

Jurassic Jet of Asturias, Spain

Alvaro Martínez-Calvo, a geologist and graduate of the University of Oviedo in Asturias, Spain, offers an overview of Asturias azabache, also known as Asturias jet.



A small seam of jet exposed in the coastal town of Villaviciosa in Asturias. The jet found on the coast is usually of low-quality and is altered by its environment.

Probably the world's best quality jet is found along the north-eastern coast of England, near the city of Whitby. The Jurassic jet of Whitby has been worked for centuries since prehistoric times, enjoying particular success during the Victorian era. However, less than a thousand miles to the south of Whitby, on the northern coast of the Iberian Peninsula there are other, different deposits. The aim of this article is to give insight into the deposits of jet in the Asturias region of northern Spain.

Asturias jet is technically a type of sub-bituminous coal, with a high content of hydrogen-rich hydrocarbons, low maturity of the organic components, conchoidal fracture and very bright surfaces. Asturias jet does not have a crystalline structure and is formed by free hydrocarbons, amorphous organic matter and pyrite or marcasite iron sulphides (FeS_2). The content of pyrite increases the density of the jet but decreases its stability because the sulphides could oxidise and form sulphates, opening cracks and fracturing the jet.

Jet is not usually found in continuous seams as in other types of coal. Its typical occurrence is linked to coastal sedimentary facies where wood fragments from trees of the Araucaracae family are transported and accumulated. The lignin of the wood is transformed

into jet in anoxic conditions, usually in the presence of saline water. In this depositional environment, the jet bearing levels are found in channel, deltaic and point bar facies of terrigenous rocks, such as sandstones, and in coastal swamp facies, where jet is found within shales. The first type of environment is similar to the Lastres Formation, where Asturian jet is found.

The Lastres Formation, dated from the Upper Jurassic, is composed mainly of carbonate cemented sandstone with some layers of impure sandstones, marls, shales and limestones. The rock sequence has a thickness of up to 500 metres. The formation is considered to be part of an ancient deltaic system and the jet bearing levels are thought to be related to forests near the coastline-located mud plain, coupled with the influence of seawater and the allochthonous accumulation of plants in abandoned channels, or in the floodplains at the final part of active deltaic channels.

It is in the upper-medium part of the rock sequence where jet is found



A view of an ancient jet mine near Oles. Image courtesy of Jose Manuel Sanchis.

in small beds within the sandstone (also associated with other fossils of vegetation). These accumulations have an average thickness of 5 centimetres and an average length of 6-8 metres, although in certain places bigger logs were found, especially during the most intense mining of the 19th century.

Of course, jet was used by inhabitants of the surrounding area long before the Victorian era. Small carvings of jet have been noticed in Palaeolithic and Neolithic sites in Asturias. The presence of jet artefacts, rough material and carvings has also been documented in Celtic and Roman sites in the regions of Asturias and Galicia.

During the Middle Ages there was a surging number of jet traders and carvers. The journey to Santiago de Compostela (the capital of north west Spain's Galicia region, known as the culmination of the Camino de Santiago pilgrimage route) increased demand for jet, especially to be worn as an amulet, usually in the form of a *higa* – a small ornament in the form of a closed fist.

The demand for jet from the British market triggered a 'jet rush' in the area, mostly for export as rough to the UK.



Traditional methods for working jet rough.

As an example, in 1412 the guild of jet carvers was established in Santiago de Compostela and in 1443 the guild set up a series of rules to try to ban and control imitations. Nowadays, the name of the street where the jet carvers settled is still named Azabachería, from *azabache* or 'jet' in Spanish. After a fall in demand during the 17th and 18th centuries, the 19th century and the beginning of the 20th century was the period of most intense mining in Asturias. The demand for jet from the British market triggered a 'jet rush' in the area, mostly for export as rough to the UK.

Characterisation of Asturian jet is still an important issue today. As no mines are in operation, rough material arises from stocked material and dumps from ancient mines and coastal sea cliffs.



Modern equipment for artisanal carving of jet.



A big fragment of rough. Note the characteristic conchoidal fracture.

Some cases of imitation material sold as Asturian jet have been found. The use of resins, or other natural materials of lower quality has been noticed by local artisans, who suffer both from the low availability of working-quality material and cheaper imitations. Some efforts have been done to open a new mine and create a trademark to guarantee the origin of the material.

Scientific work has helped with further understanding of this type of jet, and how to differentiate it, but the relative low price of the gemstone and the



Traditional jet necklace and amulet designs crafted in silver and jet.

complexity of tests make changes difficult to apply in the common trade.

Asturian jet has been described as a perhydrogenated coal (combined or treated with hydrogen, especially where hydrogen is added to an unsaturated

organic compound, to the fullest extent), with some characteristics that differ from others coals. This perhydrogenation is caused by an early impregnation of oils contained in source rock levels of the Rodiles Formation (of the geological

time period, Pleinsbachian). These oils fill the pores of the fossilised wood and cause the characteristic brightness, low porosity and durability of jet. It has an average hardness of 3-4 on the Mohs scale, fragile tenacity, conchoidal fracture and an average density of 1.2 to 1.3 g/cm³. When carved, its powder has a distinct bituminous odour and brown colour. Under ultraviolet light the fluorescence is orange-brownish.

The correct identification of the botanical species that were transformed into jet is not always easy, but for the case of Asturian jet, recent studies carried out by Spain's The National Coal Institute (INCAR) showed that the wood that was fossilised came from trees of the Agathoxylon, Brachyoxylon and Protobrachyoxylon families. ■



View of an exploitation zone inside of an ancient mine near Oles. Image courtesy of Jose Manuel Sanchis.

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