Exploratory Laboratory Handbook
Exploratory Laboratory

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Exploratory Laboratory is a BIG PICTURE project

Big Picture is a collaboration between Artsreach, Bridport Arts Centre, Dorset Visual Arts, PVA MediaLab, Sherborne House Arts, Sherborne School and Walford Mill Crafts working with Dorset County Council, Dorset Design and Heritage Forum and the Jurassic Coast Arts Programme.

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INTRODUCTION

Exploratory Laboratory is investigating the earth science and coastal processes revealed along the Jurassic Coast through the imaginative insight of visual artists. At the heart of the project is collaboration between earth scientists and artists to explore the unique geology and history of the coast and arrive at new ways of seeing and understanding it. The Jurassic Coast World Heritage Site, a 95 mile section of stunning Dorset and East Devon coastline, has been described as a linear laboratory for the earth sciences. The rocks, beautifully exposed and accessible along its length, sequentially record 185 million years of the Earth's history and display a superb range of active coastal processes. Exploratory Laboratory includes an exhibition, an arts/earth sciences symposium, commissions and a learning programme. The project is presented by Big Picture and runs over 30 months from 2010 to 2012.
The Jurassic Coast was inscribed as a World Heritage Site in 2001 based on its unique exposure of rocks that record 185 million years of the Earth’s history in an almost continuous sequence through the Mesozoic era, mapping mass extinction events, past climates, and the era of the rise and fall of the dinosaurs. This geological spectacle underpins a coastline rich in fascinating landforms, diverse wildlife and stunning scenery.
The connection between art, science and our understanding of landscape is not a new phenomenon. Writing about the British landscape painters of the early nineteenth century, John Gage argues that much of what was fresh and original in their work was due to their understanding and adoption of contemporary scientific methods. Engaging in a dialogue that has ebbed and flowed for millennia, artists in the nineteenth century replaced an allegorical portrayal of nature with a much more empirical perspective; one that more accurately reflected the increasingly technologised and scientific world around them.

The earth sciences were one of the many new scientific fields that were developing at this time. The father of modern geology, James Hutton, had only published his findings on a possible age for the Earth in 1788. His grandly titled paper, Theory of the Earth, had concluded; “The result, therefore, of our present enquiry is that we find no vestige of a beginning, no prospect of an end.”

Hutton’s oft repeated quote wasn’t describing a belief that the Earth was eternal, but was suggesting that the Earth’s age was so huge as to be incalculable. Through this paper and subsequent writings, Hutton was the first to suggest that the Earth was far older than anyone had ever considered. In fact, most of Hutton’s contemporaries, including his fellow scientists, believed that the world was under 6,000 years old, having formed on the 23 October, 4004 B.C.

Hutton had formulated his theory from time spent closely observing his surroundings. He noted the slow formation of soil by the erosion of the underlying rocks and the decaying of organic matter, the deposition of these eroded materials into rivers and seas; and the accretion of layer upon layer of sediment. He studied the cliffs on the British coast, noting the thousands of layers of sediment and the transformations they had undergone, added each process up, and deduced that these formations had taken far longer than 6,000 years to form.

In a climate such as this, when age-old beliefs were being challenged through such careful observation, it is hardly surprising that artists were also challenging the way they approached landscape. After all, the meaning of the landscape around them was changing with every scientific discovery; how could their artwork not be changed as well? As artists moved away from a traditional, classical composition, they instead choose to paint from real life and to depict new subjects, informed by these new scientific fields.

In the same spirit, Exploratory Laboratory highlights some of the new techniques and technologies being used by earth scientists to map and monitor the Jurassic Coast and explores how artists now are also working with science and scientists, interpreting and visualising data, presenting research and adopting new technologies to create new work.

This exhibition is an introduction to some correlations and shared practices between art, artists and the earth scientists who study the Jurassic Coast. From artists and scientists who use the same technology, to those who present and visualise data, there is much more common ground than might originally be expected. As technology and science become ever more present in our lives, and as our relationship to, and understanding of, landscape changes, so our artworks reflect the concerns and hopes of the day. In a landscape that has been described as a linear laboratory for the earth sciences, and which retains a rich seam of imagination and inspiration, the Jurassic Coast presents a unique opportunity for artists and scientists to attempt a mutual creation of meaning at a time of unparalleled change.
Michael Eden is an artist who has happily embraced new technologies. A successful ceramicist, several years ago he began to investigate the new processes that are revolutionising the ceramics industry. Now using rapid additive layering, rather than a potter’s wheel, Eden sees new technologies as tools, and that using a laser simply requires a new set of skills. He has said, “my view is that the tools are only a way of realising a concept... Ideas come first, the tools and techniques are then chosen as appropriate.”

Today, the tools at our disposal are far greater than what was available to Hutton and the early geologists. Our analysis of landscape can now range from the micro to the macro; from the very atoms and molecules that form the landscape to the depths of space. Where Hutton largely relied on observing what was apparent to the naked eye, today we’re aware of a world of indefinite size, both above and below us; opening up new horizons for research and understanding.

A large part of the practice of palaeontology today is indeed the study of micro and nanofossils. The Kimmeridge Clay deposits on the Jurassic Coast contain vast numbers of nanofossils, and the chalk is made almost entirely from the microscopic skeletons of plankton. These tiny organisms now form the huge cliffs along the Jurassic Coast, and provide vital information on our changing climate, yet individually, like the details of Sarah O’Hana’s brooch exhibited in Ex Lab, they remain virtually invisible to the naked eye.

