

**BRITAIN DURING THE UPPER CARBONIFEROUS**

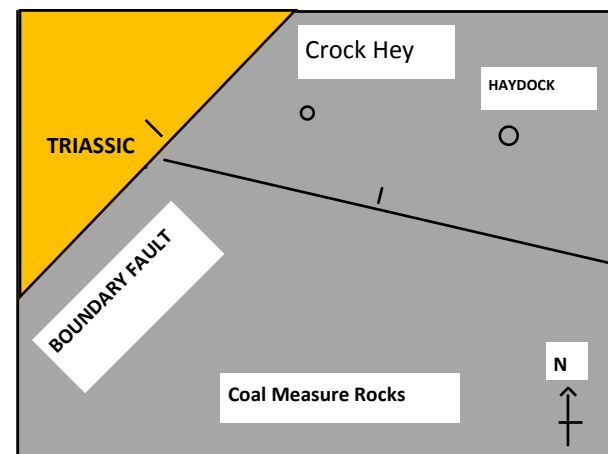
320 million years ago during Coal Measure times the British Isles was part of the Variscan Orogenic Belt -this resulted from a collision of Laurasia and Gondwanaland. Britain lay only a few degrees north of the equator . The sediments of the Coal Measures were laid down by rivers on a deltaic plain stretching from Poland to Britain, the climate was tropical,wet and possibly monsoonal. Most of the Coal Measure sediments are non-marine but many marine bands zoned by goniatites occur which represent incursions of the sea over the area.

**GEOLOGICAL SETTING OF THE AREA**

Wigan sits on the western section of the Lancashire Coalfield which is a plunging syncline much complicated by faulting-mostly tensional post Triassic faults. Some of these faults are large with displacements up to 150 metres (for example the Great Upholland Fault at Grimshaw Delf has a throw of over 2000 feet!. The Coal Measures reach a maximum thickness of 5000 feet in the Lancashire

Coalfield, thinning in thickness eastwards towards the Pennines

( the Yorkshire Coalfield on the other side of the Pennines thins westwards which indicates a land area or zone of restricted deposition in the Pennine area during the Upper Carboniferous). The Lancashire Coalfield has steep dips which means that the Upper Carboniferous disappears under the red beds of the Triassic in a relatively short distance. Crock Hey sits in a fault belt some 8 miles wide. The Boundary Fault to the west of the region throws Upper Carboniferous against Triassic Rocks and has a throw of not less than 3000 feet!



Crock Hey Pit.....GR [SJ537 980]

Latitude.....53:28:38N

## INTRODUCTION

The town of Wigan is situated about 15 miles west of Manchester on the western side of the Pennines, south of this is the low-lying Cheshire Plain. The town has been the centre of mining activity for many centuries, indeed the first reliable record of mining in the area is from 1521 where the coal was worked at outcrop in small pits up to 25 feet deep. Towards the latter part of the 16th century pits were sunk up to a depth of 70 feet. The normal method of working these deeper shafts was to dig sideways until the roof showed signs of collapse!, the shaft was then abandoned. The 19th century marked the sinking of the deeper pits and with the coming of the industrial revolution the coalfield expanded rapidly.

In 1800 there were about 1000 pit shafts within about 5 miles of Wigan town centre. At the peak of working in 1907 there were 320 collieries in Lancashire producing 26 million tons of coal per year and employing 94,300 men. In the Wigan area there are 26 workable coal seams in 2,600 feet of Coal Measures totalling 85 feet of coal.

The area around Crockhey Pit has been extensively mined and opencasted in the past, particularly during the war years when coal was in high demand. The area is now landscaped and the sites of former opencasts are now farmland. Coal in the past was transported from the area by barge on the Bridgewater Canal, later by rail and the recent opencasts used road transport.

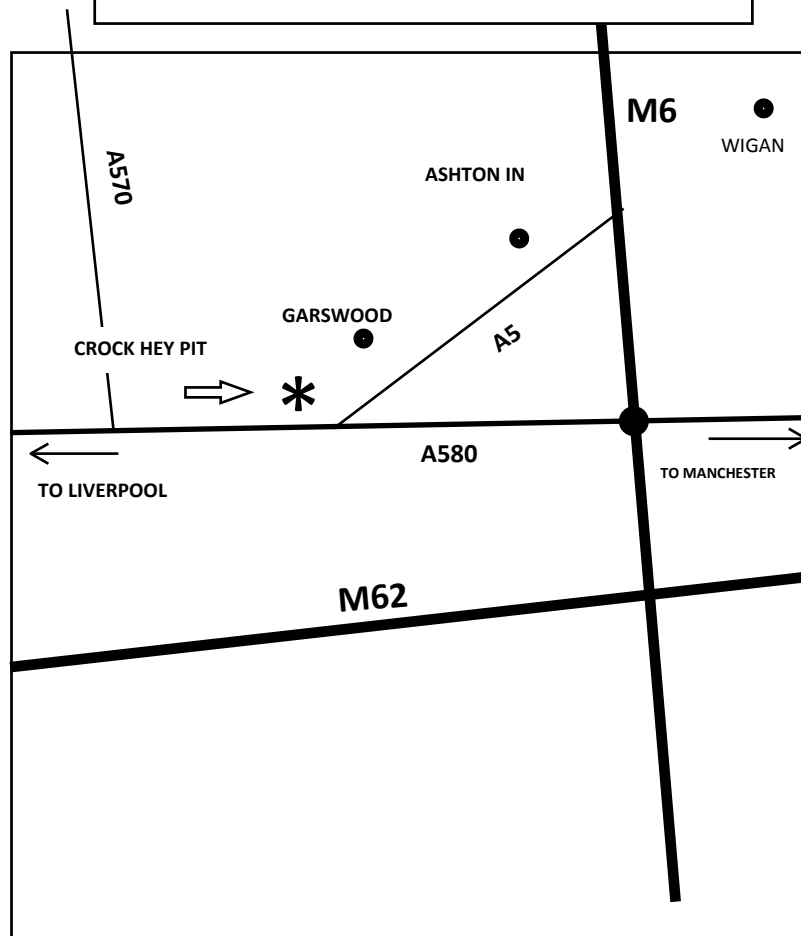
Excavation in progress in summer 2004



The last colliery in the area to close was Bickershaw which closed down in 1992. Nowadays some idea of the working conditions and history of the area can be gained by visiting Astley Colliery Museum situated in Astley, near Tyldesley, Wigan on the A580.



