

## THE CORNUBIAN DINOSAUR PROJECT

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Dinosaurs still hold a fascination for school children. Studies of the palaeogeography of the south-west of England have indicated that for large parts of the Mesozoic period there existed a land mass over parts of what today are the present counties of Cornwall and Devon. Projects have already taken place with partner primary schools within the Caradon Network Learning Community and the school is now taking the lead in developing a set of resources that have a firm basis in science that will allow dinosaurs and other fossil organisms to be used to teach aspects of the national curriculum in a new and exciting way, ensuring that Earth Science education is at the forefront of this experience.

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### INTRODUCTION

The purpose of this paper is to outline a major new initiative to put earth sciences and more especially palaeontology at the forefront of teaching and delivering science in schools in the southwest. Geology represents approximately 4% of the national curriculum for science in secondary schools (King, 2004), and yet is not taught to all groups. At primary school it is possible to enhance the science learning experience by using a familiar and exciting concept to deliver ordinary aspects of the curriculum. The use of dinosaurs for specific projects can also give an exciting learning experience at secondary school level.

### SALTASH.NET COMMUNITY SCHOOL EARTH SCIENCE CENTRE

The saltash.net community school Earth Science Centre started from a concept proposed to the leadership group and governing body of the school in November 2004. Geology has not been taught in the school since 1985, and was identified as a science where much potential was being lost. In 2005 the school obtained specialist status as a Science and Mathematics with computing Specialist College. In 2005 a bid was made to the Aggregate Levy Sustainability Fund, to allow the setting up of the centre.

The centre has three aims. Firstly the centre is available in the school to improve the teaching experience at key stage 3 and key stage 4. It is intended to teach GCSE Geology (WJEC syllabus) and also Advanced level Geology (WJEC syllabus). Secondly the school has set up a number of projects with the feeder primary schools and it is proposed that the centre will be used to inform and deliver aspects of the science curriculum at key stage 1 and key stage 2. The final objective was to provide a facility that was available for the whole community, which would allow disabled access to the earth sciences and also allow its use by organisations such as the U3A and the OUGS.

### WHY THE CORNUBIAN DINOSAUR PROJECT ?

The school is keen to become the centre of a teaching network. It has seven feeder primary schools and since 2004 has had an active and varied liaison programme in place, including a "Dinosaurs and Past Life" project. The need for the "Cornubian dinosaur project" was identified as a means of

giving non-specialist teachers support and assistance in delivering some aspects of the national curriculum in science. The project can be used to discretely deliver aspects of these units as part of the normal science curriculum or alternatively it is possible to deliver the units as a concentrated unit of work in the form of a week long project.

Another key part of the project was to ensure that it was available to the students in the secondary school sector. At this level the pressures of examinations and assessment gives much less space for the inclusion of such "specialist" projects. The project in this sector has been delivered as part of extra mural work.

### *National Curriculum: Where does the project map across ?*

The project allows a wide range of National Curriculum targets to be covered in an exciting and innovative manner. Most importantly it allows a large number of the SC1 targets to be addressed. These SC1 targets are in the area of "scientific enquiry" and allow the students to "learn" to be scientists, rather than just re-iterating facts from text books or other media. They will devise a hypothesis and then work to prove or disprove this work. As can be seen from Table 1 and Table 2 there are a large number of the statements of attainment that are covered by the materials included in the project.

Table 3 illustrates that the project does not only address targets from the National Curriculum for Science, but also allows targets in other subject areas to be covered. These can for instance be the teaching of proportionality in mathematics, or the teaching of descriptive writing in the English curriculum.

Science Unit of Work	Year Group
Unit 2C – Variation	2
Unit 3D – Rocks and Soils	3
Unit 4A - Moving and Growing	4
Unit 4B – Habitats	4
Unit 6A – Interdependence and Adaptation	6

**Table 1.** Units of the key stage 1 and key stage 2 science national curriculum.

**Scientific basis for the project**

For most of the Mesozoic the Cornubian peninsula existed as land of varying topography (e.g. Bradshaw *et al.*, 1992; Hancock and Rawson, 1992; Warrington and Ivimey-Cook, 1992). For the purpose of this paper the Cornubian Island is defined as that area which was either land or shallow marine shelf in the Mesozoic era. This encompasses the present counties of Cornwall, Devon, Dorset, Somerset and the Isle of Wight. The Cornubian region has a number of sites identified as SSSI's or the importance of the vertebrate fauna. The sites have been identified in Benton and Spencer (1995), and the relevant sites for this paper are identified in Table 4. The identified fossil vertebrate sites are on the border of the "Cornubian Island" as defined above. Fossil reptiles are known from the Mid-Triassic

of Devon, with the discovery of a new species of Rhynchosaur in 1990 in the Otter Sandstone Formation of Ladram Bay, *Rhynchosaurus spenceri* (Benton *et al.*, 1993).

