A GEOLOGIST'S APPRECIATION OF ECOS, FROME

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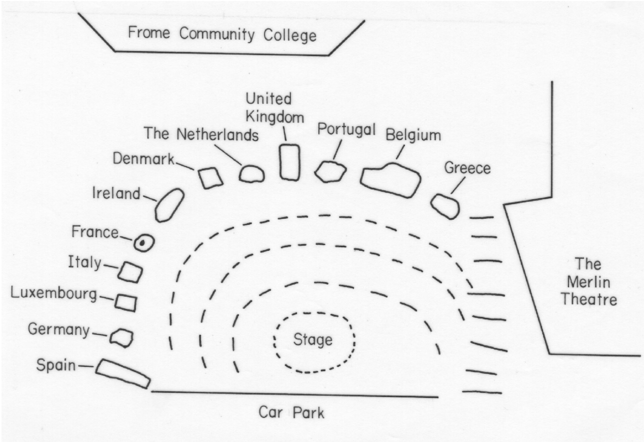
Less than a generation ago, when we considered the geological map of Britain, outcrops and 'Geology' stopped at the coastline. Offshore was left blank in ways which we would now regard as careless and a denial of connections which are quite a revelation when it comes to understanding structures and changes of facies. What becomes of Mendips limestone outcrops beyond Weston-super-Mare ? Do they link up with the stone of Steepholm? Can they be extended further to correlate with the Carboniferous Limestone of South Glamorgan and the Gower Peninsula? Well of course they do, but it took the exploration of our Continental Shelf prior to the North Sea developments of offshore oil production to make us more conscious of not just the obvious extensions, but also the less-expected occurrences of Chalk in a Bristol Channel we might have floored with simply Jurassic strata.

This a preamble to the acceptance that 'Island Britain' is a concept and belief acceptable to Shakespeare and some political parties but no longer to geologists. We are connected geologically with nearby Europe and our fellow geologists in the European political mosaic. If we accept this, then it follows that we will always applaud the vision which brought what is called The European Community of Stone to the town of Frome in 1992. More so than other towns in Mendip, Frome and its prosperity depend upon quarrying and the distribution of worked stone far and wide in Britain , so, if ECOS (European Community of Stone) was no more than a monument to the stone industry, it would have been appropriate to have those stone monoliths on the fringe of the Frome Community College campus, dominating the car parking space of the Sports Complex visited by so many local residents, especially the youngsters receptive to new ideas and awareness, *(photograph 1).*

In the late l980s, an idea grew in Frome Community College which had the vision to see that there could be common ties between Frome, in their words, "a modest town of industrious generous, and friendly people" and "similar towns throughout Europe" and make it a "place to plant, one from each country of Europe, a unique community of stones to symbolise a common purpose". (Grant Beswick, former Chairman of Governors). As an idea, ECOS caught the attention and support of Foster Yeoman, the quarrying company which as employer has much to do with the people of Frome, to the extent that they set in train the contacts and exchanges which informed their colleagues in the European quarrying industry to seek their support for the venture. They went to the extent of releasing their public relations officer, Peter Chapman, as an envoy, pressing home the invitation by a personal visit to explain the strategy. It was a successful commitment which won results when a letter, cold through the Post, might have been ignored. There was a rare



Photograph 1: The original amphitheatre

expression of unity between stone firms in that no fewer than eight of them joined forces with services and, in the case of Portland Stone, an actual stone for the 'community', representing Britain. Haulage firms connected with the stone trade also made an important contribution with the experience and equipment to transport large and unusual loads from the ports to the site in Frome. On site, special cranes and foundation-fixing firms were persuaded or paid to take care of safe mounting and setting of stones weighing possibly up to 30 tonnes. Altogether, it became a combined operation of near-wartime planning and execution.

The Canvassing and Persuasion

Peter Chapman kept a diary of his travels which has been the script for an entertaining geological travelogue. It makes the case, if it were needed, for those personal contacts when agreement to participate will involve time and money for the 'donor'. It also introduces a further element which was part of the ECOS community scheme, the involvement if possible of parties of school children from the donating countries in a celebration of the happening at the completion of the monument at Frome. Apart from quarry owners who figuratively spoke the language of stone, Peter had to address head teachers and parents and win their support. At times it reads like chapters from Graham Green and *Travels with My Aunt,* and would make an entertaining read if Peter chooses to use his retirement to set things down on paper. In no particular order, here is how it went.

