WELLS CATHEDRAL SCHOOL

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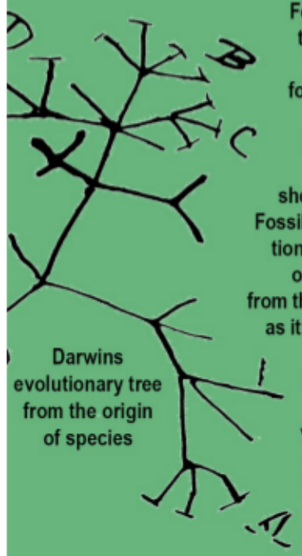
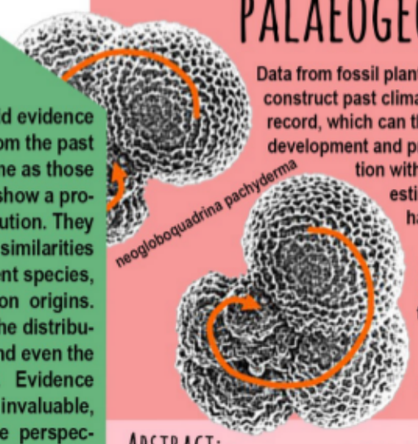
# Evolution




Darwins evolutionary tree from the origin of species

Fossils provide solid evidence that organisms from the past are not the same as those found today; they show a progression of evolution. They show anatomical similarities across different species, showing their common origins. Fossils serve to show the distributions of ancient life and even the origins of life itself. Evidence from the fossil record is invaluable, as it provides a unique perspective for understanding the evolution and very existence of life on Earth. It also provides many well-documented examples of transitions from one species into another, for example ammonoids and micraster

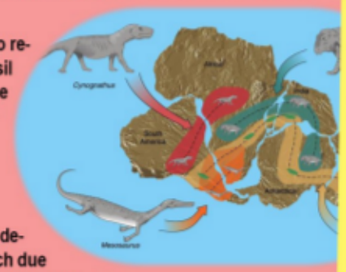



# Palaeogeographic Reconstructions

Data from fossil plants can be compared with records based on marine organisms and chemical isotopes to reconstruct past climates. there are several methods to interpret climate information stored in the plant fossil record, which can then be applied to many current problems. fossils have also played a crucial role in the development and proof of continental drift theory. The similarity or dissimilarity of the fossils in conjunction with evolutionary groups can be used to estimate the past geographic location of the continents. Analysis of sedimentary basins has also played a key role in the discovery of petroleum.

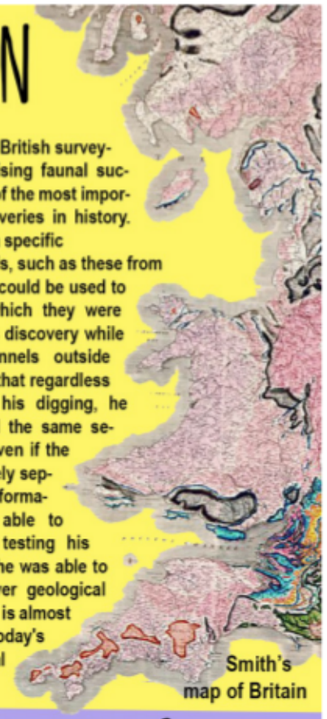
As certain plants and animals only survive in specific climates, fossils can be used to determine paleoclimates and paleoenvironments. This is a major focus of current research due to the ongoing concerns over current climate change. Examples of specific fossils include coral reefs, which can only exist between 23-27oC with a marine salinity of 30-40 pp1000. Both Rugose and Tabulate corals became extinct at the PT boundary (251 ma), suggesting rapid climate change. Microfossils are also an abundant and condition specific paleoclimate indicator.