Dinosaurs have been found in areas to the north-east of the supposed Cornubian Island. The "Bristol Dinosaur" *Thecodontosaurus antiquus* was first discovered in 1834 at Durdham Down. This was 8 years before Richard Owen "invented" the Dinosauria. The original specimen was destroyed in the bombing of Bristol during World War 2. New material was however, discovered at Tytherington Quarry. This new material has formed the basis of an exciting development in palaeontology and its use as a teaching tool – namely the "Bristol Dinosaur Project" which is being run and co-ordinated from the University of Bristol (Schouten and de Blanger, 2003). Further discoveries were made in South Wales which have been

<b>Subject</b>	<b>National Curriculum Attainment Point</b>	<b>Key Stage</b>
Science	Science (Sc1) <b>Scientific enquiry – 1</b>	1
	Science (Sc1) <b>Scientific enquiry – 2(a)</b>	1
	Science (Sc1) <b>Scientific enquiry – 2(b)</b>	1
	Science (Sc1) <b>Scientific enquiry – 2(d)</b>	1
	Science (Sc1) <b>Scientific enquiry – 2(h)</b>	1
	Science (Sc2) <b>Life processes and living things – 1(a)</b>	1
	Science (Sc2) <b>Life processes and living things – 4(b)</b>	1
	Science (Sc3) <b>Materials and their properties – 1(c)</b>	1
	Science - <b>Breadth of study – 1(c)</b>	1
	Science - <b>Breadth of study – 2(a)</b>	1
Science	Science (Sc1) <b>Scientific enquiry – 1(a)</b>	2
	Science (Sc1) <b>Scientific enquiry – 1(b)</b>	2
	Science (Sc1) <b>Scientific enquiry – 2(a)</b>	2
	Science (Sc1) <b>Scientific enquiry – 2(b)</b>	2
	Science (Sc1) <b>Scientific enquiry – 2(h)</b>	2
	Science (Sc1) <b>Scientific enquiry – 2(i)</b>	2
	Science (Sc1) <b>Scientific enquiry – 2(j)</b>	2
	Science (Sc1) <b>Scientific enquiry – 2(k)</b>	2
	Science (Sc1) <b>Scientific enquiry – 2(l)</b>	2
	Science (Sc1) <b>Scientific enquiry – 2(m)</b>	2
	Science (Sc2) <b>Life processes and living things – 2(e)</b>	2
	Science (Sc2) <b>Life processes and living things – 4(a)</b>	2
	Science (Sc2) <b>Life processes and living things – 4(c)</b>	2
	Science (Sc2) <b>Life processes and living things – 5(b)</b>	2
	Science (Sc2) <b>Life processes and living things – 5(c)</b>	2
	Science (Sc2) <b>Life processes and living things – 5(d)</b>	2
<b>Subject</b>	<b>National Curriculum Attainment Point</b>	<b>Key Stage</b>
Science	Science (Sc1) <b>Scientific enquiry – 2(a)</b>	3
	Science (Sc1) <b>Scientific enquiry – 2(b)</b>	3
	Science (Sc1) <b>Scientific enquiry – 2(c)</b>	3
	Science (Sc1) <b>Scientific enquiry – 2(d)</b>	3
	Science (Sc1) <b>Scientific enquiry – 2(e)</b>	3
	Science (Sc1) <b>Scientific enquiry – 2(i)</b>	3
	Science (Sc1) <b>Scientific enquiry – 2(j)</b>	3
	Science (Sc1) <b>Scientific enquiry – 2(k)</b>	3
	Science (Sc1) <b>Scientific enquiry – 2(n)</b>	3
	Science (Sc2) <b>Life processes and living things – 4(b)</b>	3
	Science (Sc2) <b>Life processes and living things – 5(e)</b>	3
	Science (Sc3) <b>Materials and their properties – 2(e)</b>	3
	Science (Sc3) <b>Materials and their properties – 2(f)</b>	3

**Table 2.** Science Key Stages 1, 2 and 3 National Curriculum attainment targets covered by the Cornubian Dinosaur project. (DfES 2002).