THE LOCATION OF CROCKHEY  
OPENCAST PIT.



a view southwards into Crockey Pit in the summer of 2004



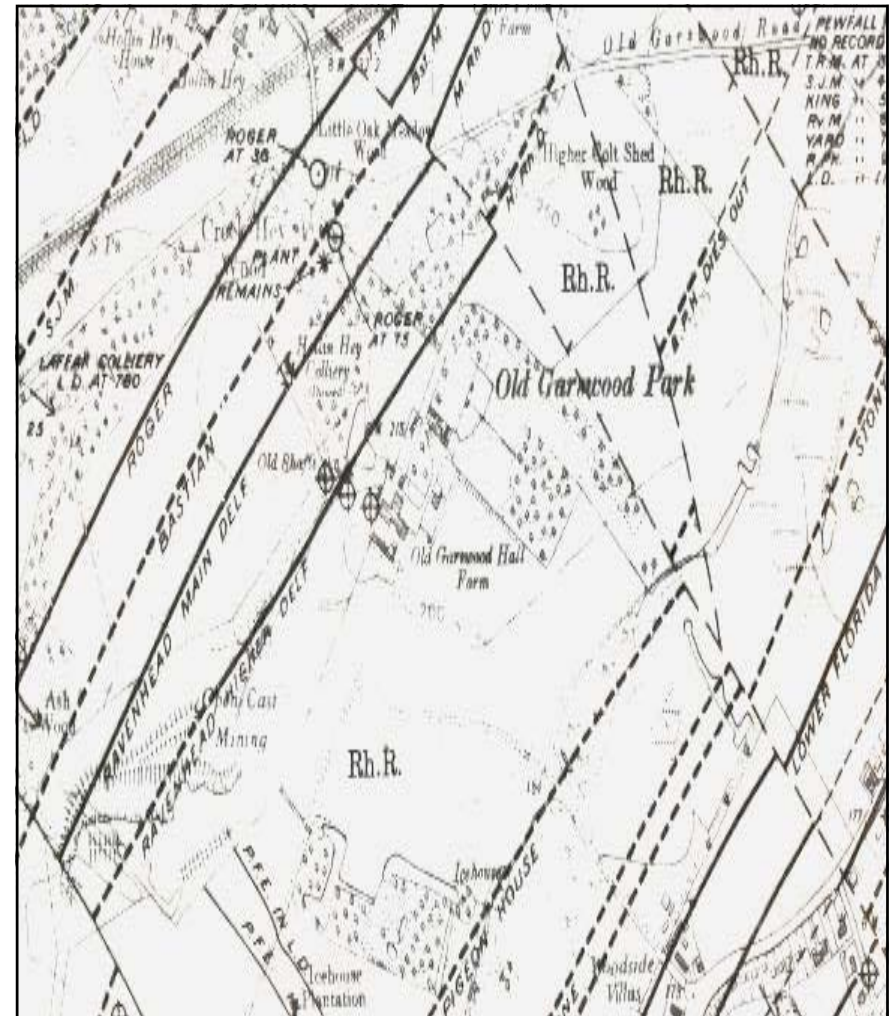
The picture shows the four main coal seams exposed:-

(1). The Wigan Nine Foot Coal -this is the lowest exposed coal and forms the floor of the pit. The machine to the right of the number one in the picture is a water pump which had to work 24 hours a day to prevent the pit from flooding, the water was lifted by large pipes up the face of the pit to be emptied into large settling tanks.The two excavators give scale to the picture.

(2) The Wigan Two Foot Coal- this is seperated from the underlying Wigan Nine Foot Coal by a thick shale parting with distinctive pyrite nodules. The parting thins north westerly becoming one coal on the western side of the pit.

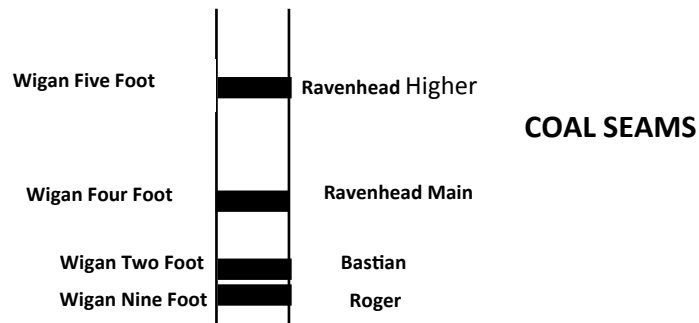
(3) The Wigan Four Foot Coal - this is the main commercial coal seam of the area,extensively dug in the Wigan/Bolton area. An old mine working cut through by the present pit can be seen high in the face of the pit on the left of the picture. These old workings have produced pickaxes and a handcart! Fred dibnah visited the pit to load up his Traction engine with coal from this seam.

(4) The Wigan Five Foot Coal- this is a thin coal much worked at the surface locally. Weathered and sulphurous at this locality but said to be a good quality coal when mined at depth. This coal seam immediately underlies the Ravenhead Sandstone.

