Farnham Geological Society

GEOLOGISTS' ASSOCIATION 1858

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NEWSLETTER. NOVEMBER 1992.

This Newsletter is wide ranging in its articles and for these we have to thank Jill Brash, Cath Clemesha, Allan Comer and Elizabeth Matthews. The order of names is strictly alphabetical.

The interesting, not to say revolutionary, article on Gryphea arcuata by Allan Comer is obviously the result of much deliberation and research. Comments on his article by members of the Society, in writing, would be much appreciated and would be published in a later Newsletter.

David Caddy.

GEOLOGICAL WALKS ON PURBECK BEACHES.

After a very interesting dissertation in Wareham the previous evening by Professor J.C.W.Cope, the party was raring to go when we met at Renscombe Farm car park on Saturday morning 29th February (OS 965 785). So eager were the vanguard that they short-circuited the path a little further on and headed straight down the precipitous hillside for Chapmans Pool. Before 1977 we could have driven down to a flat grassy parking area and walked down a path, bridged the stream and arrived at the bay. The hot summer of 1976 dried the Kimmeridge Clay into great cracks, and the following winter heavy rains caused landslides, making the area a muddy mess. Fortunately, the area was now negotiable for us after the dry winter.

Once on the beach we headed westwards, admiring the abundant Ammonite pavlova moulds too friable for collection, in the Kimmeridge Clay. The tide was low so we continued to scramble along the beach below Hounstout and into the A. pallasoides and A. galbanites zone. Rock falls from above and pebbles on the smooth Kimmeridge rock caused a few slip-ups. Part of an Ichthyosaur claw was extracted from the K. shale. Below the highest point of the Tout we started up the soft facies. It looked almost vertical but offered good foot-holds. At about 200 ft the Portland "sand" was reached. It consisted of hard bands, alternating with soft bands of marl with cherty beds at the top. With relief we continued diagonally westward until emerging on to the coast path. The return route was due east and upwards to the top of the Tout, the highest point at approximately 500 ft on the Purbeck coast, and then down the steps the other side and on to Chapmans Pool. (Whew!)

After a picnic lunch in the sunshine with cars as windbreaks back at Renscombe, we walked down the track to St Aldhelm's Head, passing the Portland Stone quarry, with hopes dashed of finding someone at work there: it was locked. Their work can be seen in recent additions to Portsmouth Cathedral. The tiny Norman St Aldhelm's chapel was duly admired.

He was a 7th Century priest scholar, poet and musician. His departure to Rome to be made Bishop of Sherborne was delayed by a great storm and the ship could not put out from Wareham, a port at that time.

Leaving the un-manned coastguard station behind us, we descended to the remains of second world war fortification and into an old quarry, and were shown the Shrimp bed, the topmost layer of the Portlandian, a white stone with tiny pink shrimp fossils clearly visible. The coast path walk, north-east, to Windspit was a delight in sunshine, little wind and blue sea and sky and leaves of wild cabbage to nibble along the way. There are two old quarries at Windspit. One was a mine and now has a grille over the entrance to protect the horseshoe bats which live there: the other is a great open cave with columns of freestone supporting the roof. The public are warned of the danger of entry. The cherty bands can be seen as well, to be avoided as building stone. The hey-day of these quarries was in the last Century. The stone was loaded, using whims (stout wooden gibbet-cranes), into flat bottomed boats for the first stage of their journey to London and many other places for the construction of town halls and other buildings. Purbeck stone was mined underground in Acton, Langton Matravers and Herston on the outskirts of Swanage. Purbeck marble was used extensively in the 13th and 14th Centuries when Tournai marble from France was no longer available. Church fonts of Purbeck marble can be seen in Surrey, the pillars in Salisbury Cathedral and even in the old Galilee chapel in Durham Cathedral.