<b>Subject</b>	<b>National Curriculum Attainment Point</b>	<b>Key Stage</b>	
English	English (En3) <b>Writing</b> – 9(a)	1	
	English (En3) <b>Writing</b> – 9(c)	1	
	English (En3) <b>Writing</b> – 9(d)	1	
English	English (En2) <b>Reading</b> – 5(a)	2	
	English (En2) <b>Reading</b> – 5(g)	2	
English	English (En3) <b>Writing</b> – 10	2	
English	English (En1) <b>Speaking and listening</b> – 3(b)	3	
	English (En1) <b>Speaking and listening</b> – 3(c)	3	
	English (En2) <b>Reading</b> – 4(a)	3	
	English (En2) <b>Reading</b> – 4(b)	3	
	English (En2) <b>Reading</b> – 4(c)	3	
	English (En3) <b>Writing</b> – 1(i)	3	
	English (En3) <b>Writing</b> – 1(m)	3	
	English (En3) <b>Writing</b> – 1(n)	3	
	English (En3) <b>Writing</b> – 1(o)	3	
Mathematics	Mathematics (Ma3) <b>Shape, space and measures</b> – 1(e)	1	
	Mathematics (Ma3) <b>Shape, space and measures</b> – 4(c)	1	
Mathematics	Mathematics (Ma3) <b>Shape, space and measures</b> – 4(b)	2	
	Mathematics (Ma4) <b>Handling data</b> – 2(b)	2	
	Mathematics (Ma4) <b>Handling data</b> – 2(f)	2	
Mathematics	Mathematics (Ma2) <b>Numbers and algebra</b> – 2(f)	3	
	Mathematics (Ma2) <b>Numbers and algebra</b> – 4(a)	3	
	Mathematics (Ma4) <b>Handling data</b> – 1(e)	3	
	Mathematics (Ma4) <b>Handling data</b> – 1(f)	3	
	Mathematics (Ma4) <b>Handling data</b> – 1(j)	3	
	Mathematics (Ma4) <b>Handling data</b> – 3(b)	3	
	Information and Communications Technology	ICT – 1(a)	1
		ICT – 1(b)	1
ICT – 2(a)		1	
ICT – 2(b)		1	
ICT – 3(a)		1	
ICT – 3(b)		1	
Information and Communications Technology	ICT – 1(b)	2	
	ICT – 2(a)	2	
Information and Communications Technology	ICT – 1(a)	3	
	ICT – 2(a)	3	
	ICT – 3(b)	3	
	ICT – 5(a)	3	
History	History – 6(c)	1	
Geography	Geography – 1(e)	1	
Geography	Geography – 1(a)	2	
	Geography – 2(b)	2	
	Geography – 2(d)	2	
	Geography – 2(e)	2	
	Geography – 4(b)	2	
Geography	Geography – 2(b)	3	
	Geography – 2(e)	3	
	Geography – 4(b)	3	
	Geography – 6(b)	3	
	Geography – 6(c)	3	
Citizenship	Citizenship – 2(c)	3	
	Citizenship – 2(c)	3	

**Table 3.** Other subject areas: National Curriculum attainment targets covered by the Cornubian Dinosaur project. (DfES 1999 and 2002)

assigned to the species. *Thecodontosaurus* is identified as a basal Prosauropod. The systematic palaeontology can be found in Benton *et al.* (2000).

The Cornubian peninsula 210 Ma ago (Late Triassic [Norian-Rhaetian]) was a low-lying region, the full extent of which was uncertain (Warrington and Ivimey-Cook, 1992). Further details about the Cornubian peninsula during the Triassic can be found in Cope (2004) and a review of Triassic reptiles in Devon can be found in Benton (1997). Jurassic dinosaurs from the area include armoured dinosaurs which have been found in Charmouth, in close proximity to the study area. Specimens of *Scelidosaurus harrisonii* have been known from the Lower Lias in the region of Lyme Regis, Dorset. *Scelidosaurus* is classed as a basal Thyreophoran, falling outside the clade comprising *Ankylosauria* and *Stegosauria* (Norman *et al.*, 2004).

*Scelidosaurus* is known only from near-shore marine deposits. Owen (1863) interpreted the likely habitat of *Scelidosaurus* as being near to watercourses which would have allowed the “bloat-and-float” hypothesis – they were transported out to sea by rivers after they had died. The likely feeding mode of taxa like *Scelidosaurus* was that of an active forager of shrubby vegetation (Norman *et al.*, 2004).

