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Geology, landscape and human interactions: examples from the Isle of Wight

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ABSTRACT

The British Geological Survey has recently re-mapped the Isle of Wight at a scale of 1:10,000. This has added to a wealth of geological research already published. Within this paper, we highlight the importance of geology to the heritage of the Isle of Wight and its impacts on everyday life. There is a growing cultural awareness of the variety of landscapes and resources, the geology that underpins them, and the need to manage and understand them in a sensitive and sustainable way. 'Geodiversity', which collectively embraces these themes, is defined as "... the natural range (diversity) of geological (rocks, minerals, fossils), geomorphological (land form, processes) and soil features ..." (Gray, 2004). This paper will focus on the geomorphological features; that is, the link between geology, the landscape it influences, and the human interactions with it. Examples from the Isle of Wight of the influences of geology on landscape include the landslides at Ventnor; geotourism at The Needles, Alum Bay and various dinosaur sites; and the artificial landscapes resulting from resource extraction. The geological issues and examples that we have used are some of the most applicable to everyday life, and therefore ones that many people will be able to relate to, such as geohazards (e.g. landslides), water supply, economic value (e.g. quarrying) and tourism. The paper is aimed at the non-specialist and students but also may provide a contextual element to professionals.

1. Introduction

Geology and geodiversity have received more interest in recent years particularly with the focus on climate change and impacts on our environment. Many Local Authorities are now publishing Local Geodiversity Action Plans (Burek and Potter, 2006) and Defra has provided various policies and guidance, e.g. Aggregate Levy Sustainability Fund, to reduce the impact of activities such as aggregate extraction (Defra, 2006). The value of outreach for both geology and geodiversity have been comprehensively reviewed in Anderson and Brown (2010), which concentrates on the Quaternary aspect of geology but their reasoning and assumptions can readily apply to all areas of geology. The method of outreach and communication is important and depends upon the target audience. Good communication will lead to better understanding of the geological environment, its implications and consequences. This paper draws on the increased scientific knowledge gained from detailed new mapping of the Isle of Wight and helps to highlight the importance of continued scientific research as well as raise awareness of environmental issues and sensitivity. This case study of the Isle of Wight can easily be applied across a variety of other regions.

1.1. Background

The first geological survey of the Isle of Wight was carried out by the British Geological Survey (BGS) (then named the Ordnance Geological Survey) and published in 1856 (British Geological Survey, 1856) on the one-inch scale. The island was resurveyed in 1886–1887 on the six-inch scale and reprinted a number of times to incorporate minor ammendments. The first 1:50,000 scale map of the Island was published by BGS in 1976 (British Geological Survey, 1976). Since those first surveys, a wealth of geological research has been undertaken and published covering a wide range of subjects from formation level descriptions (e.g. Insole et al., 1998) to the discovery of flint arrow heads that provide evidence of human occupation some 365 thousand years ago (Wenban-Smith et al., 2009). Over the past 3 years the BGS has completed a new detailed geological survey of the Isle of Wight, incorporating up-to-date knowledge of the stratigraphy, e.g. the modern chalk nomenclature, and new airborne geophysical data. A team of geologists has mapped, logged and sampled across the whole island, collecting a huge amount of scientific data and recording their observations at a scale of 1:10,000. This data will lead to new updated, more detailed geological maps. In this paper we will explore how the new geological map can be interpreted to reveal

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the rich Geodiversity of one of Britain's most popular islands. The island also boasts a stunning array of habitats for flora and fauna – for example the Chalk Downlands, and several areas classified as Areas of Outstanding Natural Beauty (AONB). These habitats are influenced by the underlying geology and it is raising the awareness of this that is essential to recognising its value and preserving these fragile environments.

The Isle of Wight is primarily a rural island with a large percentage of land use devoted to agriculture. The Digital Terrain Model (DTM) image (Fig. 1) shows the landscape features of the island.

The distinct shape and topography of the island is controlled by the dominant east-west trending Chalk Downlands. This elevated ridge creates a spine across the island and is formed by intensely hardened, folded and faulted chalk rocks. To the north of this east-west spinal structure, Palaeogene deposits, overlain by sporadic fluviatile and marine deposits, form gently sloping topography. The southern Chalk Downlands, isolated from the spinal folded feature, provide the greatest elevations on the island rising up to 235 m OD on St Boniface Down. Separating these two areas of Chalk Downlands is an area of gently undulating dissected topography, underlain by Lower Cretaceous rocks and patchy Pleistocene and Holocene deposits that relate to the present-day fluvial systems. The major rivers consist of the eastern and western Yar and the Medina rivers. These dissect the prominent chalk ridge as they flow northwards, taking advantage of weaknesses, such as faults, in the bedrock.

The major towns of the island are primarily situated in the north and east. The administrative municipality of Newport lies in the centre of the island, whilst other towns, such as Sandown, Shanklin and Ryde became extensively developed during Victorian times as popular tourist destinations. The island's main ports have been situated in locations that take advantage of the natural harbours and embayments – Cowes, Freshwater, Yarmouth and Bembridge.