March 1st dawned damp and grey. We assembled at the big car park above Swanage pier (OS 034 786) and walked down to Peveril Point where Purbeck marble beds outcrop into the sea. Closely packed viviparus take an attractive hard surface polish. Our feet crunched along the beach south towards Durlston Bay examining the Unio and Corbula beds. The tide was going out, but a minor headland barred the way to the oyster bed, the marker for the end of the Jurassic and the beginning of the Cretaceous. Scrambling over the top was not on, big horizontal cracks in the overburden indicating great instability. Three agile young men calculated the interval between the waves and dashed over the slippery rocks to collect samples for us all. Although most of the Purbeck is fresh water limestone there were marine incursions into the deltaic and lacustrine area from time to time and there are good bands of freestone for building.

Back at our cars we drove to the north end of the promenade (OS 033 797) and then continued walking northwards along the sands, looking at the Wealden clay. It is 700 metres thick at Swanage, thinning to 40 metres at Durdle Door and only 4-5 metres at Upwey near Weymouth. It is derived from the north and west, Exeter and Dartmoor area, and includes some sandstone ridges. It is predominantly sandy with pebbles. It was raining really hard by now. We pressed on as Wealden was replaced by Lower Greensand at Punfield Cove.

The thin layer of Gault between Lower and Upper Greensand was rather obscured by undergrowth. Greyish Lower Chalk at Ballard Cliff and the sea ended our walk.

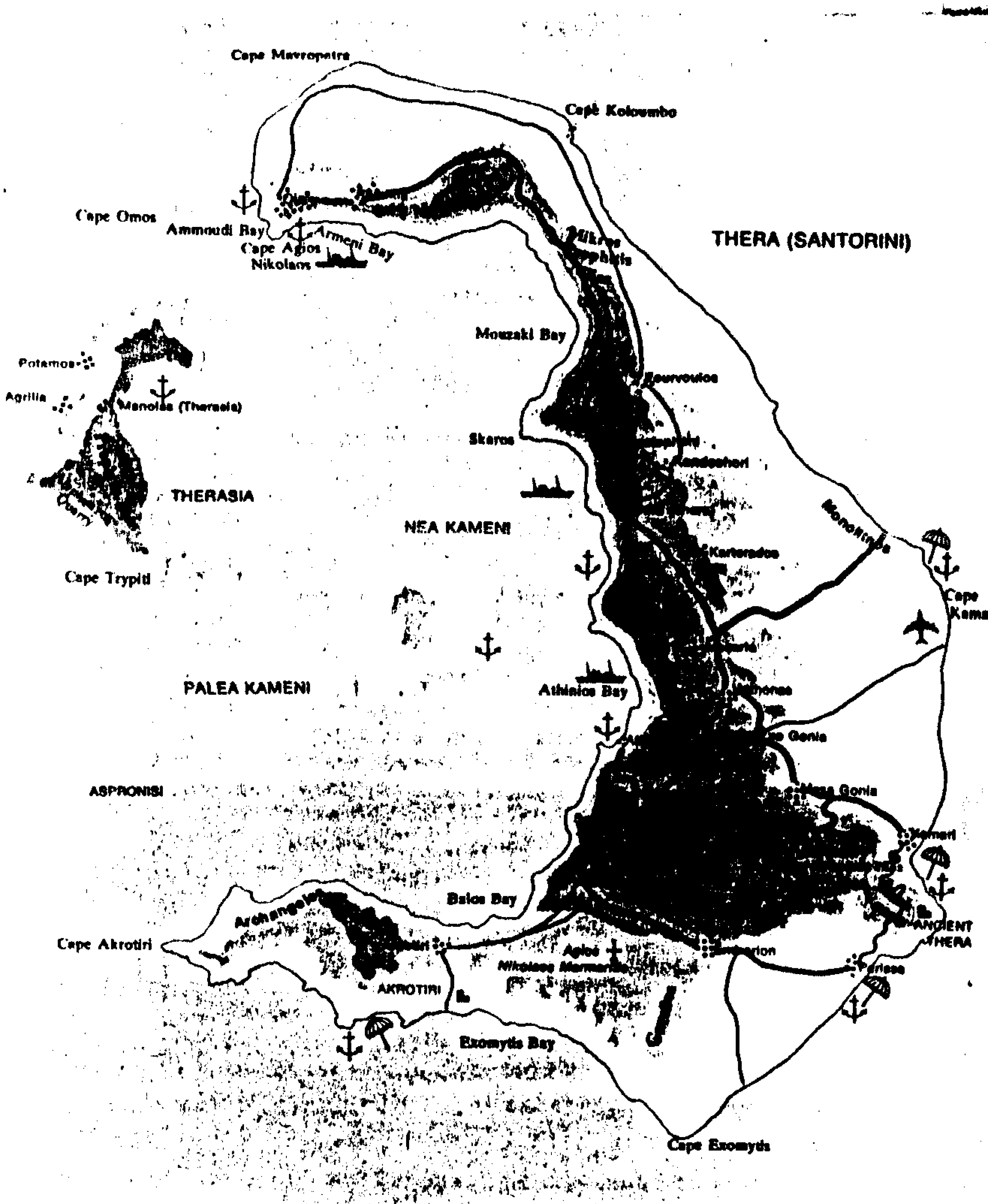
After lunch parked in the Bankes Arms car park at Studland (OS 038 824) we walked south along the beach to the Upper Chalk, the north side of Ballard Down, the Belemnitella mulcronata zone, with black flints much in evidence. Grey sandy Reading beds lie immediately to the south, a discordance of 10 to 15 million years, followed by brightly coloured red and yellow sandstone of Redend. We then bade eachother a somewhat damp farewell after a most enjoyable and instructive week-end.