Although not known from the study district, it would seem likely that carnivorous dinosaurs also lived on or near the Cornubian landmass in the Jurassic period. The best- and paradoxically least-well known species is that of *Megalosaurus bucklandi*. It is named as one of the founders of the Dinosauria, founded by Owen (Owen 1842). *Megalosaurus* is a theropod, but due to the fragmentary nature of its fossils it is not terribly well known. Its remains are known from rocks of Late Jurassic age in the Stonesfield Slate Formation in the Oxford district (Buckland, 1824) and it remains conceivable that

the Cornubian Island supported some vertebrate life during this period.

A Pterosaur, *Dimorphodon macronyx* is also known from the Liassic rocks of the Lyme Regis area. Not a dinosaur, this is an important species as evidence for the idea of the “Cornubian Island” as it is likely that the animal nested close to the sea, and its fossils are found in near-shore marine sediments (Buckland, 1829).

Dinosaur footprints are recognised from the Purbeck Limestone Group of Dorset (Ensom, 2002). There are two types, a tridactyl pes print, attributed to either *Iguanodon* or *Megalosaurus* and quadrupedal tracks attributed to nodosaurid ankylosaurs or a sauropod.

A classic area of Cretaceous palaeontology is the Isle of Wight. Dinosaur fossils from the Wealden strata at this locality are famous for their abundance, diversity and high quality of preservation. More than 20 species of dinosaur have been found on the Isle of Wight, some of which have not been found in any other locality. Reported dinosaur taxa are as follows: *Aristosuchus*, *Baryonyx*, *Calamosaurus*, *Calamospondylus*, *Chondrosteosaurus*, *Eotyrannus*, *Eucamerotus*, *Hypsilophodon*, *Iguanodon*, *Iticosauros*, *Neovenator*, *Oplosaurus*, *Ornithodesmus*, *Ornithopsis*, *Pelorosaurus*, *Pleurocoelus*, *Polacanthus*, *Thecocoeurus*, *Valdosaurus* and *Yaverlandia* (Martill and Naish, 2001). As can be seen, there was a wide range of dinosaur species present on the Isle of Wight during the Wealden. The Wealden facies were laid down at a time when there is evidence for the Cornubian Island draining to the east. Some of the species were large animals and were likely to have wide ranges.

The species that are present include both carnivores and herbivores. The carnivores varied in size from the Compsognathid *Aristosuchus* to the Allosaurid *Neovenator*. The species range from the carnivorous *Neovenator* and *Eotyrannus*, to the Pischivorous *Baryonyx*. Large species such as the Allosaurid *Neovenator* were possible pack hunters.

Amongst the herbivorous species the dinosaurs show a number of different species again. These vary from the Ankylosaurid *Polacanthus* which was probably a low browser to the Iguanodontid *Iguanodon* which was possibly a herding animal that would probably have had an extensive range.

The herbivorous species have included the armoured dinosaurs such as *Polacanthus* and possibly a *Stegosaurid* as well as a Pachycephalosaur *Yaverlandia*. Sauropods were another major component of the animals found in the area. It is conceivable that these animals had a wide range much like that of modern large herbivores on the African Savannah.

## THE “CORNUBIAN DINOSAUR PROJECT” – THE MATERIALS

The “Cornubian dinosaur project” has two incarnations. The first is as a set of materials and resources that will allow the partner primary schools to use dinosaurs and other fossil species to deliver aspects of Key Stages 1 and 2 of the National Curriculum for England and Wales. The second is the running of a project over a period of one week for the “Curriculum Enrichment Week” at saltash.net community school. This will allow the use of dinosaurs in the delivery of some aspects of the Key Stage 3 National Curriculum for England and Wales.