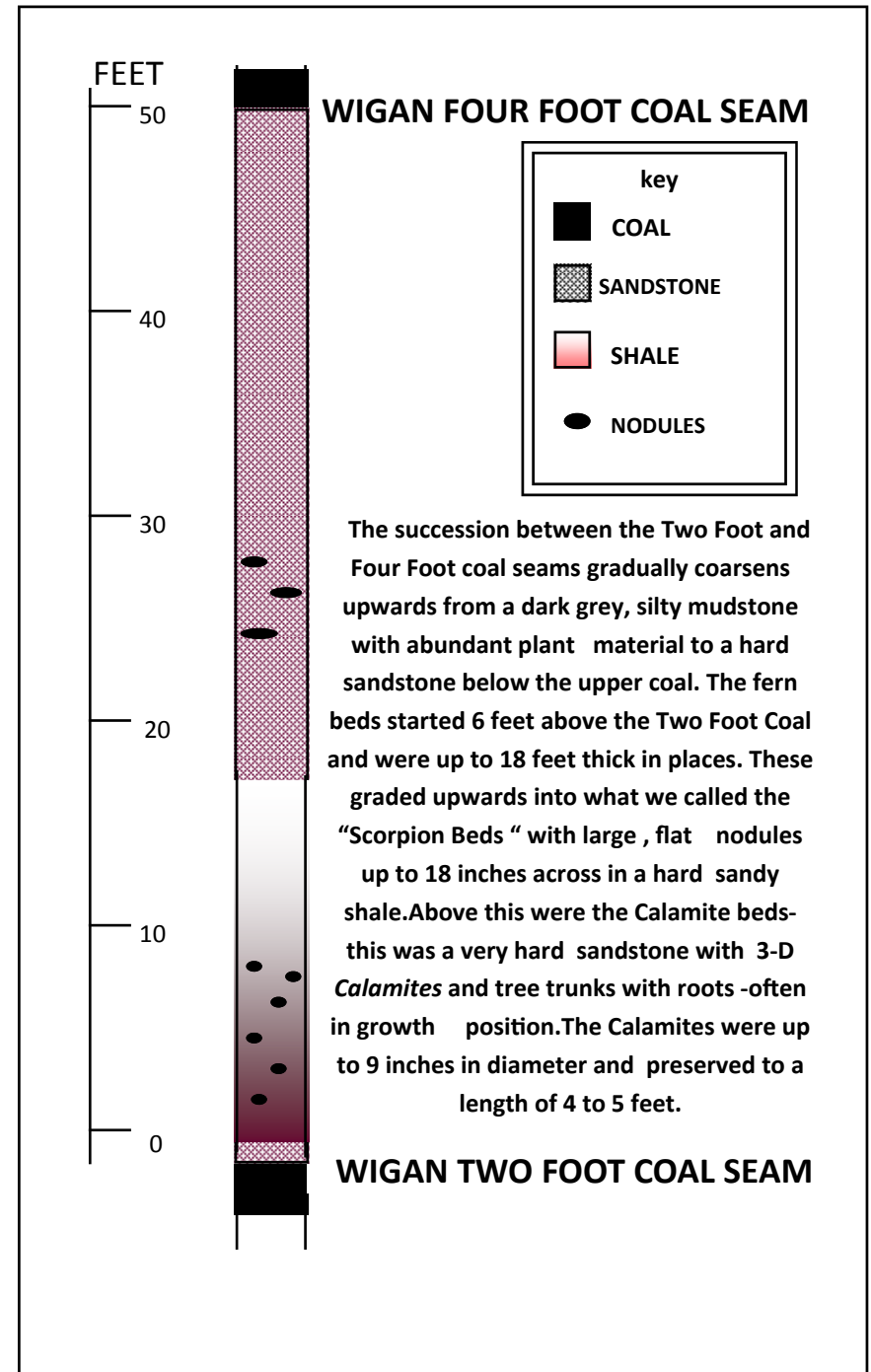


## THE GEOLOGICAL SEQUENCE

When we first started collecting from the pit in October 2002 we wondered whether the beds were at the same horizon as Westhoughton , a few miles east of this site, where the rich fauna occurred above the Wigan Four Foot Coal Seam. On further investigation at Crockhey Pit we realised that the fauna in this pit came mostly from above the Wigan Two Foot Coal- represented on the map by the Bastian seam(usually spelt Bastion). This impersistent coal seam is represented at Crockhey by a five foot thick, good quality coal separated from the underlying Wigan Nine Foot Coal (known as the Roger coal seam on the map) by a seven foot shale parting with pyritic nodules and large septarian concretions. The pyritic nodules were very distinctive and easily recognisable ,these contained badly preserved plant remains and occasional *Belinurus* horseshoe crabs. The Wigan Four Foot coal was separated from the Wigan Two Foot by about 50 feet of shales and sandstones.



The map on page 6 is taken from the geological survey map of 1861, resurveyed in 1925-30 by R.L Sherlock and W.B. Wright , further revised in 1947-48. The Bastian seam (Two Foot Coal ) is represented on the map by a dotted line because the surveyors did not recognise it as a separate seam as at Crock hey it merges westwards with the underlying Roger Seam (Wigan Nine Foot Seam). Marked on the map is a fossil plant locality in Crock Hey Wood overlying the Bastian Seam-this must be the same horizon as the plant rich beds in the pit.The dip of the strata was 25 to 30 degrees to the South East, becoming a little steeper towards the Southern end of the pit.







The picture above shows the two coal seams - the lowest is the Wigan Nine foot, the higher one is the Wigan Two Foot coal. The beds overlying the top coal-roughly 20 feet in thickness-are the richest in fossils.It is from these beds, known by us as the fern beds, that most of the well preserved specimens were collected. Immediately above the coal were poorly bedded shales with much plant material, the nodules were irregular and contained plant debris. These nodules also contained arachnids, crabs and millipedes. Sigillaria was most abundant just above and in the top two feet of this coal, some were upright. Above this were thickly bedded greyish shales with many regular, often nicely splitting siderite nodules with well preserved plants and animals. The fern nodules were characteristically fern or pear shaped and gave away the presence of a fern inside.

