirgizia. In *Fossil Fishes as Living Animals* (ed. E. Mark-Kurik), Academy of Sciences, Estonia, Tallinn, pp. 185–91.
- Stensiö, E.A. (1931) Upper Devonian vertebrates from East Greenland, collected by the Danish Greenland in 1929 and 1930. *Meddelelser om Grønland*, **86**, 1–212.
- Young, G.C. (1974) Stratigraphic occurrence of some placoderm fishes in the Middle and Late Devonian. *Newsletters in Stratigraphy*, **3**, 243–61.