O’Hana is a jeweller who has been working at a molecular level; using nanotechnology to pattern works in the minutest detail. A nanometre is one billionth of a metre, which is the length of ten hydrogen atoms, or about one hundred thousandth of the width of a hair. Knowing that the detail of the brooch shown in Ex Lab continues to this level, far beyond what we can see even with the help of O’Hana’s accompanying magnifying pendant, is a dizzying thought.

At the other end of the spectrum, geologists at Bournemouth University have been using a Differential Global Positioning System (dGPS) for precision landform mapping and monitoring the velocity of small landslides. To record the speed of the moving landscape, wooden stakes are driven into the ground and their location recorded with dGPS to an accuracy of approximately 15mm. Several months later their location is measured again, the rates of movement calculated and maps plotting the shifting earth created.

On a similar scale, Aaron Koblin’s Flight Patterns takes data from the Federal Aviation Administration and translates it into an accurate animation, plotting the much faster movement of planes across America. Both of these visualisations bring an unnoticed, or unperceivable, movement to life; making something beyond our usual perceptions big enough, or small enough, for us to experience.

Where Hutton chose not to quantify the age of the Earth, today’s geologists must deal with time in billions of years. The current Geological Time Scale begins with the formation of the oldest rocks and the Earth itself 4.6 billion years ago, progressing through periods of millions of years up to the current day. The Jurassic Coast itself covers 185 million years of the Time Scale; beginning with Orcombe Point, made from sand dunes 250 million years ago, and continuing to the relatively young chalk of Old Harry Rocks, formed 65 million years ago.

These astronomical figures are so far away from our own experience of time that it is difficult to properly comprehend them, we may as well return to Hutton’s notion of incalculable time. There is no technology available to help us visualise geological time and we are still left, as Hutton was, with an expanse of time that has no ‘moments’ to anchor ourselves in.

It is this lack of actuality that Ilana Halperin’s work deals with, linking geological events and processes to a more human scale. With Halperin’s work, time seems elastic. She has made artworks exploring some of geology’s more remarkable artefacts; footprints made in an instant in the mud and preserved for hundreds of millions of years as trace fossils, or accretionary lapilli, volcanic hailstones formed around drops of moisture that fell during an eruption. These momentary events, frozen forever, create a feeling of time expanding and contracting, propelling us through millions of years to experience a split second.

Recently, Halperin has harnessed geological processes in fast-forward to create her own artworks; richly detailed reliefs that are never cut or chiselled, but are formed in moulds left in mineral-rich caves for up to a year. A resin cast from these moulds simulating a ‘new’ rock created through this process is shown in the exhibition. Also included in Ex Lab is an example of the tools for Halperin’s next work, a branding iron to mould molten lava. These tools should create new stones even faster than the calcifying caves. All Halperin needs is a suitably erupting volcano, and of course, that could happen tomorrow, or in twenty years time. Katy Woods’ film Sailing Dinghy Hawk... is also about waiting and watching, showing the coast from the lookout posts of the National Coastwatch Institution (NCI). The film has a heightened sense of time, as the NCI patiently observe the sea, noting down every occurrence within their individual stretches of water. The background noise of the radio transmitting the conversations of the coastguard makes us aware that even on a sunny day the sea is a dangerous place where the weather can turn, or equipment can fail, with serious consequences. But momentous or inconsequential all events are recorded by the relentless gaze of the NCI. Like rock seams containing trace fossils, the records of the NCI preserve these transitory events, marking the passage of a human time on their coastal lookout.
One of the people who helped uncover the geological importance of the Jurassic Coast was Lyme Regis resident Mary Anning. Anning lived from 1799 to 1847 and although she was described as the greatest fossilist the world had ever known, her contributions to early palaeontology were not as widely acknowledged as they could have been. As a working class woman who sold her fossils to earn a living, the museum records never mention her, only recording the wealthy gentlemen geologists who later donated her specimens.

Nonetheless, she was regularly visited and consulted by eminent geologists of the time and one, Henry de la Beche, tried to help her financial situation by producing and selling lithographs of his watercolour Duria Antiquior (A More Ancient Dorset) for her benefit. Duria Antiquior depicted many of the animals discovered and excavated by Anning. It was the first image to portray a fossil environment in its entirety, showing interactions between the various animals and plant life that had been discovered by Anning. The image proved influential in its time and was widely reproduced, spawning other drawings that were in turn reproduced in scientific and popular literature. The scene Duria Antiquior portrays is quite graphic, as sea monster takes on sea monster, and fish eats fish. Instantly memorable, it's hard not to walk along the Jurassic Coast without imagining Beche's ancient Dorset scene.

This interrelation between ourselves and nature, and the visualisation of scientific discovery is evident in the work of both Mat Chivers and Charlie Hooker. Although Chivers' sculpture is based on photographs taken of his exhalation, he chose to mediate those images through his drawing and final sculpture. It's this mediation that interests Chivers as he focuses on "the location between data capture and its consequent interpretation." Chivers feels that, "it is at this boundary that ambiguity often resides, potentially conflating notions of fact and fiction." Outbreath (Facts & Fictions) is therefore a physical object that influences our experience; having seen Chivers' version of the shape and size of an exhalation, we too imagine the swirls and volume of air as we breathe out.