Nodules containing the fossil animals were often rounded and very regular. Nodules containing crabs were particularly distinctive, large, rounded with a slightly flattened cross-section., these became known as "crabbers"! . Ferns, seeds and tree cones tended to occur in localised patches throughout the beds. The nicest of the fern nodules could be split easily with a light tap of the hammer. Spiders, insect wings, millepedes, Rochdalia, shrimp-like crustaceans (as yet unidentified), Euproops, Belinurus, cockroaches, scorpions, whip scorpions, Cyclus, giant millipedes and rare bivalves and fish also occurred.

The commonest fern was *Neuropteris heterophylla*. Also present were *Mariopteris*, *Cyclopteris*, *Sphenopteris*, *Alethopteris* (rare), *Renaultia*, *Palmopteris*, *Aphlebia*. Fern seeds-*Trigonocarpus parkinsoni* -were very common, often in small, rounded nodules. Cigar-shaped seed cones - *Lepidostrobus* and *Sigillaristrobus* were

plentiful but often the nodules were long and very hard to split. The honey-comb like structure of the nodules containing *Sigillaristrobus* were often mineralised.

*Neuropteris* was usually preserved as a single frond, often with the tip leaf present, though this sometimes projected into the shales and was not preserved in the nodule.

The ferns showed excellent detail of leaf veins. *Neuropteris* nodules from this locality averaged approximately 60mm in length, anything larger than this was quite a rarity.

*Cyclopteris* were always single leaves and preserved in large nodules, again usually showing fine detail. In terms of numbers *Neuropteris* is by far the most abundant, *Mariopteris* is the only other plant which occurred in the fern beds in any numbers, everything else being uncommon. During our time collecting in the pit we never saw any leaf damage which could be due to insect feeding. The preservation of these plants led us to the conclusion that they had not originated from far away from their present resting place, possibly due to being rapidly covered by sediment.



An old miners trolley found in one of the old mine tunnels cut through in the pit. Presumably used to haul coal to the surface!

Calamites occurred abundantly throughout the sequence but were to be found uncrushed and in upright growth position in the sandstone layer above the fern beds-some up to 5 feet and reaching diameters of approx 9 inches. An "island" of *Calamites* was excavated during the removal of this sandstone where a large concentration of these horsetail ferns could be walked over. *Calamites undulatus* seemed to be the predominant species at this locality. Many large trees were observed in upright position, often with root systems. The tops of the trees were planed off at the same level, could this have been due to flash flooding?

*Sigillaria* was more common at the base of the sequence, in the few feet above the coal and could also be seen in the topmost surface of the coal when it was possible to walk across it and see the flattened trees displayed which make up the coal. *Lepidodendron* occurred throughout, preserving well as small areas of bark on nodules in 3-D. Large masses of bark of this tree were uncommon.

Stigmara rootlets were common, again in life position and preserved in 3-D showing hair-like rootlets branching off. Large concentrations of ferns were present in the sandstone beds above the fern beds running in all directions through the rock-these were not *Neuropteris* but *Sphenopteris*, *Renaultia*, *Aphlebia*, *Palmopteris* and others.