Elizabeth Matthews.

SANTORINI. MAY 1992.

This is not a geological treatise but a short account of an enchanted week on the beautiful island of Santorini or Thera with few members of the Farnham Geological Society. We tried to understand the complicated geology, saw some of the archaeology, enjoyed the lovely scenery, good food and wine.

In early May seven of us met at 7.20 a.m. at Manchester Airport , as this seemed to be the only airport that had a direct flight.



MAP OF SANTORINI

Santorini is the southern-most island in the Cyclades group. The Cyclades lie along part of the junction of the African and Aegean plates and are all volcanic. Originally Santorini consisted of a few Mesozoic limestone islets, when the vulcanism started about 39 million years ago. The lavas surrounded the limestone and formed a round island. With further eruptions large craters were formed. There were thirteen massive destructive eruptions producing the caldera through which the sea entered, and finally the Bronze Age explosion gave the present shape to the caldera and crescent-shaped island.

We stayed in Kamari in the south-east corner of the island in self-catering apartments, eating out most evenings in a local, incredibly cheap, taverna where we ate excellent Greek food and drank litres of the local plonk.

Our first expedition was to view one of the few exposures of basement rocks, Messa Vouno, a Triassic limestone mountain, and quite a climb. It is well faulted and exhibits shelly limestone, schists and conglomerates with the pebbles flattened and stretched laterally. We took the climb slowly, stopping to discuss our findings and look at the panoramic views of villages and the sea. Our picnic that day was taken with seven of us trying, unsuccessfully, to crowd into a small cave in a sudden shower of rain. We ended up with very wet knees. At the top of the mountain are the remains of a Graeco-Roman town, Old Thera, which was founded in the 9th century B.C. as a garrison and was used as such in Alexander's time. In the Romam era it expanded and houses, theatres, baths and more shrines and temples were added to the barracks and guard houses. It was abandoned at the coming of Christianity.

The following day we visited a far older city, the Minoan town of Akrotiri. This is thought to have been built around 2000 B.C. and was completely buried by the Minoan eruption of 1600 B.C. It was a large town at the south of the island near the sea, and was excavated by Professor Marinatos from 1961 until he was killed in 1974. He thought the enormous Minoan eruption which covered Akrotiri and all of Santorini with a deep layer of rose pink pumice had caused tidal waves which destroyed the Cretan palaces. This theory is now doubted as recent dating gives 1450 B.C. instead of 1600 B.C.as the time of the eruption. However, the effect of the explosion must have affected a vast area and pink pumice has been found in Crete and many other islands.

We walked a short distance along the coast to eat a delicious lunch of fish, freshly caught that morning. On our way back we looked at the Akrotiri flood breccias. The Akrotirian volcanics lie on basement rock and erupted 39 million years ago. The upper Akrotirian lavas are exposed along this part of the coast and consist of red andesitic scoria and ashes with Strombolian cones.