Similarly, in Night Sky, Charlie Hooker has imposed a musical system on the movement of the stars. Correlating the star's height with pitch, and the star's size with the volume of the note, Hooker has literally created his own 'music of the spheres'. Translating the movement of the stars into music makes reference to ancient concepts about the correlation between celestial, geometrical and musical harmonies. These concepts are no longer part of the canon of scientific research, but remain influential in many ways in modern life, as a persistent ideal. Each of these works then gives the artists' particular translations of nature, and each exerts, or is in part a response to, an imaginative influence. Just as Duria Antiquior must have inspired many young people to become geologists or palaeontologists and seek out the world they saw depicted in the painting, the relationship between imagination and knowledge does not flow in only one direction.
While many visitors to the Jurassic Coast are imaging an ancient Dorset, some of the landscape has also been shaped by a much more recent history. Studland beach was the training ground for the D-Day invasion, and many of the military bunkers or ‘pill boxes’ remain along the coast today. The ninety-foot concrete bunker, Fort Henry, that still overlooks the beach at Studland is now protected by the National Trust.

As much as the Jurassic Coast has been sculpted by geological processes, it is now also a man-made environment. As Neal White has described: “Far from simply being a neutral and uncontested space of outstanding natural beauty, the coast of the UK is also a major resource and open laboratory in terms of technological and scientific experimentation, as well as military testing.”

White’s work, as the founder and coordinator of the Office of Experiments, explores the often overlooked areas and histories of the Jurassic Coast, specifically the sites of intelligence communications and military testing. At the heart of White’s work for Ex Lab is an archive of material put together by Mike Kenner, who used the Freedom of Information Act to discover secret trials conducted by the Ministry of Defence. Between 1963 and 1975 the Ministry of Defence used Lyme Bay as an open air testing ground, releasing clouds of live bacteria at sea and then measuring the spread of bacteria inland.

As our beliefs, discoveries and fears about landscape have changed, so art has changed, reflecting the concerns and ideas of the day. The artists and scientists of the early nineteenth century were united in their approach to their landscape, rejecting classical assumptions that had persisted in painting as in science, seeking instead to take their experience of the world as a true source of knowledge. Many of today’s artists and scientists are united in raising concerns about climate change and use research and work as a way to communicate the lasting effects of man’s approach to nature as an exploitable resource.

Alex Hartley’s work Nymark (Undiscovered Island) documents the discovery of a ‘new’ island in the High Arctic, one only recently revealed by the melting ice. The work documents the process of recording and surveying the island and having it officially recognised by the relevant authorities. As he participates in a strangely arcane process, Hartley’s language in the blog documenting the discovery recalls the diaries of earlier explorers, and wryly highlights the inherent difficulties of claiming a land.

“Upon our return to the mainland our new island will be charted and I will submit it for inclusion in all subsequent maps. The land will be named and registered. The name has not yet been finalised, but I feel the most obvious Alex Hartley Land may cause some ill feelings amongst my fellow crew members. Nothing has yet been ruled out; annexation, independence, tax haven, wildlife sanctuary, short let holiday homes or time shares. Postcards will be printed and a major architectural competition will be launched. Engineers will be consulted as to how best to keep all the mud together and prevent any shrinkage of our island.”

Hartley’s humorous text and photographic installation portrays the human need to map and name a piece of land in order to possess it, and reveals the futility of these very human activities in the context of a planet in crisis.
The range of the artworks in Exploratory Laboratory, and the diversity of our responses to landscape, through our culture and science, indicates the complexity of our relationship with the landscape. On close inspection nothing is straightforward. Just as one of the greatest challenges of the Jurassic Coast is the speed of erosion, so that erosion has been the means of revealing the fossils that have made the coast an invaluable geological resource.
Mat Chivers

Mat Chivers uses technology to help make the invisible visible. His work often explores events and processes that are fundamental to our existence, but which cannot be seen by the naked eye.

Outbreath (facts & fictions) is a representation of Chivers’ own exhalation. Research scientists at Bristol University took thousands of high-speed photographs of Chivers’ breath, made visible by a tablet of carbon dioxide in Chivers’ mouth producing a cloud of vapour as he exhaled.

Chivers then worked from the photographs, using drawing as a form of mediation on where the breath started and stopped, a process that required him to make decisions and interpret the data as he saw fit.

Chivers sees his work as an exercise that parallels our difficulties in perceiving the complexities of the world by attempting to fix processes that are in constant motion. “It is”, he says, “like trying to draw a cloud”.

Mat Chivers lives on the outskirts of Dartmoor National Park and is involved in an ongoing collaborative research programme with research scientists at the University of Bristol. He recently exhibited in On Form, an exhibition devoted to sculpture in stone, held biennially at Asthall Manor, Burford.

Michael Eden

An established ceramicist of over 20 years, Michael Eden’s work has shifted recently to encompass new technologies like Additive Layer Manufacturing (also known as Rapid Prototyping or 3D printing) a technology which allows the production of 3 dimensional objects from digital designs.

His Wedgwoodn’t Tureen is based on the design of early Wedgwood tureens, and is in part an homage to the industrialization of the manufacture of pottery, but is also a celebration of the new forms made possible through the technologisation of production. Eden has said, “there are only certain forms that I can throw on a wheel; gravity, centrifugal force and the material qualities of clay limit the possibilities. The Wedgwoodn’t Tureen demonstrates the removal of these constraints and the potential I now have to create previously impossible forms.”