Plant Species recorded at this locality:-

*Neuropteris heterophylla*

*N. jongmansii*

*Macroneuropteris scheuchzeri*

*Mariopteris mucronata*

*Aphlebia crispa*

*Cyclopteris orbicularis*

*Laveineopteris* sp

*Alethopteris* sp

*Calamites undulatus*

*C. suckowi*

*C. schuetzeiformis*

*Palmopteris* sp

*Sphenopteris* sp

*Eusphenopteris* sp

*Renaultia* sp

*Pecopteris* sp

*Cordaites*

*Cyperites* sp

*Ulodendron*

*Asterophyllites longifolius*

*Annularia*

*Sphenophyllum*

*Calamostachys*

*Lepidostrobus*

*Sigillariostrobus*

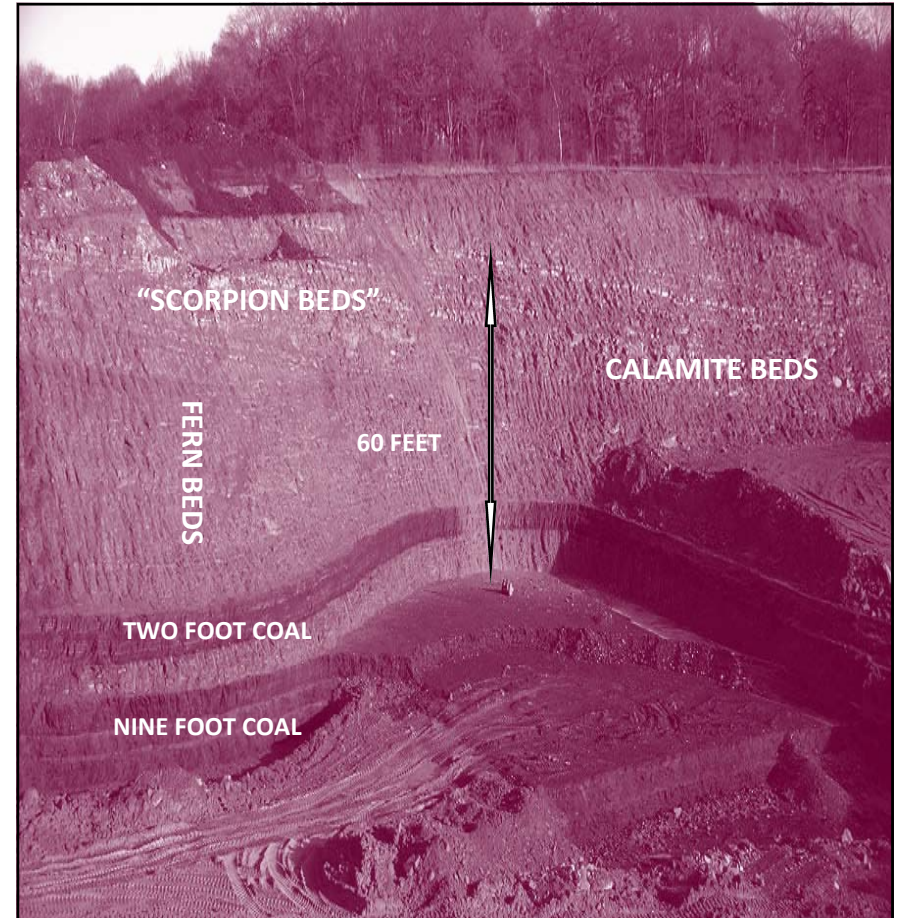
*Lepidostrobophyllum*

*Trigonocarpus parkinsoni*

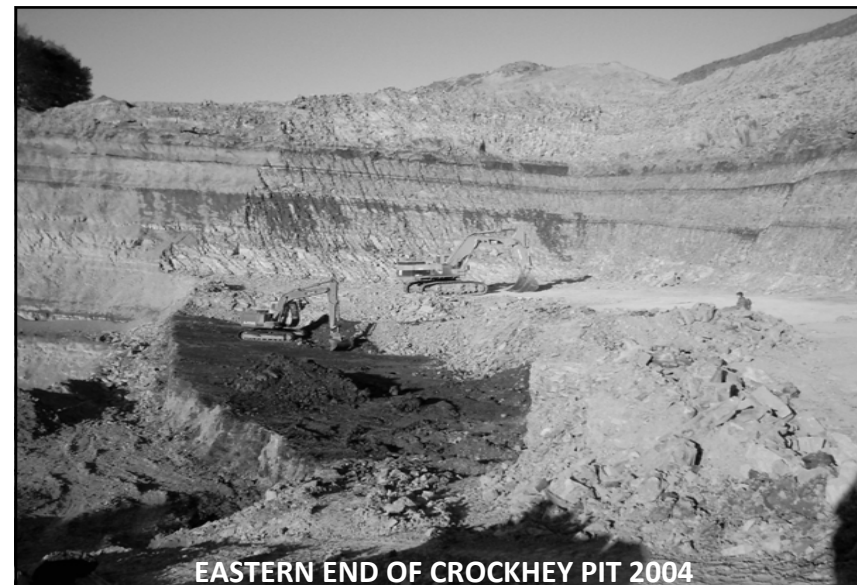
*Potonia*

*Whittleseya*

*Cordaites*



Most of the animal remains (spiders, crabs, insects, millipedes, etc...) were collected from the Fern Beds where preservation was exceptional. Generally speaking the more regular the nodule the higher chance of a "beastie". Terrestrial and aquatic animals were found together at the same horizon. The Xiphosaurids- *Euproops* and *Belinurus* were also found in nodules again at the same horizon. It has been suggested that these two crabs inhabited different environments -this is not the case at Crock Hey! The succeeding "Scorpion Beds" were named, not unsurprisingly, from the presence of scorpions. These beds are slightly lighter in colour (see page 12) due to being more arenaceous. The beds were more blocky than the underlying Fern Beds with larger, flatter, very hard nodules, some of which yielded scorpion remains up to 10 inches long!! Remains of vertebrates were also found in the form of large fish scales and shark egg cases. Nodules containing partly digested remains of crabs, millipedes, scorpions and in some cases fish were common in these beds, usually along a single plane of the nodule. Some of these were large -up to a foot across- a large animal, probably a fish must have produced these! Some of these are definitely coprolites (droppings) but some may be regurgitates, the fact they lie along a thin plane of the nodule seems to support this theory. We never found any fish teeth of any kind. The first scorpion from these beds was found one summer night in 2003 -this was a large specimen which, when the nodule was struck with a hammer, the large fragile body shattered into tiny pieces and was sadly unsaveable. The same night also produced a nodule with a complete scorpion with fantastic detail of eyes, legs and body. The next night we returned, not expecting any more luck, another specimen turned up! -this is why we thought the term "Scorpion Beds" was appropriate. The overlying Calamite Beds were a hard whitish fine-grained sandstone, these beds thinned towards the north end of the pit. These beds were characterised by an abundance of well preserved calamite stems and upright tree trunks. In one area of the pit during excavation a large area of calamite stems in growth position was uncovered. This bed could be walked across and the stems pulled out of the ground. Above the Calamite Beds is the Wigan Four Foot Coal seam -traceable across the Lancashire Coalfield. A good quality coal low in sulphur. Excavations at Crock Hey cut through many of the old mine workings from the early 1900's and occasionally some of the miners tools were found (picks, spades and a cart.....see page 10). The coal from all the seams at Crock Hey was mixed to prevent the coal being too sulphurous when it was delivered to the nearby power stations. The fireclay associated with the coal was used to make firebrick for furnaces.