The present day little towns perched on the hills were most attractive with their white houses and the churches crowned with bright blue cupolas. They suffer from earthquake damage and Oia, at the north-west end of the island, was destroyed in the 1956 earthquake. It is now rebuilt. We enjoyed wandering round, taking photographs and sampling the coffee and cheese pies. We found the museum in Thera very interesting with many pots and other articles from Akrotiri, but, sadly, the well-preserved frescoes have all gone to Athens.

There was an enormous quarry near the town of Thera which we spent most of the morning exploring. The thick top layer was the pink Minoan pumice. Further into the quarry the Theran volcanics were exposed and there were huge boulders which had been blown out by the eruption. These showed excellent slump structures where they landed. We found the Minoan soil layer with possible roots, although there was some discussion on this and also fascinating channel structures in the Theran layers.

Near Thera there is a peninsula with a large outcrop of Skouros volcanics. These were extrusive dacitic lavas overlain by horizontal andesites, the top layer is red andesitic scoria deposited before 16,000 B.C. These lavas continue in the caldera wall on either side of Skouros and the crater must have been somewhere in the present caldera. The Venetians occupied the peninsula during the 14th and 15th centuries and built a prosperous town on Skouros. The town was destroyed in 1851 by earthquakes and considerable landslip. We had a pleasant evening looking round the peninsula and its geology and had supper that night gazing over the caldera watching the sun go down.

On our final day on Santorini we took a boat trip round part of the caldera. We had, on an earlier occasion, walked down the cliff path near Thera to look at the Theran pyroclastics. There are layers of pumice, quartz-andesite lavas, scoria and ashes with a basal layer of ignimbrites at sea level. The Theran volcanics lie on the Akrotirian sequence. We had looked at the ignimbrites at the bottom of the cliff and then three of us had elected to go up the hill by mule while the others took the cable car. Our mule ride proved quite exciting as two of the mules decided to see which could reach the top first.

On our boat trip we went out into the caldera, sailing by the volcanic island of Palaeo Kameni which erupted quartz-andesitic lavas in 197 B.C.