Michael Eden’s work is included in several public collections in the UK including the Crafts Council, the Stoke-on-Trent Museum and the Fitzwilliam Museum, Cambridge. In 2008 he was the recipient of the Ceramic Futures Award, RSA Design Directions and articles on the Wedgwoodn’t Tureen have featured in Crafts, Dezeen design magazine and Blueprint.

Alex Hartley

Alex Hartley's photographic installation Nymark (Undiscovered Island), made up of notes and collaborative ideas, takes the form of the island he discovered in the High Arctic whilst on an expedition with Cape Farewell – an organisation that brings together artists, scientists and educators to instigate a cultural response to climate change.

As the first humans to set foot on the island – only revealed in the last five years by a retreating glacier – Hartley and the crew conducted a survey, recording the island’s location and features. On returning to the mainland the crew submitted their findings and the island was recognised by the Norwegian Polar Institute, which now includes the island on all its charts and maps.

Hartley is currently developing this work for nowhereisland, the Artists Taking The Lead 2012 Cultural Olympiad project for the South West of England. He will be touring a scaled version of the island along the ports and harbours of the South Coast. Hartley is represented by Victoria Miro and has exhibited at the Fruitmarket Gallery, Edinburgh and the Natural History Museum London.

Ilana Halperin

As an artist, Ilana Halperin is concerned with the relationship between mankind and geology, asking “What is the duration of daily life, the life span of an island, a volcano, your own time floating on tectonic plates? What does a time span of 300,000,000 years actually mean?”

Recent work has seen Halperin visit a landmass to celebrate their joint birthdays, use a calcification cave to create a sculpture from the same process and material that makes stalactites, and correspond with geologists on the connections between the production of mountains and the stones produced by the human body.

Halperin’s drawing, Physical Geology, takes the form of a geological section, but maps her conversations with earth scientists and her own personal journeys of discovery. A mould cast and brand illustrate the methods Halperin has used to capture and shape the limestone of caves and the molten lava from volcanoes, using geological processes to produce artworks.

Ilana Halperin was born in New York, but has lived and worked in Glasgow since 2000. Halperin is represented by doggerfisher and has shown internationally including recent group shows at Compton Verney, Talbot Rice Gallery, Edinburgh; Estratos, Murcia curated by Nicolas Bourriaud and the Sharjah Biennial.
A professor at the University of Brighton, Charlie Hooker has consistently produced work that traverses recognised categories within the arts, making work that communicates scientific data through unique sound systems.

The Night Sky series takes images of the stars and translates them into musical notation. This notation is then processed through audio software into musical notes, the pitch varying with the height of the star and the volume varying according to the size. As the notation is scanned, the sounds become increasingly chaotic as more and more stars appear in the night sky. Night Sky expresses our inability to process and comprehend the magnitude of the universe. By transforming one sense into another, Hooker awakes a wonder for what we often take for granted.

Hooker has exhibited in a range of spaces and exhibitions, from contemporary art venues like the Barbican and Bloomberg SPACE, London to the Bjerknes Centre for Climate Research, Bergen. His work is included in the Science Museum’s permanent collection and his public sculpture Twins is in Churchill Square, Brighton.

Aaron Koblin is an artist specialising in data visualisation, his work straddles the worlds of technology and art and is as likely to be found on the internet as in a museum. His work in Exploratory Laboratory, Flight Patterns, is part of the permanent collection of the Museum of Modern Art in New York, and Koblin is also the Technology Lead of Google’s Creative Lab.

Flight Patterns is a data visualisation project that precisely traces the paths of thousands of aircraft as they move through American airspace during the course of a single day. Using data from the Federal Aviation Administration, Koblin creates a portrait of American life. He shows the country waking up, moving around and going to sleep, as Koblin describes; “You can see the ebb and flow as plane routes erupt on the East Coast in the morning, flow over to the West Coast and eventually to Hawaii.”

Aaron Koblin has exhibited at the V&A London and has been included in international festivals such as Ars Electronica and the Japan Media Arts Festival. Other work includes visualisations for the New York Talk Exchange and Bicycle Built for Two Thousand with Daniel Massey, an online project which records voices across the globe singing together.

Sarah O’Hana is a jeweller who holds a PhD from The University of Manchester School of Mechanical, Aerospace and Civil Engineering, where she studied the creative use of laser processing and its application to contemporary jewellery.

The work shown in Exploratory Laboratory is a brooch and accompanying magnifying pendant. Produced in collaboration with material scientist Lesley Turner, who usually works with the bio-medical applications of nanoscience, the brooch is patterned to a microscopic level. O’Hana says, “To see the full detail you would have to look with a microscope, but the magnifying pendant is a nod to looking beyond just the surface of things.”

O’Hana is a lecturer at the University of Lincoln, and has exhibited throughout the world, including Form, Perth; Manchester Art Gallery, Manchester; Museo Fortuny, Venice and Hove Museum and Art Gallery, Brighton.

Over the last few years, Neal White has been engaged as artist in residence at the Utah-based organisation, The Center for Land Use Interpretation. The Center explores human interaction with the earth’s surface, by investigating the manmade landscape as a cultural inscription, something that they believe “can be read to better understand who we are, and what we are doing”.