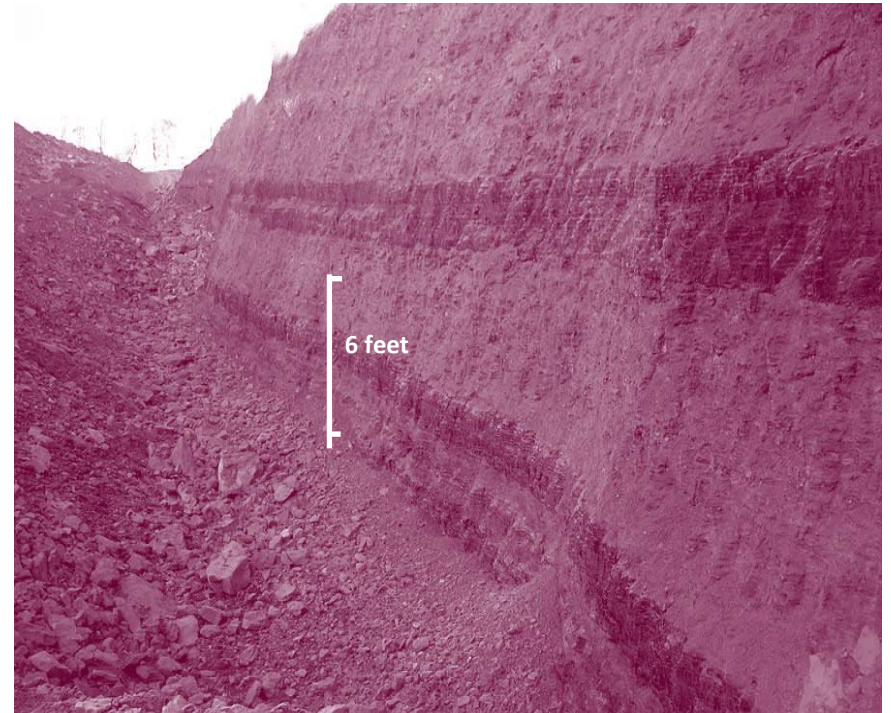


The section below was measured at the eastern end of Crock Hey quarry in 2004, the beds changed in thickness constantly with every new "cut" of the quarry.

RAVENHEAD SANDSTONE.....	15ft 0ins
(the full thickness of the sstn was not exposed)	
WIGAN FIVE FOOT COAL.....	4ft 9ins
SHALES.....	2ft 0ins
BLOCKY COAL/SHALE WITH FISH ReMAINS.....	1ft 0ins
SHALES WITH FLAT ROUND NODULES.....	35ft 0ins
WIGAN FOUR FOOT COAL.....	5ft 6ins
SANDSTONE ("CALAMITE BEDS").....	24ft 0ins SANDY
SHALES ("SCORPION BEDS").....	5ft 0ins
GREY SHALES WITH NODULES ("FERN BEDS").....	16ft 0ins
WIGAN TWO FOOT COAL.....	5ft 7ins
SHALE PARTI NG.....	7ft 0ins
WIGAN NINE FOOT COAL (with 2ft 3ins shale parting).....	9ft 7ins



Upright trees were a common sight often with large root systems preserved . Stigmara rootlets were a common find but we never saw an upright tree which could be definitely identified as a *Lepidodendron*, the bark was always preserved as a thin layer of coal with no features. The trees were up to 10 to 11 feet long but were truncated at the top along the same bedding plane indicating a sudden event, for example a flash flood. Having read about amphibians being preserved inside tree trunks in other parts of the world we always checked this out when the trees were accessible-unfortunately no luck! No plant remains were found in the infilling of the tree trunks. The characteristic diamond-shaped bark pattern of *Lepidodendron* was found in the Calamite beds but was not a common occurrence. In this sandstone were characteristic large ,flattened nodules containing large fronds of ferns, abundant but it could be difficult and frustrating to collect a good specimen due to the nodule not breaking along the plane of the fossil or the hammer blow! One summer night after spending a frustrating hour or two trying unsuccessfully to lift a heavy portion of tree trunk into the back of the van ,during a tea break a nodule was tapped open which revealed a fine specimen of a cockroach larvae with wings.A nice find which made the trip worthwhile. Large *Aphlebia* (resembling a large lettuce!) was present with *Mariopteris*,*Sphenopter*,*Eusphenopteris*,*Palmopteris* and *Renaultia*. Large fish scales and coprolite nodules were present but not as easy to find as in the underlying beds. *Euproops* were still to be found occasionally but no *Belinurus*. One nodule from the Calamite beds produced a large insect wing. Between the Four Foot Coal and the Five Foot Coal are a succession of fine bedded shales ,light in colour with easily recognisable flat, unfossiliferous, fine-grained ,discoidal nodules often sharp edged and with a raised middle on one side. About 3 foot above the Four Foot Coal nodules occurred with *Belinurus*, often just headshields or bodies. Another foot or so above this was a band of nodules with *Neuropteris* ferns , not as well preserved as in the Fern Beds but nice specimens could be found with perseverance. No insects were found but a specimen of part of the body of a shrimp was found. In comparison with the Fern Beds these shales between the coals were poor in fossils. Freshwater mussels were present in these shales but again were a rare find.Two feet below the Wigan Five Foot Coal occurred shaley coal which was easily spotted on the tips being completely different from the other beds. This shaley coal contained plant remains-Lepidodendron twigs ,Calamites and fish remains -mainly single fish scales, but one complete, disarticulated fish was found in these shales.Complete fish were extremely rare, in four years only 4 were found. No amphibians or reptile remains were found-it seems that the top predators were the large fish-represented only by large scales.



A view in late 2003 showing the Wigan Two Foot converging with the underlying

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Wigan Nine Foot Coal





Thirsty work for the diggers- the diesel tanker filling up a digger



One of the tippers having a rest after hauling coal up from the bottom of the pit.

## SUMMARY

Recent publications have suggested that the horizon of the fossil material at Crock Hey Pit comes from above the Wigan Four Foot Coal . After much research by us and study of the stratigraphic sequence in the pit and the local area we are convinced that the fossils come from above the Wigan Two Foot Coal. The evidence for this came initially from consulting the geological surveys and borehole sequences done for the pit owners- LEM mining.