For Spain, he flew to Madrid and then on to Vigo the historic seaport on the Galician coast. A few kilometres inland is the enormous quarry of Fernandez y Martinez de Granitos company, one of the largest granite quarries in Western Europe, at one time (1980-95) supplying its stone to most new building constructions to EEC countries including Britain. As a colour not dissimilar to Scottish Peterhead Granite, it still has a strong place in the market when architects seek a pink or pale red stone to match their client's specifications. Peter's presentation won the approval of Senõr Fernandez, and he was assured a 6m high monolith of Rosa Porrino Granite (Porrino is the inland village of the quarry site). None of the officials spoke English so Peter had the services of an interpreter, who proved invaluable in gaining the participation of a school in Vigo at the opening ceremony in Frome.

The visit to Germany was not so direct a contact with the eventual stone or the donor, but stands as success stemming from sound Foster Yeoman connections. Caterpillar provide a wide range of trucks and bulldozers which keep quarries active. They are also a multi-national company, and it was their network based upon Munich which took on the task of contacts, any offer of stone, and the transport to Frome. This was a situation which we might regard as the good fortune which seems to have accompanied the ECOS project. Had the choice of a national and representative stone rested with committees of geologists, discussion and disagreement might have delayed action. The whole matter might have been abandoned. Left to Industry and those who were moved by the scope and novelty of the idea, the outcome from twelve European countries was a selection which has many causes for satisfaction. Geological history and the growth of ideas which we now all accept as our working philosophy can be hung upon several of the donated stones.

The third stone in the semicircle is from Luxembourg, a small country, mainly known for its Jurassic strata and limestone. The stone sent to Frome, however, is simply called 'sandstone', which poses a problem of recognition. What kind of sandstone? And what age? These will be questions which need to be addressed by every geologist who looks at the ECOS display. Something for them on which to make up their own minds after a close observation and a weighing up of the alternatives. It would not be the first time that Luxembourg had posed a searching question.

No such problems associate with the next stone which is from Italy. The quarry source was the small town of Pontecorvo, some 80 miles south of Rome at the southern end of the province of Lazio. It lies on the slopes of the Apennine range, close to Monte Cassino. The limestone was selected from the stock of the company Perlato Coreno Marmi, and offered at a bargain price by a Director who was persuaded by the imagination of the scheme, including the involvement of children from Lazio.

The trip to France could have gone to the rich Jurassic terrains of Burgundy or the Loire Valley which provide so much of the French competition to our Bath Stone, but instead ended in the Palaeozoic limestone quarries of the Pas de Calais, another happy coincidence for the European connections embodied in ECOS as it stands in Frome. Ferques can almost match Frome in is dependence upon stone quarrying for its prosperity and sense of history, It even has a museum to quarrying and the kinds of stone which it sent to Frome. Another happy coincidence.

The Irish stone is an interesting link with the Yeoman venture in 1983 into the development of coastal superquarries in localities where suitable aggregate stone could be worked and loaded directly into bulk carriers moored at deep water anchorage. For Foster Yeoman, the site was Glensanda on Loch Linnhe, working the granite of Morven on the West Coast of Scotland. Other companies followed suit, opening up several similar superquarries on the shores of Bantry Bay, County Cork, a deep fjord-like inlet which has a place in the itineraries of Atlantic cruise liners. From that location came the slaty slab sixth in order in the semicircle. Irish through-and-through, it has been called 'sandstone' or 'quartzite', but is neither, so here is another test for a personal examination.

The geology of Denmark is almost entirely of varieties of Chalk with overlying Tertiaries and Pleistocene, but the Chalk monolith mounted here is unlike almost all of our familiar chalks. It is both harder, and more clearly fossiliferous. To get it, Peter had a visit to Faxe, a very large and ancient quarry on the southern tip of the island of Zealand, the island on which Copenhagen stands. Looking out over the narrow strait which is the main access to the Baltic Sea, Faxe Quarry has many associations. Its large floor area was served by a network of rail spurs worked by a famous collection of small steam engines, a place of pilgrimage for railway enthusiasts (many of them geologists when the International Geological Congress was in Copenhagen in 1960). The other fame has to be the nearby Brewery. Faxe Beer has qualities which geologists attribute to the nature of the local groundwater (naturally chalky and hard), which is an excuse for testing a bottle or two. The brewery, as is the norm in Scandinavia it seems, has always been a sponsor of archaeology and exploration. As much may be true of the quarry company, so it is a happy thought that the ECOS stone for Denmark came from Faxe.