Experimental Proving Grounds of Coast and Sea, is a micro exhibition that draws on the Office of Experiments archive of research conducted by individuals into secret and intelligence spaces in the UK. Focussing here on the locations across the Jurassic Coast, the exhibition includes some of the extensive material gathered by Mike Kenner on the work of Porton Down research facility which conducted biological warfare experiments across Lyme Bay in the 1960s and 1970s. By revealing the often overlooked sites of military testing and intelligence gathering Experimental Proving Grounds… turns the technology and the gaze back on its developers, and reflects on these open secrets situated within our landscape.

Neal White is the founder and coordinator of the Office of Experiments which was established in 2004 to create a structure for artists, activists, thinkers and researchers to work together in ways that standard and established institutions find challenging. The Office of Experiments has worked with organisations such as The John Latham Estate, The Arts Catalyst, The John Hansard Gallery, Chelsea College of Art (Critical Practice) and Bournemouth University (IPE).
KATY WOODS

The National Coastwatch Institution (NCI) is an entirely voluntary organisation that was set up in 1994 to provide a person at coastal lookouts, rather than relying purely on maritime technology. The NCI volunteers constantly observe the sea and listen to the radio, noting down every event, every passing ship or canoe that occurs in their stretch of coast.

Katy Woods’ film, Sailing Dinghy Hawk 20 Passing Lookout on Passage from Gull Rock Towards Falmouth, Gull Rock is Starting to Disappear in the Mist uses footage from active and empty coastal lookouts positioned along the Cornish coastline. Time seems to function in a different way here. The film captures the sense of endless watching and waiting and a heightened awareness of time passing. As chroniclers of every event that passes them by, the NCI in Sailing Dinghy Hawk… stand in contrast to the condensed, epic timescale of the Jurassic Coast. Every minute and every event, momentous or transitory, are noted and stored by the NCI. Like the seams in the cliffs, this too is a record of time and life, but one on a much more human scale.

Woods lives and works in Birmingham. Recent projects have included a solo show at S1 Artspace, Sheffield and group exhibitions at Leeds Met Gallery, Leeds; Oriel Davies Gallery, Newport; Bury St. Edmunds Art Gallery and Northern Gallery for Contemporary Art, Sunderland. Woods’ film Sailing Dinghy Hawk… was originally commissioned by ART SHEFFIELD 08: Yes, No & Other Options.

THE JURASSIC COAST A LINEAR LABORATORY

The cliffs between Exmouth in East Devon and Studland in Dorset are made of rocks that formed between 250 million and 65 million years ago. During that time, as the land masses moved, the environment shifted from desert to marine, followed by forests and swamps and finally a warm tropical sea. These changing conditions gave rise to many different kinds of rock which in turn have given us a remarkably varied coastline. The cliffs, landscape, wildlife and even towns and villages are influenced by the changing geology, creating a coast where every part is different from the rest.
The importance of the Dorset and East Devon Coast to the earth sciences is demonstrated by its critical contributions to many of the major, formative debates in the early days of geology and geomorphology. The fossil wealth of Lyme Regis was first pointed out in 1673 by John Ray. In 1770 the fame of the area drew a visit to Weymouth from James Hutton (1726-1797) of Edinburgh, often cited as ‘the father of modern geology’.

The Site rose to pre-eminence during the early part of the nineteenth century. At this critical period, the discoveries made by the Anning family, who ran a fossil hunting and selling business at Lyme Regis, advanced science in a way without parallel in Europe (Tickell, 1995; Torrens, 1995). They found the first ichthyosaur to come to scientific attention in around 1811-12; the world’s first complete plesiosaur followed in 1823, the first British pterodactyl in 1828, and other equally important finds in invertebrate palaeontology, coprology and taphonomy.

Their activities stimulated the activities of many now famous collectors, including the three Philpot sisters, William Willoughby Cole, third Earl of Eniskillen (1807-1886), Sir Philip Egerton (1806-1881), Lt. Col. Thomas James Birch (1768-1829), and Thomas Hawkins (1810-1889), a maniacal collector of giant fossil reptiles. Their collections of fossils from the Site, and those of later collectors such as Sir A.S. Woodward (1864-1944) and James Frederick Jackson (1894-1966) now form the basis of major museum collections including those at the Natural History Museum, London, the Sedgwick Museum in Cambridge, the Bristol City Museum and the National Museum of Wales, Cardiff. A second specimen of plesiosaur discovered by Mary Anning (1799-1847) is now displayed in the Musée Nationale d’Histoire Naturelle in Paris. This and other material from Dorset was used by the great French vertebrate palaeontologist Georges Cuvier (1769-1832) in his epoch-making Récherches sur les Ossements Fossiles (1821-1824).

Although the fossil-bearing strata of Lyme Regis were the early hub of scientific inquiry within the Site, other features were prominent in these early debates. One of the main controversies of the time was between the catastrophists, who believed in the reality of occasional violent events in the geological past, and uniformitarians, who claimed that geological processes had never been more intense than those observed at the present day. The topography of the Dorset and East Devon coast was used by Buckland and de la Beche to argue that the valleys must have been excavated by a violent flood in the geologically recent past, while others thought that only the slow action of rivers had been involved.
The important vertebrate faunas of Purbeck were another early discovery. Samuel Beckles, encouraged by Sir Richard Owen, searched for mammal remains from the cliffs of Durlston Bay with such success that he collected many unique species later described by Owen (1866). The same of the coast as a source of fine fossil material was also helped by the activities of the then world’s largest natural history agency, built up by the Weymouth hosier and glover Robert Damon (1814-1889) and his son Robert Ferris Damon (1845-1929). Between the 1840s and 1914 they supplied museums throughout North and South America, Australia and Europe with much Dorset geological material.