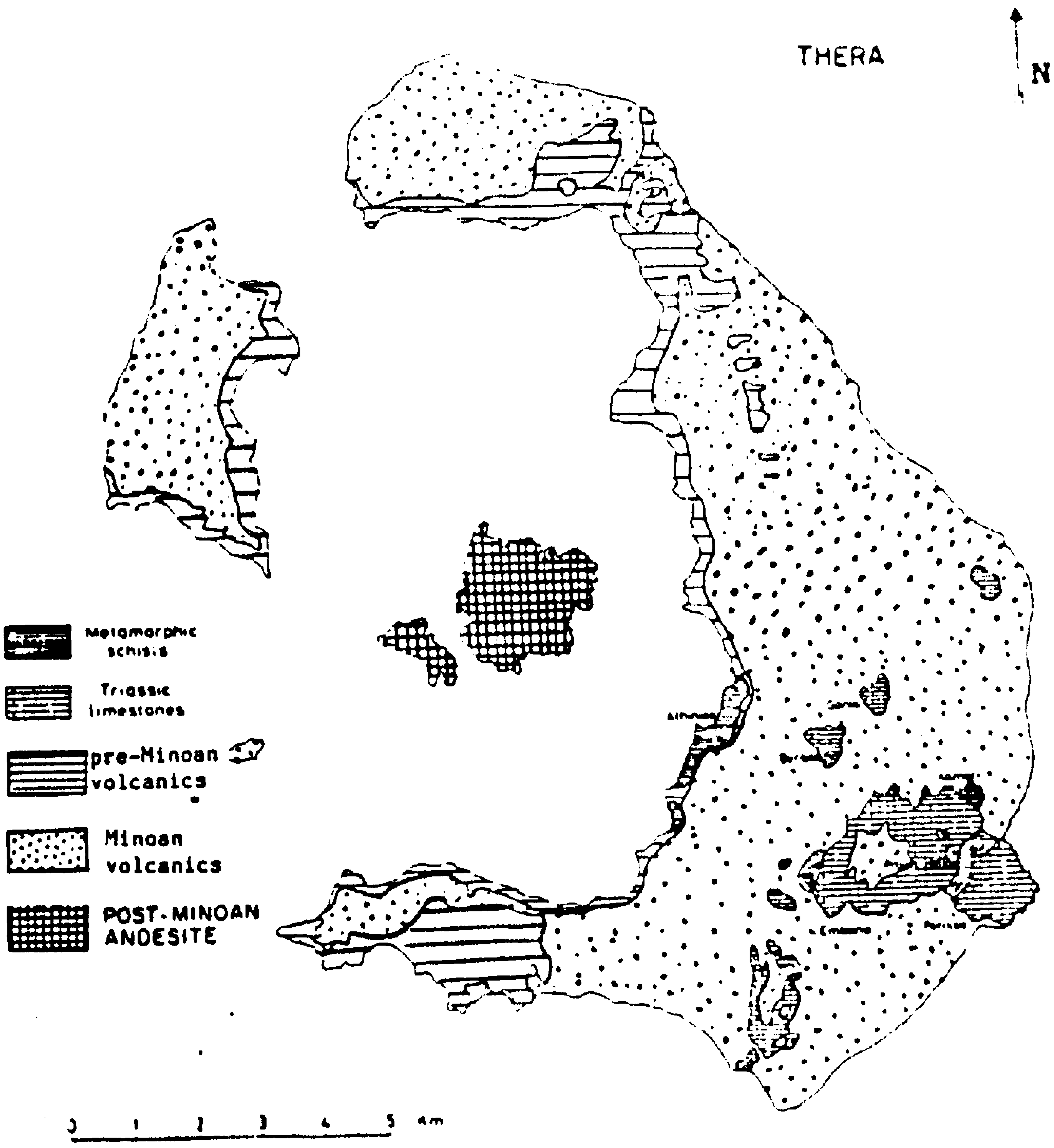
We landed at the next island, Neo Kameni and climbed up to see the crater. Neo Kameni is the most recent crater and has erupted at intervals since 1570. The last eruption was in 1950 when quartz latiandesitic lavas were ejected.

Our final island hop was to Therasia, another crater formed of a sequence of quartz andesitic lavas. Most of us went up the cliff by mule to walk round the town at the top. Many of the houses were built into the rocks with the front part extending to the narrow passages which we walked along. There was a chance to bathe before boarding the boat again, but only two of our party swam.

The final part of the boat trip was to sail north along the caldera wall. We had a good view of the various volcanic strata. Unfortunately, the boat did not go as close we had expected, but with binoculars we could see the different colours of the layers and identify the different volcanic episodes.

I would reccommend Santorini for a delightful holiday, with plenty to do and see. We were very fortunate that there were few tourists at that time and it was un-crowded and peaceful.

Jill Brash.



CHURCH STRETTON. JUNE1992

At the end of June I joined a group from Bristol University's department of continuing education for a week-end based on Church Stretton. There were 14 of us and we travelled daily by minibus, driven by the leader, Tom Barklem from Urchfont Manor Study Centre.

We visited nine exposures in a day and a half and travelled quite long distances in the bus, first along Wenlock Edge from Craven Arms to past the Ironbridge Gorge Museums, to our furthest locality.

The names will be familiar to those of you who have visited the area with Paul Olver: Soudley Quarry (mid-Ordovician with brachiopods and trilobites); Hope Bowdler (a road-side unconformity between Pre-Cambrian and mid-Ordovician); Hazler quarry (with a mid-Ordovician Neptunean fyke through inter-bedded basaltic lavas abd tuffs); View Edge quarry near Craven Arms where we tried unsuccessfully to extract whole pentamerid brachiopods(Conchidium knighti); two Silurian exposures reminiscent of the Wren's Nest area and Comley quarry, which is an S.S.S.I, very much neglected since my last visit and minus its explanatory notice board.