The ancient super-continent pangea, reconstructed using fossils



# Faunal Succession

William Smith was a British surveyor, who, by recognising faunal succession, found one of the most important scientific discoveries in history. He recognised that a specific assemblage of fossils, such as these from the Lower Jurassic, could be used to date the rock in which they were found. He made this discovery while digging canal channels outside London, he noticed that regardless of the location of his digging, he always encountered the same sequence of fossils, even if the strata had been widely separated. With this information, William was able to travel the country testing his theory, and in 1815 he was able to publish the first ever geological map of Britain which is almost as accurate as today's B.G.S geological map.



Smith's map of Britain

**Abstract:** Fossils are undeniably beautiful and, as such, are objects of fascination for geologists both young and old. However fossils can be used for so much more. They are evidence for elolution, enable us to reconstruct past environments and climates, they were used to help create the first geological map of britain, they also have industrial applications, they were used in the construction of the Thames barrier and the channel tunnel. They are also used in the oil industry and the distribution of fossils is used as evidence for continental drift. fossils literally fuelled the industrial revolution and are still powering the world today, they are an invaluable source of plastic and the majority of the world's transport depends upon them. However the environmental impacts of fossils have never been more relevant with the disposal of plastic and the burning of fossil fuels affecting every single one of us daily.

# "Fossils are pretty, but they don't do much, do they?"

- Elizabeth Cairncross - Head of Wells Cathedral School

# Forensic Geology

Sherlock Holmes in the Conan Doyle novels was perhaps the first forensic geologist. The provenance of sediment can be determined by using detailed geological knowledge of an area, as was the case in the Soham murder investigations in 2002: The car used to dispose of the bodies contained microfossils that matched the microfossils in the track leading to the site where the bodies were dumped.

Geological analysis of sediment

# Zone Fossils

zone fossils (index fossils) are used to correlate rock strata. They are commonly used in the oil industry, as directional drilling uses micropalaeontology to 'steer' the drill. They were very important in the construction of the Channel Tunnel- which followed the Chalk marl. This is a marine deposit that is mainly comprised of microfossils which, due to its high clay content, is relatively impermeable. Another example is the Thames barrier, which was also located using biostratigraphy

# Industrial Revolution

Coal, oil and natural gas are all fossil fuels, which sparked Industrial Revolution. Fossil fuels powered, and still do, automobiles, ships, engine rooms, airplanes, electricity, heating and providing hot water supplies. Since then, the demand for fossil fuels has increased parallel to economic growth, providing a head start for countries containing large reserves, such as Saudi Arabia and UAE, allowing them to rapidly develop and create financial alliances with superpowers such as America, China and Russia.


Plastic soft drinks bottles are regularly disposed of incorrectly

# Environmental Harm

4% of global oil production is used to produce plastics. They are incredibly useful materials visible in many aspects of our everyday lives. Ironically plastics are often used to reduce our carbon footprint by replacing other materials with lighter, improved ones, which are found in your phones and computers.

Plastiglomerate formed from waste in the ocean

However plastic pollution has lead to the death of more than a million seabirds and at least 100,000 marine mammals a year. This intense plastic pollution will stay with us for many years, as it is non biodegradable. However, geologists have tried to see the positive side of this. Jan Zalasiewicz, who is a geologist at the University of Leicester has said that "plastics and plastiglomerates might well survive as future fossils" - in this sense the cycle is complete. Fossils are turned into plastics which over time will be turned back into fossils, although not like any seen before.

The other product from fossil fuels that causes environmental harm is Carbon dioxide. Carbon dioxide is an essential part of our atmosphere, and its trapping of heat in the atmosphere is what has made it habitable for life. However, due to human actions, the amount of $CO_2$ being emitted is increasing rapidly, causing rapid heating of the earth. These increasing amounts of $CO_2$ don't just affect our atmosphere but our oceans too. Seawater is rapidly acidifying, turning it into carbonic acid which dissolves coral reefs and the carbonate shells of marine organisms, destroying the oceans and fossils of the future.


The Thames Barrier, built with the help of fossils

Plastic washed up from around the world

References: www.bgs.ac.uk, http://www.rsc.org/chemistryworld/2014/07/ocean-acidification, www.scotese.com