Other specialised advances in geology and geomorphology drew on the Site. Osmond Fisher (1817-1914), born at Osmington, was inspired by his observations on the Purbeck coast to write the first ever textbook on theoretical geophysics The Physics of the Earth’s Crust (1881 and 1889). He was the first to conclude that the crust beneath the oceans must be younger than that beneath the continents, anticipating ideas which became the basis of modern plate tectonics (Wilding, 1988). The German palaeontologist Albert Oppel (1831-1865) used the ammonite succession of the Dorset coast within his pioneering studies of biostratigraphic zonation (Hallam, 1989), and a number of significant contributions to ammonite zonation have been made through studies of the Jurassic and Cretaceous faunas from the Site. Stratigraphic investigations at Burton Bradstock and West Bay by Sydney Savory Buckman (1860-1929), helped lead him to the first proper demonstration of diachronity in rocks of the same lithology. E. St. J. Burton’s studies of the Purbeck Coast led him to the idea of substituting space for time in explanations of landscape evolution – a forerunner of the so-called ‘ergodic hypothesis’ of geomorphology.

Since the earliest days of study the Site has provided inspiration for new generations of earth scientists. The work of Joscelyn Arkell (1904-1958) is particularly notable. His magnum opus, Jurassic Geology of the World (1956) was the first example of a world-wide study of a system of rocks by a single person. Arkell began his work with a description of the Jurassic rocks of Dorset and East Devon, which he then took as the standard of reference. The earliest geological mapping of the coast dates from the 1820s. The area has been thoroughly re-mapped since 1995 by the British Geological Survey. A full series of modern maps at 1:50,000 scale was published during 2000 and 2001, and more detailed mapping at 1:10,000 is also publicly available from the Survey. There is also an exceptional subsurface database as a result of onshore and offshore oil exploration since the 1930s (Uterhill, 1998). This level of information, together with the quality and accessibility of the exposures, provides a rich and inspirational resource.

The Jurassic Coast Team coordinates many different projects along this stretch of coastline linking understanding of science and heritage. The team also monitors the geology and geomorphology of the Jurassic Coast, investigating landslides and how coastal and climatic changes are affecting this stretch of coastline. One of the current projects being undertaken along the Jurassic Coast is the Coastal Change Pathfinder project. This project looks at ways of helping communities along this stretch of coastline adapt to coastal and climate change that will affect their area in the future. This project is especially relevant to coastal areas where it will no longer be viable to maintain or erect coastal defences.

The Dorset and East Devon Coast is one of the best documented geological sites in the World. From the earliest days of geology to the present day the coast has generated an enormous volume of high quality scientific study. The coast is visited by hundreds of geologists and geomorphologists each year including international groups, oil company geologists, student field trips and amateur groups. The Upper Jurassic sections are probably the most frequently visited geological sections in Europe, both by geological parties and by professional geologists, mostly from Britain, Europe and North America. Most geological undergraduate courses in the UK include field visits to this coastline. There are notable geological collections in the local museums in East Devon and Dorset, which also provide various displays and advice to the public. The East Devon and Dorset Coast has a particular importance as a training ground for petroleum geologists, attracting international attention. The rock succession presents a complete section through an oil basin allowing source, reservoir and cap rocks, and its structural geology, to be studied at outcrop. The Kimmeridge Clay provides one of the World’s best examples of an immature hydrocarbon source rock, and is of particular importance as the main oil source rock within the North Sea. Data from the nearby Wytch Farm oilfield, Europe’s largest onshore field, together with the results of other oil exploration data, add to the importance of the area for the study of petroleum geology. The Site has provided material for numerous post-graduate and post-doctoral research.

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Geoinformatics is the science of capturing data about the world around us and processing and analysing it to reveal important information for society. In the case of the Jurassic Coast surveying technologies based on lasers, GPS and radar are being used by Bournemouth University to capture data regarding the shape of hills and cliffs over time so as to quantify which parts of the coast are eroding or land-sliding, by how much and why.

**Airborne Laser Scanning (ALS)** is used to produce a very detailed topographic map (i.e. relief) of the landscape. A laser is mounted aboard a small aircraft (usually a twin-engine turboprop) such that it can see through an aperture in the underside of the fuselage. A laser pulse is fired and the instrument waits for a reflected pulse to be returned. The time delay divided by the speed of light gives us the distance (or range) from the aircraft to the ground. If we also know the exact location of the aircraft at that instant we can calculate the elevation of the ground below very precisely. The laser fires many pulses every second and sweeps (scans) from side to side. Thus in a few minutes it is possible to produce a very accurate (centimetre precision) 3D topographic map.

If more than one such map is created at different times (e.g. different years) they are good enough to reveal both large and small changes in the landscape. Bournemouth University is currently using just such a technique to monitor the volume of material moved by landslides along the Jurassic Coast, especially at Black Ven and Stonebarrow Hill.