One disappointment was that all the highly fossiliferous Wenlock limestone quarries along Wenlock Edge are no longer open to geological parties because of Health and Safety regulations. The National Trust owns a lot of the ridge, but not the quarries.

We made our own way to Church Stretton and arranged our own accomodation. The weather was kind and it was a thoroughly enjoyable excursion.

I came home via the National Stone Centre at Wirksworth, near some reef limestone quarries we had visited with Dave Taylor. At present it is mainly geared to primary school parties but there are plans for further displays. It is worth a visit if you are passing.

Cath Clemesha.

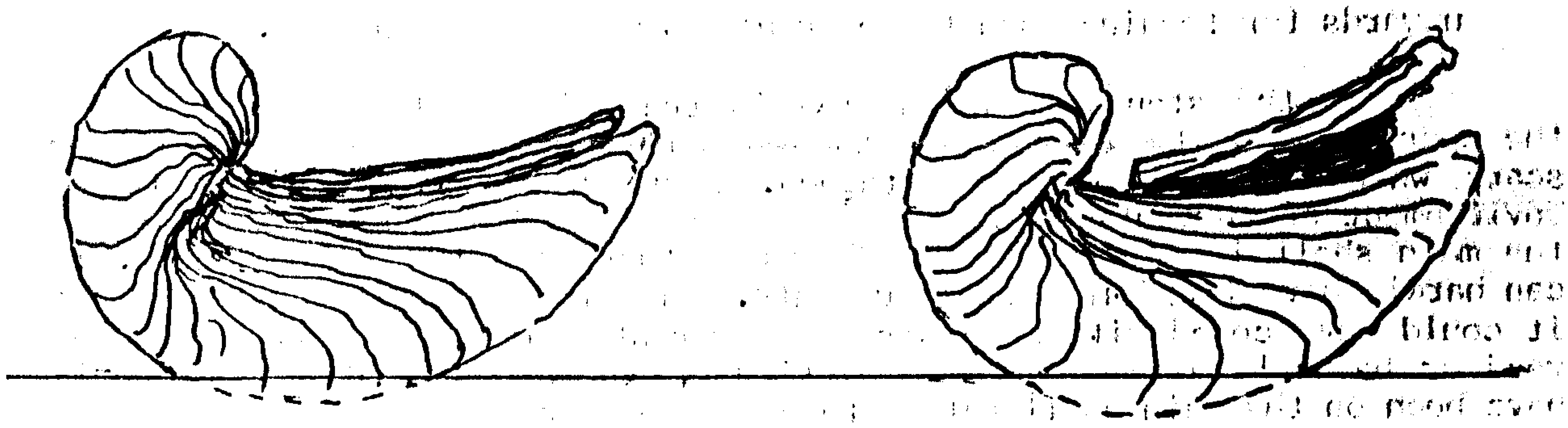
Gryphaea Arcuata.

by A.T.F.Comer

I have become involved in a minor controversy with several members of Bath Geological Society that might be of interest.

Gryphaea Arcuata from the Lower Lias, the familiar 'toenail', is a very common fossil near Bath. It is known to be completely extinct, and there is no modern shellfish of quite the same shape to guide us to an understanding of how it lived, although modern oysters might possibly give us a clue about its diet.

Most of the literature on the subject says that it lived on a fairly shallow, muddy, sea floor, though probably not so shallow that it was uncovered at low tide, and that its food consisting of tiny particles of algae or plankton, was brought to it by currents in the water in the same way as for our sedentary shellfish of today. The shell is said to be sufficiently heavy to keep it on the bottom without further anchorage, and diagrams show the creature lying on the sea floor with its operculum elevated when feeding or closed for defensive purposes.