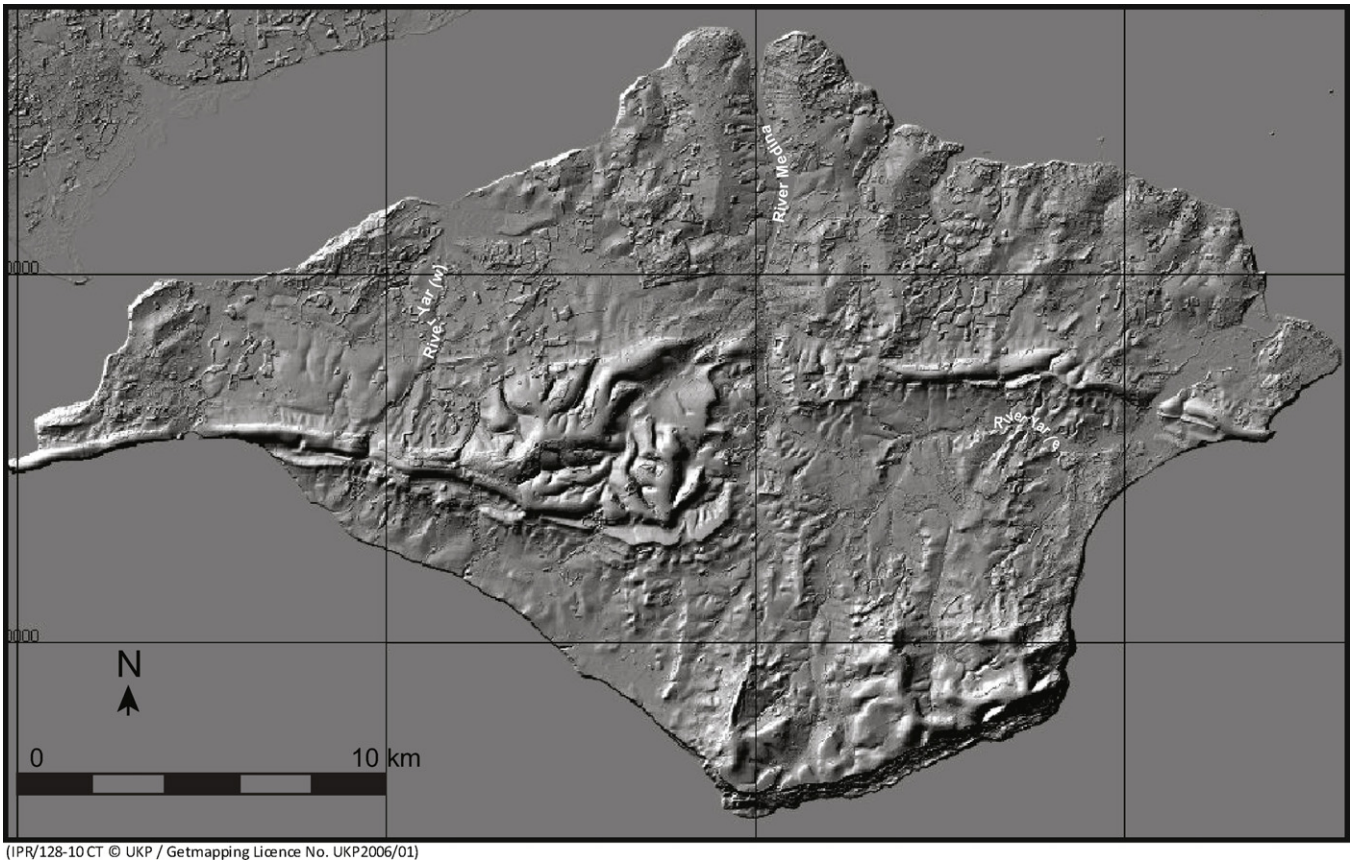
Lying just a few miles off the south coast of England, split from the mainland by the Solent, the island has a significant geological story to tell.

2. Landscape domains

This paper identifies the different landscape domains present on the island and examines the geology that underpins them (Fig. 2). These domains comprise the southern coastal plains and central low-lying Lower Cretaceous Wolds (Domain 1), the Chalk Downlands and foothills (Domain 2), the Palaeogene landscapes of the north (Domain 3) and the Quaternary deposits (Fig. 3) that include the present day coastal areas and tidal flats of the northern coastline, and the numerous river deposits (Domain 4). These landscape domain–geology interactions will be discussed in chronological order and a generalised stratigraphy is provided in Table 1.

2.1. Domain 1 – the Lower Cretaceous Wolds

The majority of the central part of the island is characterised by the Lower Cretaceous Wolds. Landscapes of this domain are defined by low-lying, gently undulating topography dominated by arable farmland interspersed with pasture. The flat coastal plain around Brighstone and Chale Green gives way to gently undulating topography inland to Godshill, Newchurch and Shanklin. The area consists of small river valleys and low-lying poorly drained areas that provide conditions preferable for peat formation. The undulating topography is formed by harder layers of sandstones, more



(IPR/128-10 CT © UKP / Getmapping Licence No. UKP2006/01)

Fig. 1. Digital Terrain Model (DTM), surface model hillshade of the Isle of Wight (IPR/128-10 CT.© UKP/Getmapping Licence No. UKP2006/01).