**Terrestrial Laser Scanning (TLS)** is a similar instrument, but fixed on a static tripod. This allows the laser to scan up-down and left-right to produce a 3D model of the environment surrounding it. TLS has a greater precision (down to millimetres) than its airborne cousin, but covers a much smaller area (a few hundred metres rather than many kilometres). TLS can also be used to produce a very detailed topographic map or maps of the landscape. Bournemouth University is currently investigating the power in combining both ALS and TLS to gain the ‘best of both worlds’ for the study of coastal change and archaeology.

**Differential Global Positioning System (dGPS)** is a much more precise and accurate relative of a hand-held or in-car ‘sat nav’. In this case it has been used by Bournemouth for precision mapping of the Jurassic Coast’s natural heritage, such as the Ammonite Pavement near Lyme Regis, and for monitoring the velocity of small landslides. In the case of the latter wooden stakes are driven into the ground and their location recorded with dGPS to an accuracy of approximately 15mm. Several months later their location is measured again and back in the office we can calculate the rates of movement and produce maps of landslide velocity.

**Interferometric Synthetic Aperture Radar (InSAR)** is a satellite-based technique which also monitors the movement of the landscape, but over a much larger scale (many kilometres) than dGPS. For this reason Bournemouth University uses such technology to monitor the acceleration/deceleration of large landslides and glaciers. A radar satellite does not see the Earth in the same way as a conventional satellite does (as you might be used to with Google Earth). Instead of relying on sunlight, a microwave pulse is sent out by the satellite, which scatters off the many and varied objects on the ground. When the signal returns to the satellite a greyscale image is formed, resembling a very abstract, grainy and distorted black and white photograph. Radar images can be captured even in darkness or cloudy weather. In many respects a radar satellite ‘sees’ the Earth in a way more akin to echo sounding used by bats or dolphins. The technology is so good that millimetre to centimetre movements of the Earth’s surface can be spotted over days or years, from many hundreds of kilometres above us in orbit, as the satellite travels at many times the speed of a rifle bullet.
Coastal change describes the effects of the ongoing natural processes that shape the Jurassic Coast. These processes include the impact of wave action and weather on the coast which causes sediment and rocks to be eroded and washed away. Local geology influences the rate of coastal change. On a ‘hard’ coastline like the Jurassic Coast, change is usually sudden and dramatic, often triggered by harsh weather conditions when waves are powerful and water levels are high causing landslips and rock falls. Conversely, in areas where the coast is made up of softer rock, such as on the east coast of the UK, coastal change tends to be more consistent.

**Landslides**
The unstable coastline of Dorset and East Devon contains a wide variety of landslips of different scales. Landslips happen where porous rock lies above layers of impermeable clays. Rain water sinks through porous rocks but once it reaches the underlying clays it can sink no further. After prolonged rainfall, the build up of water increases the weight of the cliff top; eventually reduced friction allows large sections of the cliff top to break away. This displacement shunts thousands of tonnes of material into the undercliffs (the area between the cliff top and the beach) generating mudslides within the softer Jurassic clays that in turn slide towards and across the beach. The terraced nature of the undercliffs is due to hard bands of limestone within the clays. Each landslide is an attempt by the slope to reach a stable angle. Along the coast marine erosion removes the slipped material which constantly destabilises the slopes.

**Rock falls**
Rock falls are common all year round on the Jurassic Coast. Cliffs on the coast are exposed to the erosive power of the sea which attacks cracks and fissures in the cliff, often resulting in major collapses without any warning.

**How the changing coast affects people**
Many settlements along the Jurassic Coast are vulnerable to coastal change. Over the years, as development along the coast has increased, people have developed methods of resisting coastal change in order to protect their homes and infrastructure. The construction of sea defences such as groynes, rock armour or sea walls and the impact of sea level rise can dramatically influence the rate at which the coast changes. However, these solutions are expensive to build and require maintenance in order to remain effective. In addition, the construction of coastal defences interferes with the natural processes that have formed the outstanding landscape of the Jurassic Coast. As a result there is growing national awareness of the need to consider means of adapting to coastal change, perhaps in some communities as an alternative to building or maintaining defences.
EXPLORATORY LABORATORY: DIRECTORY

Exhibition Artists
Mat Chivers www.matchivers.com
Michael Eden www.edenceramics.co.uk
Alex Hartley www.nowhereisland.org
Ilana Halperin www.alchemy.manchester.museum/fellowshipilana.htm
Charlie Hooker www.charliehooker.co.uk
Aaron Koblin www.aaronkoblin.com
Sarah O'Hana www.ohana.co.uk
Neal White www.nealwhite.org
Katy Woods www.axisweb.org/seCVWK.aspx?ARTISTID=11730

Related Projects and Organisations:
Jurassic Journey
Shell Wildlife Photographer of the Year (2007), Ben Osborne, embarks on a photographic journey along the World Heritage Jurassic Coast of Dorset and East Devon.
www.artsreach.co.uk

Mapping the Jurassic Coast is a collaborative project between artists Amanda Wallwork and Jeremy Gardiner mapping the archaeology and geology of the coast from combined aerial and terrestrial perspectives.
www.amandawallwork.com

Light Years: Digital Coast is large scale 3D immersive landscape digital projection combining painting, drawing, computer animation, immersive Virtual Reality, ambient sound and satellite data. Light Years Projects is a creative partnership between Jeremy Gardiner and Anthony Head.
www.lightyearsprojects.org