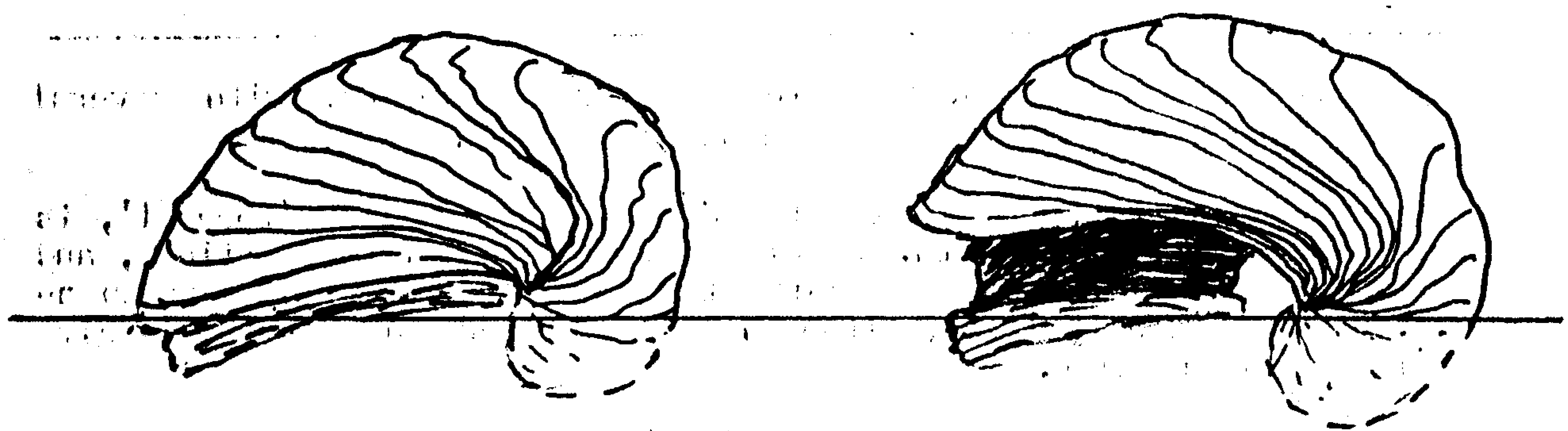
There is so much authority for this description that it is probably pointless to make any alternative suggestion. However, the diagram does not look very convincing;-

a. The heavy umbo would surely unbalance the creature so that it would tend to point its shell upwards.

b On firm mud it would be very unstable in the currents it relied on for food. Its weight in water would be only about half its weight in air, so that it might be rolled or skidded from place to place in a most uncomfortable manner.

c Alternatively on very soft mud its aspect would be conducive to its sinking until its food-gathering was terminated by burial. There is no evidence that it had any means of digging itself out.

How much more sensible the story appears to be if the creature is drawn the other way up;-



a The umbo would be an effective anchor against movement by the currents that brought its food, its shape and weight assisting this function helped by the streamlined presentation of the main shell.

b Its slightly concave underside would resist penetration into the mud, and its heavy operculum could be used to raise it, should it begin to sink below an acceptable amount. It might even have limited ability to bury itself a few millimetres below the surface for defence, or to reduce the effects of strong tides.

c The umbo is ideally shaped to allow the main shell to pivot upwards for feeding when the operculum is pressed downwards.

If the standard explanation is true, it might be expected that the operculum and the surface of the umbo are likely to show barnacles or scars where seaweeds became attached, particularly if it lived in an environment of currents so weak that its stability was not impaired, while the main shell is clear because of its contact with the muddy bottom. It can hardly have lived in strong currents.In the proposed alternative aspect it could have coped with much stronger currents which might have rendered weed or barnacle attachment more difficult, but any such attachment would have been on the main shell rather than on the operculum or umbo.

Unfortunately the few samples of Gryphaea in my collection were chosen because of their unmarked appearance, so that they were not very helpful in resolving the matter. One shows some parasite attachment on the main shell, and all umbones are clear of marking, but it would be unwise to form conclusions from so few examples.

As a result, one afternoon last August a small party set out for Hock Cliff, a site on the upper tidal reach of the Severn not far from Fretherne in Gloucestershire where Gryphaea are particularly common, with the intention of gathering 100 specimens for examination at home, although tide, rain and mud ultimately defeated us and only 78 were collected. These were a very mixed lot, deliberately unselected, all dirty, some broken, 28 without opercula, 12 with umbones damaged or broken off, but all sufficiently complete to be identified as Gryphaea after cleaning.