The version of the “Cornubian dinosaur project” for the partner primary schools consists of a visit by the director of “The Earth Science Centre” at saltash.net community school involving an illustrated talk about the importance of the study of extinct organisms and the opportunity to study under supervised conditions large replicas of fossils. Aspects of the study of geology will also be introduced. An opportunity is also given to students in either year 10 or year 11 to join the director of the Earth Science Centre on these visits. This gives a valuable input for these students in terms of the opportunity to gain work experience and the opportunity to work with younger students. The materials that will be supplied to the

Name of SSSI	Geological Period			
	Triassic	Lower Jurassic	Middle Jurassic	Upper Jurassic
High Peak (Sidmouth), Devon	✓			
Otterton Point (Budleigh Salterton), Devon	✓			
Aust Cliff, Avon	✓			
Slickstones (Cromhall) Quarry, Avon	✓			
Durdham Down, Avon	✓			
Emborough Quarry, Somerset	✓			
Tytherington Quarry, Avon	✓			
Lyme Regis, (Pinhay Bay – Charmouth)		✓		
Furzy Cliff, Overcombe, Dorset				✓
Smallmouth Sands, Weymouth, Dorset				✓
Kimmeridge Bay, (Gaulter Gap – Broad Bench), Dorset				✓
Encombe Bay, (Swyre Head – Chapman’s Pool), Dorset				✓
Isle of Portland, Dorset				✓
Durlston Bay, Dorset				✓
Brook – Atherfield, Isle of Wight				✓
Yaverland, Sandown, Isle of Wight				✓

**Table 4.** The fossil reptile SSSI is as identified in Benton and Spencer (1995).

Code	Fossil Description
TRR1.0	<i>Thecodontosaurus antiquus</i> jaw
TRR4.0	<i>Plateosaurus</i> ulna
JR2.0	<i>Megalosaurus bucklandi</i> tooth
JR4.02	<i>Liopleurodon</i> tooth
JR6.0	Ichthyosaur skull
JR8.0	<i>Megalosaurus bucklandi</i> claw
JR9.0	<i>Megalosaurus bucklandi</i> metatarsal
CRR1.0	<i>Iguanodon</i> tooth
CRR3.0	<i>Iguanodon</i> tooth
CRR4.0	<i>Iguanodon</i> claw small
CRR5.0	<i>Iguanodon</i> claw large
CRR6.0	<i>Iguanodon</i> metatarsal
CRR11.0	<i>Polacanthus foxii</i> dermal ossicle
CRR12.0	<i>Polacanthus foxii</i> dermal armour
CRR13.0	<i>Cetiosaurus</i> claw
CRR14.0	<i>Calamospondylus</i> tibia
CRR15.0	<i>Yaverlandia bitholus</i> skullcap
CRR16.0	Pterosaur tooth
CRR22.0	<i>Baryonyx walkeri</i> claw
CRR25.1	<i>Iguanodon</i> thumb spike
TRF2.2	Fish coprolite, whole surface full of fish scales
TRF2.3	Coprolite, showing curvature and break
TRF27.0	Dinosaur footprint

**Table 5.** The contents of the “Cornubian Dinosaur Project” box. Emphasis has been given to “British” biota.

junior schools consist of a set of fossil replicas together with a set of worksheets. A number of “characters” have also been created to allow the delivery of lessons using a number of different techniques including the use of puppets. These cartoon characters have been created by one of saltash.net community schools year 11 students and were included in aspects of her GCSE coursework, again showing the “cross-curricular” nature of the project.

At Key Stage 3 a different approach has been adopted. The “Cornubian dinosaur project” at this Key Stage is run during the “Curriculum Enrichment Week” at saltash.net community school. The project is run in partnership with the Department of Geological Sciences at the University of Plymouth and Geoed Limited of Lostwithiel. Over the course of the week the project includes making fossil replicas, a field visit to the Lyme Regis-Charmouth area, working in the sedimentology laboratories at the University of Plymouth and researching using both primary and secondary sources. A key component of the project at this level has been the provision of a booklet so that the students taking part in this project have a document that allows them to summarise the learning experience and that is clearly mapped across to the relevant sections of the National Curriculum for England and Wales. Fossil replicas utilised in the project box are listed in Table 5.

## SUMMARY

In summary this project has allowed the Earth Science Centre at saltash.net community school to put Earth Science at the forefront of the learning experience for students not only at saltash.net community school but also for the partner primary schools within the Caradon Network Learning Community. By researching the palaeogeography of the Mesozoic period it has been possible to place the “Cornubian dinosaur project” into the curriculum and foster a greater understanding of Mesozoic vertebrate life.

The project also has allowed those students who are not “turned-on” by the school curriculum to access aspects of it that

do not normally appeal. It has also allowed students at Key Stage 4 and 5 to take part in voluntary work experience which allows them to work with younger students and finally the project is an effective way of ensuring that links between the primary, secondary and tertiary education sectors are strengthened.

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