When it came to the Netherlands, it would be a fair question to ask, 'What stone occurs in Holland that could stand up to Mendip weather?'. This would be to forget

Maastricht and the quite hilly region of the Netherlands where it borders the Belgian Ardennes. Nevertheless, the stone for Netherlands which was volunteered is like that of Luxembourg, not something which we could accept as 'flint', but comes from the soft cover sands of the glacial period in the Low Countries, and an excuse to debate and discuss the processes of lithification when we pass on to identifications later.

No problems with the identification or background to the stone which follows in the semicircle. Portland Stone was the obvious choice to represent the best of British building stones. The monolith from the quarries on Portland Island south of Weymouth not only figures the textures and fossils which make it recognisable in our grand and civic buildings, as much as in outcrop, but also bear the evidence of traditional methods of extraction from the massive beds if only to remind us of the techniques of quarrying which have lasted a span of centuries.

Portugal is well-known for its marbles from the district known as Estremoz, east of Lisbon and fairly close to the Spanish border. Quarries are concentrated in a triangle between Borba, Evora and Villa Vicosa producing mainly the distinctive pale pink marble Rosa Aurora (Dawn Pink). The visit won approval for ECOS from quarry companies and the Ministry of Culture, and the offer of stone from the company Marbrito, 12 tonnes of the Rosa Aurora type.

From Belgium came a large square joint block which has much in common at first with local Mendip Carboniferous Limestone. Could it be the same? Well again, this is a geological puzzle to be resolved by close inspection and some mild tests. ECOS is living up to its role as a challenge to geological awareness in addition to links which should be explored for the fullest community relationships through this stone amphitheatre.

Last of the original twelve stones representing the European community was a classic marble of antiquity; white marble from the island of Paros - Parian Marble. NO stone would be more appropriate for a typical Greek open air theatre if our climate were only more kindly. From its reputation and what it offers a sculptor, this could be the most valuable of the twelve stones to have acquired, but there was more to the project than the individual stone monoliths which we have catalogued. For example, the tiered banks of the amphitheatre focussing upon the stage platform involve the local Jurassic limestone from Doulting Quarry, the stone of Wells Cathedral and the Abbey at Glastonbury. Pavings and edge-holding slabs are from Carboniferous Coal Measure quarries producing the local Pennant Sandstone from the Bristol and Radstock coalfields. Two local contributions to the total effect, framing the more exotic stones "now assembled creatively to blend into and around the ECOS site to complement the expression of community unity" to quote the 1992 opening programme.

The Geology of the Individual Stones

The dominant effect of the tall monolith of Rosa Porinno Granite could in one way represent the popularity of this pink granite in British high streets and pavings between 1965 and the recent past. It can be studied as the paving to Leicester Square in the heart of London, especially if it has been raining. In Frome, however, the rough-riven and naturally fractured surfaces reveal the even-grained texture given by the two feldspars; one pink and giving the body colour to the granite overall, the other colourless. Whatever sunlight is available will produce a mirror reflection from the cleavage faces of the crystals. Glassy quartz forms a groundmass otherwise flecked by black biotite mica to complete the simplest mineral analysis of a typical granite for beginners in our craft.

In its European context, Rosa Porinno is an intrusion of Hercynian date, contemporaneous with our granites of South West England, but having undergone a degree of metamorphism when Galicia and Cantabria were later deformed during the Alpine Orogeny as 'older granites' when the Pyrenees were formed. No serious deformation, but just a hint that the feldspars may be lightly kaolinised. Intruded around 290 million years ago, it shares affinities with the granites of Sardinia, Brittany and Savoy as well as those of Cornwall and Devon.

The several surfaces of the Spanish granite are excellent for a close quarters study of the mineral make-up and texture of a typical granite. The size of the crystals tell of a slow cooling from a melt which probably rose to within 5 or 6 kilometres from the surface of the crust. If necessary, a light spraying with water will clarify this stone's details, as it will in the cases of the other 11 stones. The virtue of these monoliths must be that whatever your height, the surfaces are comfortably there for your inspection.

Coming to the German stone *(photograph 2)* alongside the granite, the first impression will probably be its squared shape, with surfaces pock-marked with deep and rounded outline cavities. Walk around it as you can, and it will emerge that there are at least five flat surfaces, giving it an overall hexagonalish cross section. It is then a single columnal from one of those Giant's Causeway style complexes which we recognise as a cooling pattern developed in thick basaltic lavas. Those pock-marks are gas escape holes as the entrapped gases broke through the stiffening external surface to the column. There can be powdery mineral deposits left in the cavities if you look.