Although not many were text-book specimens, they nearly all contributed some information when they were examined. First of all we had clearly collected two distinct species in nearly equal numbers, 35 Gryphaea arcuata, and 27 of a lighter species, the remainder being inconclusive, although this might be slightly misleading as there were more broken specimens that could have been of the less robust type. Gryphaea arcuata was clearly identifiable, comparing very well with the drawing in Plate 11 of 'British Mesozoic Fossils' (4th Edition), whereas the other had a thinner shell, umbo turned to a greater angle from the medial line, and a length to width ratio much closer to Gryphaea sublobata (Plate 14 of the same reference) although it is unlikely to be identical owing to the the time difference between the Lower Lias and the Bajocian where it is usually found. It is a pity that these differences were not noticed in the field as it would have been of interest to report whether they lived in separate zones or whether they were exactly contemporaneous. There was no sign that they had been mixed at that particular site by the action of present-day running water. The nearest Inferior Oolite is many miles away, and neither species shows any sign of tumbling down a stream bed.

It was surprising to note how many of the fossils were either complete, or were clearly broken only recently by present day processes of exhumation by weather and tide, the impression being that they must have been buried very quickly after death, before they could be broken either by scavengers or by being tumbled about by currents in the water. The implication is that these creatures lived on a soft bottom into which they sank very easily when they died, but this raises the question of how they remained above it when they were alive, unless they were capable of taking some action to avoid premature entombment. What better action can be envisaged than to press downwards with the broad operculum they all possessed to raise the main shell, followed by the use of the umbo to hook themselves out.

When shellfish are observed living in present-day environments, it is clear that they are prone to gather barnacles or other passengers including fronds of algae on their exposed shells, and where currents are not particularly strong some shellfish can become so encrusted that they are almost invisible on the bottom until they move. Weed and barnacle accumulation is not exclusive to creatures that live permanently submerged, as those in the intertidal zone can also be affected depending on the violence of the tidal regime. However, creatures in such environments usually have some means of attachment to solid surfaces for their protection, such as a recognisable pedicle, a capacity to cement themselves down, or to hold on tightly by suction, but after death these mechanisms give little protection against breakage before the shells reach the fossil record. Other creatures survive by burrowing into sand or mud, which might protect their shells after death, but it also prevents the acquisition of algae or barnacles during life, any such marks on isolated specimens of their fossil shells usually denoting a period of post-mortem exposure.

Barnacles and the scars or specks of calcareous cement where algae were secured, fossilize very readily with the shells that were their hosts, remaining very useful clues to their mode of existence when they were alive even for shellfish long extinct, provided they are found in unambiguous numbers. In this respect the Gryphaea were very interesting;

a Only three were found to have barnacle-like growths, one of which was most certainly post-mortem, as it bridged between the operculum and the lip of the main shell.

b Eight, including all three with barnacle-like growths, had evidence of algae on the operculum.

c Twenty-eight, including four from b. had clear evidence of algae on the domed part of the shell.

d A further ten had marks on the domed part of the shell that might have been algae, but were considered inconclusive for various reasons.

e Only three had clear marks of weed attachment on the umbo, one being from a. above.

f The remainder had no marks of any significance.

Whilst acknowledging that this might have been a statistically improbable sample, it is difficult to reconcile these observations with the concept of a sedentary creature that passed its quiet life umbo and operculum upwards, on a fairly solid floor that presented no danger of engulfment.

To me, it suggests an animal able to resist by its own efforts the continual prospect of early burial in the mud that became the present Lias, aided by its shape which presented a large flat surface downwards. It was clearly prone to occasional weed infestation on its exposed domed shell, although many would escape this because of the muddy conditions. There were probably isolated harder patches on their living floor on which an occasional specimen might be stranded in any aspect after death for long enough to acquire a posthumous weed or barnacle on other parts of their shells, but such events would be exceptional rather than normal. It would be an uncompromising environment for creatures less well adapted to it, which would account for the absence of predator damage.

The somewhat tentative suggestions in the early part of this article appear to have become a case that requires to be answered.