The Lyme Regis Fossil Festival is a fusion of science and art, with sessions led by teams from some of the UK's top natural science organisations, art and cultural events, talks, walks and boat trips. An annual event, the next festival is from 29 April to 1 May 2011.
www.fossilfestival.com

The Jurassic Coast Earth Festival is a celebration of our natural heritage through an eclectic mix of arts, science and educational events. Launched at the Fossil Festival on 4 May 2012, it continues until the end of the Olympics on 9 September 2012.
www.fossilfestival.com

Desert Crossings is a cross-cultural performance collaboration between State of Emergency (UK) and choreographer Gregory Maqoma (South Africa). Inspired by the similarities between the Jurassic Coast and the Skeleton Coast of Namibia.
www.deserdcrossings.wordpress.com

Cape Farewell pioneers the cultural response to climate change bringing together scientists and communicators to stimulate the production of art founded in scientific research.
www.capefarewell.com

Land/Water & the Visual Arts is a research forum of artists, writers and curators addressing a range of issues including environmental change, sustainability, journey, site and regional specificity. The next Land/Water symposium will be held in Plymouth on Thursday 23 and Friday 24 June 2011.
www.landwater-research.co.uk

Jurassic Coast: Creative Coast
The Creative Coast team aims to make the Jurassic Coast World Heritage Site in Dorset and East Devon the most creative coast in the world.
www.jurassiccoast.com/creativecoast

Art Catalyst
The Arts Catalyst commissions contemporary art that experimentally and critically engages with science to spark dynamic conversations about our changing world.
www.artcatalyst.org

The National Trust
The Trust protects and opens to the public over 350 historic houses, gardens and ancient monuments, and is a significant landowner, including much of the Jurassic Coast.
www.nationaltrust.org.uk

The Natural History Museum
The museum's vision is to advance our knowledge of the natural world, inspiring better care of our planet.
www.nhm.ac.uk

The Science Museum
Science Museum Arts Projects explore artists' perspectives on the past, present and future of science and technology.
www.sciencemuseum.org.uk
Big Picture Partners

Artsreach organises a varied programme of touring visual art exhibitions which circulate to village halls, rural galleries, and other venues throughout rural Dorset. These include contemporary craft shows and thematic exhibitions bringing together contemporary and traditional work and collaborations with national and regional artists. Artsreach also manages a range of visual arts projects and residencies working with community groups and artists throughout rural Dorset.

www.artsreach.co.uk

Bridport Arts Centre promotes the arts in West Dorset, delivering a diverse professional performing and visual arts programme. It also runs an extensive programme of community activities with a particular emphasis on activities for young people.

www.bridport-arts.com

Bridport House Arts (SHA) is an artist led organisation that curated the visual arts programme at Bridport House in Dorset. Its aims are to present exhibitions and projects that reflect current visual art practice, encourage dialogue and develop opportunities for the creation of new work. Although currently unable to present an arts programme at Bridport House, SHA continues to promote contemporary visual art in the region.

www.sherbornehouse.org.uk

Walford Mill Crafts provides the focus for encouraging, promoting and maintaining the highest standards of contemporary craft work in the region. It aims to encourage audience awareness through its exhibitions and participation for all ages in a complimentary education programme. It also offers contemporary craft works for sale in the craft shop.

www.walfordmillcrafts.co.uk

PVA Medialab has established itself at the heart of artist led activism in the UK, working directly with artists to produce new, interdisciplinary work. The organisation's strategic role is to encourage a broad and diverse range of participants and audiences to engage in creative activities that involve digital media.

www.pva.org.uk

CREDITS AND ACKNOWLEDGEMENTS

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Images:
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Page 11: Duria Antiquo: Courtesy Department of Geology, National Museum of Wales
Page 12: Neal White with Office of Experiments – Dark Places Archive
Page 13: Top: Osmington, Middle: Ladram Bay and the Needles, Bottom: Alex Hartley – Nowhereisland
Page 14: Burton Bradstock
Page 15: Mat Chivers – Outbreath (facts & fictions)
Page 16: Mat Chivers – Outbreath (facts & fictions), Michael Eden, Wedgewoodn’t Tureen
Page 17: Alex Hartley – Nymark (Undiscovered Island), Ilana Halperin – Physical Geology
Page 18: Charlie Hooker – Night Sky series, Aaron Koblin – Flight Patterns
Page 19: Sarah O’Hana – Pendant and Brooch, Neal White with Office of Experiments – Dark Places archive
Page 20: Katy Woods – Sailing Dinghy Hawk 20
Page 23: Top: Fossil found at Lyme Regis, Middle: Kimmeridge, Bottom: Kimmeridge clay fossil
Page 24: Left: White Nothe c.1820, Right: Beckles Pit
Page 25: Storm at Charmouth

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Dorset Visual Arts
www.asholt.co.uk

Dorset Visual Arts is a large open membership organisation designed to promote the work of artists, designers and makers. It manages exhibitions, events, websites and projects. Its core activities are the huge, biennial Dorset Art Weeks and Art Trails. DVA increasingly works through partnerships to increase the effectiveness of the visual arts regionally.

www.dorsetvisualarts.org.uk

The Oliver Holt Gallery at Sherborne School supports innovative ways of making and interpreting art. The gallery creates new opportunities for national and international artists and audiences through site, material, context and learning.

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