All very familiar and text-book, but those near hexagonal columns should be cause for thought. First there is the perfection of their shape continued through what must have been a substantial flow (perhaps 2-3 metres thick?) We are told that columns develop about 'centres of cooling', shrinking inwards, the hexagon joint surfaces pulling apart from those adjacent. Why should they be so regular and equal-sized? Why should they persist through the flow from top to bottom? Why don't the cooling surfaces of top and bottom exert some influence upon their

Photograph 2: Germany - the basalt column from the Vogelsburg volcano

size as the lava chilled either to the air, or the base surface? Food for thought which you might like to ponder upon.

To turn to the source, some of the simpler questions about the nature of spectacular columnar jointed rocks, even their recognition as 'fossil' lavas, were asked by German naturalists in the 17th and 18th centuries, much as French contemporaries debated the character of black stones draping the slopes of conical hills in the Auvergne region of Central France. The Vogelsburg is a massive shield volcano to the east of the Rhenish 'slate mountains' of the middle Rhine, to the north of Frankfurt. It is situated at the northern end of the Rhine Fault Graben structure, crustal fractures which elsewhere have been the focus of volcanic outbreaks (the Eifel, or the nearby Spessart). The Vogelsburg columnar sheets were eventually seen to be formed in eruptions similar to those of Etna and Vesuvius as witnessed and recorded in the 18th century by Goethe and other early observers. They saw these Rhineland outcrops truly as evidence for volcanoes in past times. The eruptions were actually of Miocene age, a consequence of the crustal disturbances associated with the formation of the Alps many kilometres to the south. Geological history is here in Frome.

Questions have already been raised about the 'sandstone' from Luxembourg, its provenance and its identity. We might agree that the brown rock, bounded by rough joint surfaces, doesn't look like the average sandstone we might see in the Carboniferous rocks of the Somerset coalfields, or the Lower Palaeozoic successions of the Welsh Borderlands. For comparisons, we need to look to the sarsen blocks of the Newbury Downs and Avebury. Luxembourg sees its solid geology thickly mantled by deposits of cover-sands laid down when the Baltic ice sheets melted and sent millions of gallons of meltwaters to the North Sea Basin. Locally, those loose sands could be consolidated when mineral-rich springs bonded the grains into a tough sand rock. If the springs were silica rich what we term sarsen is the resulting rock, hard and flinty, perhaps one of the toughest of rock types. As such, sheets of sarsen are quarried and split in Holland and Belgium to obtain the regular shaped setts which make their roads such a nightmare to walk or cycle upon. Just as the loose sands unaffected by spring impregnations can contain pebbles and rock chips, look for similar inclusions in this third rock of the ECOS semicircle.

For Italy, we have a fine grained limestone, Perlato, which sits on the borderline between limestone and the true marble as recognised by geologists. For them, the limestone has had to be refined and changed by crustal heat and pressures to be recrystallised, truly changed in form literally to qualify as a metamorphic rock type. That could have been the history of the stone from Pontecorvo, a locality on the foothill slopes of the Southern Apennine mountains several hundred kilometres south of the source of most Italian marbles, Carrara. But that area lay closer to both intrusions and areas of intense deformations with the crustal energy to transform. Evidence of that lower intensity of change rests with the presence of traces of fossil shell in the ECOS block. In age, the stone is early Cretaceous, but in character, the stone is quite different from the Chalk which is our time-equivalent.

As mentioned earlier, there is a happy coincidence in the choice of the stone for France *(photograph 3).*

Photograph 3: A French visitor examining the Devonian karst block perched on a base of Carboniferous Napolean Marble, Ferques, Pas de Calais

To find the source, we need only cross the Straits of Dover and travel a few kilometres south of Calais to come upon what are in geological terms the French Mendips. Beneath a blanket of white Chalk lie fold structures which bring close to surface rocks of Carboniferous and Devonian ages, mainly crystalline limestones, the Carboniferous limestones rock types which would not look out of place in Torr Quarry. It is one of the shrewder speculations in Geology which made Godwin-Austen mentally connect the Mendip folds with South Wales, and then adventurously take the same folds and successions eastwards beneath the Chalk of Wiltshire and Salisbury Plains, and then beyond to underlie the Weald of Kent and the Channel Coast. Borings in Kent, with faith, proved the coalfield which was a replica of the Radstock Basin, containing those high Coal Measures which in Kent, were classified Radstockian on the basis of their fossil flora. In France, those deep folds are but an extension of the Mendip folds and the structure of the Hercynian Front passing through Western Europe. The stones brought to Frome are actually representations of two elements in the Ferques sequences. On top, the 'doughnut' shaped block is actually a waterworn slab which is the weathered top surface encountered when the Chalk cover is stripped back. The waters draining from the Chalk aquifer, have created a karstic top surface, a kind of limestone pavement to compare with surfaces at the top of Cheddar Gorge or Charterhouse. The parallels continue to build up the longer we go on, to the satisfaction of the ECOS dream of 'community'.