Also we have copies of the geological map of this area which states clearly that it is the Wigan Two Foot! The fauna and flora differs from that at Westhoughton and Bickershaw.

In the early years of our fossil collecting frenzy we visited many coal measure fossil localities in the Manchester area and never found more than a few mussels and badly preserved plants. We often admired the plant and animal collection in Manchester Museum collected many years ago from localities such as Sparth Bottoms in Rochdale never dreaming we would have a chance to study a locality such as Crockhey. Our thanks go to LEM mining for there patience and helpfulness to us and allowing us to collect.

A special thankyou goes to Horace at the pit who helped us up the muddy slope with large, back breaking bags full of rock many times! Also we would like to thank Andrew Tenny for his knowledge, friendship and stupid jokes!( he is the finder of a large insect wing at the pit which is a new species-his smile could be seen from the other side of the pit!).



A view of the area around the pit - under these fields lies more coal !

Sizes on pics refer to nodule length.



Neuropteris 90mm



Neuropteris 60mm



Neuropteris 40mm



Neuropteris 55mm



Neuropteris 49mm





Neuropteris johnsoni 46mm



Neuropteris 50mm



Sigillaria 185mm



Neuropteris 102mm



Lepidodendron 80mm



Calamites 65mm



Lepidodendron 58mm

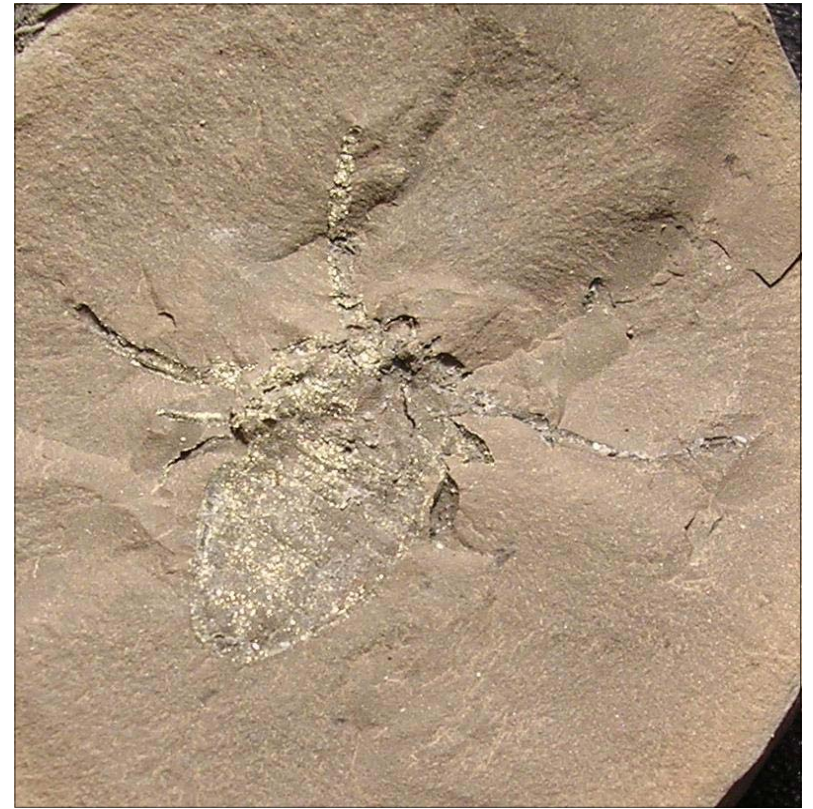




Macroneuropteris 60mm



Mariopteris-both 60mm



Phalangotarbid spider-Mesotarbus .Spider length is 25mm



Large millipede section-Euphoberia sp, 55mm





Crab-Belinurus trilobitoides 37mm



Crab-Euproops 60mm

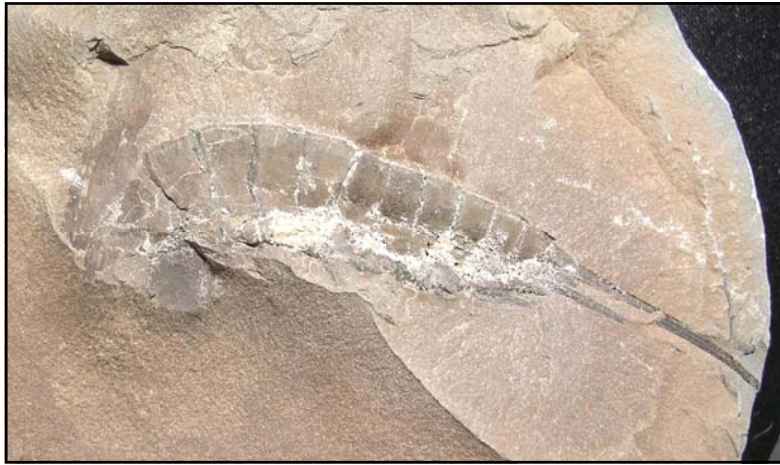


A dragonfly leg -species unknown  
length of the leg is approx 40mm



Crab-Euproops 50mm





length of shrimp- 72mm



Length of shrimp-75mm

Two as yet unidentified species of shrimp



Millipede-Xyloius with legs and spines- length of millipede is 35mm



Insect Wing- 40mm across



The tail sting of a scorpion-15mm

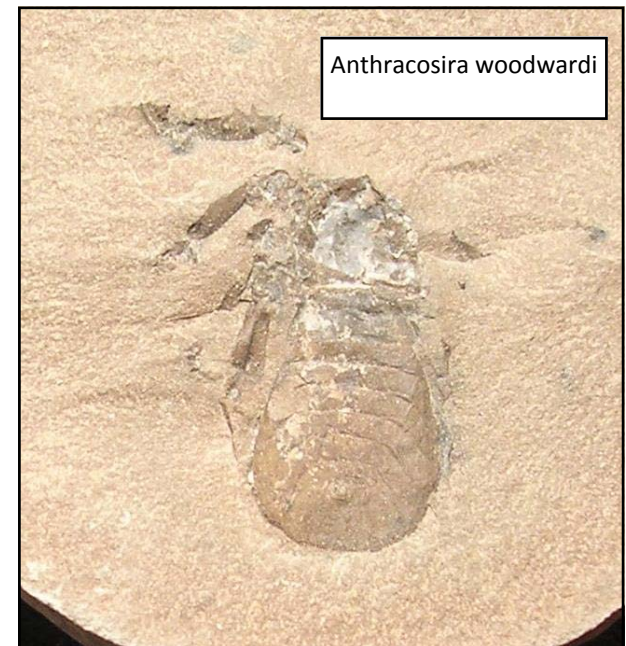




Insect Wings- bottom nodule is 45mm, top nodule is 50mm



Meiocercus celticus-spider is 28mm in length



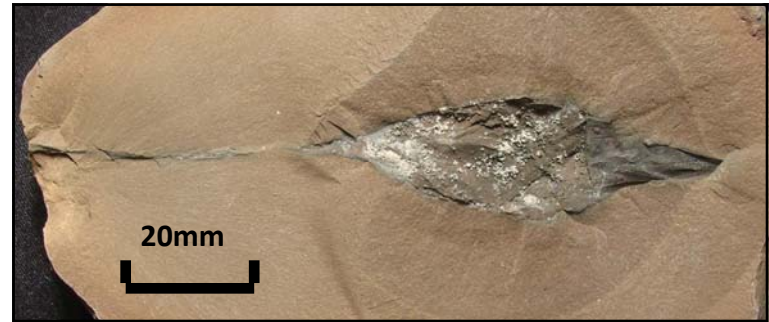




A terrestrial Scorpion-Eoscorpion. Scorpion measures approx 45mm in length. Close up pic below shows the head with eyes



Millipede-Xyloius Millipede is 40mm across



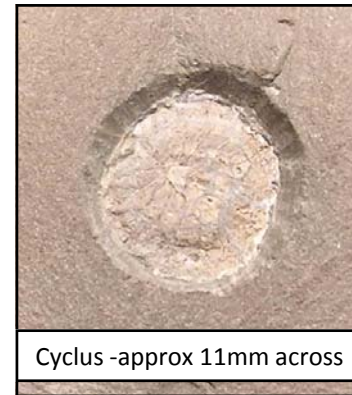
Two shark egg cases -Palaeoxyris



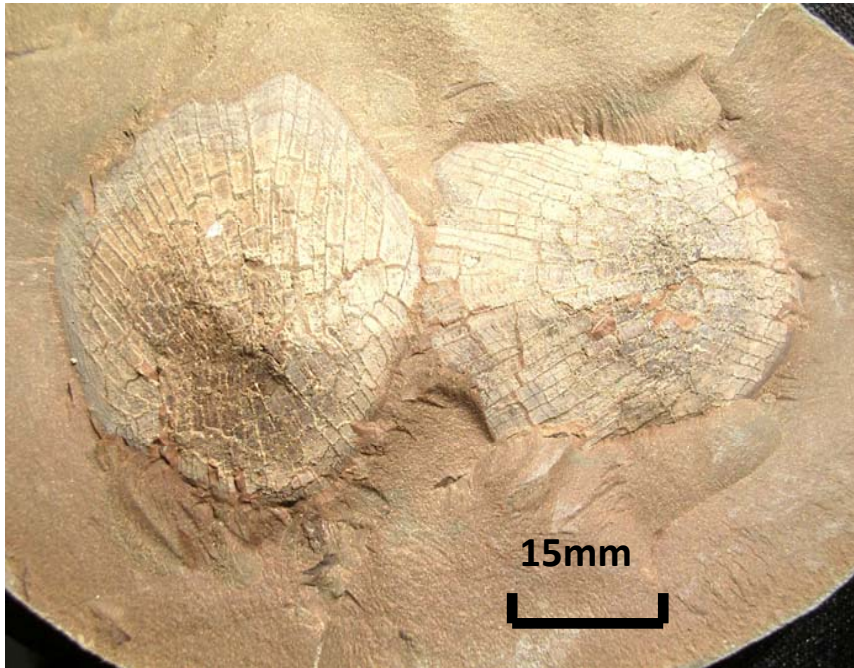




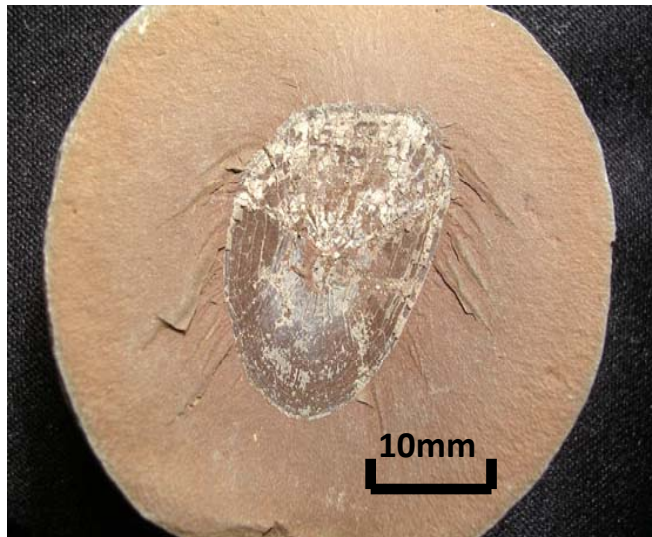
A whip scorpion 65mm







Large fish  
scales



Two specimens of non-marine lamellibranchs  
which turned up only occasionally!