The top stone is a Devonian limestone which may reveal fossils on closer study. Below, the darker limestone is much like Black Rock, but is less crystalline. Indeed, it may be more akin to what Reynolds and Dixon would have called 'porcellanous' or 'chinastone' the outcome of shallow water marine conditions in which algae played an important rock-forming role. In France, this is a stone called Napoleon Marble for historic and sentimental reasons. It was on the cliff tops nearby that the Emperor marshalled his Grande Armée for the projected invasion of England before his better judgement made him call off the venture. Disarmingly, the French celebrate the occasion with a monument on the cliff top and the naming of this limestone. In many city centres, polished, it has the character of 'marble', taking and retaining a high surface finish and revealing cloudy outlines of calcareous algae in its 'figure'.

In the far south west of Ireland, beneath a thick cover of Old Red Sandstone, there are equally thick outcrops of Silurian greywacke and mudstones in a facies comparable with the rocks which we see in Cardiganshire. In both areas, we are seeing rocks which were deposited by turbidity currents in deep elongate basins. In both areas too, they are rocks which have been mildly changed by pressure during folding to assume a cleavage. Some of the surfaces of this irregularly shaped block are cleavage planes. Some areas are decidedly flinty, possibly giving rise to the suggestion that this is 'quartzite'. It isn't, in the normal sense of that term. It is a stone which is used as a mass aggregate material and traded as such from one of the Irish superquarries worked by Wimpey Associates.

The creamy white stone *(photograph 4)* alongside is the Cretaceous limestone worked in what amounts to Denmark's superquarry at Faxe. A source of a pure calcium carbonate, it has several industrial uses other than cement making. It is a pure chemical lime, as well as a powerful aquifer for the water supplies of the island of Zealand and Copenhagen. The striking feature of the ECOS stone must be the richness in fossils, some in section within the rock, but many standing out from the weathered surface like a fine spaghetti. These are bushy colonies of bryozoa which are one element in animal life which created reef banks on the Cretaceous sea floor. Bryozoan and algal reefs are one of the visual features of the worked faces of this important quarry. Important for the record of Chalk of much later date than zones which we see in Britain other than some outcrops in North Norfolk. The level is called the Danian. So, apart from revelling in the fossils which you can see, here in Frome you have fossils which you would not see elsewhere in Britain. If the equivalents were deposited at the time, they were later eroded by the advances of the Tertiary seas.

Photograph 4: Bryozoa in the stone from Denmark

The dark monolith alongside the Faxe Chalk is the stone from the Netherlands, and, as for the stone from Luxembourg, this is a sand rock which we might call sarsen, with the same history of cementation by siliceous groundwaters to create a flinty stone from unconsolidated sands. The same Pleistocene outwash sands covered Holland, Belgium and Luxembourg to make this secondary siliceous stone possible. When the cover materials were gravels, the sarsens are pebbly and conglomeratic. When the groundwaters were iron rich, the result is what we call ferricrete.

At a height of about 4 m, the monolith of Portland Stone dominates the semicircle of stones and represents the United Kingdom, *(photograph 5).* The four faces contain the basic facts on which we would expect to recognise this limestone and distinguish it from all others. First, the weathered surfaces darkened with time make clear its oolitic texture and overall even-grained character which make it a perfect 'freestone', capable of being dressed or carved equally well in any direction from the block. There are also traces of oyster shells which give an idea of the bedding within this block and testify to the relatively

Photograph 5: Portland Stone from the UK

shallow water origin for the Jurassic stone. Look closely and you may detect a small chert nodule, a feature which renders the stone less commercial when its outcrop is followed from Portland Island onshore and into Purbeck. The side faces are scarred by the short drill holes which allow the large quarried blocks be split using the traditional plug and feathers wedges which do minimum damage to the valued stone as it is worked to desired slabs. The problem posed has to be to detect and decide the direction of bedding.

In 2004, a further example of Portland Stone was added to the overall plan for ECOS when the sculptor, Barry Cooper, fashioned a massive carving of a Holm Oak leaf from another 4m block, set alongside eleven oak saplings to signify The Tree of Life. The worked surface of the stone as opposed to the natural surfaces of the originally mounted monolith allow study of smooth worked surfaces and reveal the wealth of fine shell debris which this high energy limestone represents.

The slightly triangular outlined block alongside the Portland upright, gives us a full appreciation of the characters of a true marble (in the sense appreciated by a geologist). The blush pink surface colour is flecked with small red crystals which are evidence of the recrystallisation of the original limestone. Flat surfaces show slickenside grooving which demonstrate compressive stresses. These features are signs of the metamorphism which this Cretaceous limestone has undergone as the Spanish-Portuguese outcrops were folded and intruded by granite bodies as the regional expression of Alpine folding in the Miocene. It is typical of the rose-pink marbles of the Estremoz district of Eastern Portugal. There are faint grey veins running through the rock, and when wetted, the slightly blurred outline of calcite crystals make up a typical marble texture.

The bluff upright which represents Belgium is a stone which might well have come from a Mendip quarry as fossils prove it to be Carboniferous Limestone. Shells of thin brachiopods, corals, but above all, the tiny perforate discs which are crinoid stem ossicles will be familiar to anyone who has studied the limestone crags of Burrington Combe or Cheddar, but there is a difference. Vein surfaces on the block are of crystals of dolomite. If the stone were tested with weak hydrochloric acid (with the care required by Health & Safety regulations these days) there would be a disappointing lack of reaction, or at best, only mild effervescence. The original carbonate has been subsequently altered to the double carbonate (magnesium/calcium) a process which can take place soon after the lime mud has been deposited, or at a later date when limestones are involved in the introduction of mineral veining. The stone comes from the massive cliff outcrops which occur in the Meuse Valley around Namur, a setting which matches the familiar Avon Gorge or any of the Mendip canyons. Once again, ECOS is pointing up the thoroughly European unities which exist across our region and into the terrains beyond the Straits of Dover.

The final stone of the array is relatively small and slightly unrevealing of its geological character. It is, however, a Greek marble which was one of the most sought-after stones of antiquity. Parian Marble vied with the white marble from Mt. Penteli closer to Athens. That marble, however, is more closely jointed, restricting the size of the block which can be extracted. On Paros, there were no such limitations, hence the flourishing school of sculptors which worked the stone from Bronze age to a peak around 750BC. Paros is one of the Cyclades, a pattern of islands which swirl in the complex created by the Mediterranean structures which result from the collision of Africa with Europe. A consequence of that turmoil was the pure white marble interbedded with graphite and schists which testify to the high grade of metamorphism. The purer marble seams were mined into the heart of Mt Profitis Elias which rises to 771m in the centre of the island. The surface of one side is coated with a stalagmitic screen and a small breccia of recemented marble fragments, all located on what was a joint surface in the quarry.

A Final Appreciation

For the intended purpose of the ECOS project, it would be difficult to make a more practical or significant choice of stones. Had it been left to committees of experts, be they geologists, or members of the stone industry, it could have taken ages to accomplish and created all manner of disagreements. This has been the reality of several projects intended to express a harmony in which I have been despairingly involved. What seems a near miracle is the diversity as well as the links which the stones donated and acquired highlight between Frome and Mendip and nearby Europe. Take the structures which link Mendip with the Pas de Calais, and the Meuse Valley. Take the sarsen stones which link Wiltshire with Luxembourg and the Netherlands, where an identical process has produced recognisably identical end-product rock types. These are but two lines of thinking which will be valuable to teachers, over and above the practical lessons which each stone will present when looked at, as all Geology requires, face to face and touchable. We are an observation science, for which personal contacts are all important and in which our own judgments are paramount. ECOS will allow this to take place.

Finally, many of the stones evoke the arguments and debated issues which are the history of our science. Faced with the questions, we can marshal the facts we observe and come to a conclusion on a weight of evidence which we have compiled. It may be that we will contest what may have been the orthodox conclusion. Anyone may challenge what I have offered as truth, and that challenge would be a welcome sign of the stimulus of the ECOS stones.

In 2002, when the enlargement of the European Community was announced, we anticipated that this might bring a further contribution from the new member states. What would we receive form Poland, Bulgaria, Rumania, or the Baltlc States let alone those fragments of Yugoslavia? Would there be room enough for Malta, or even Cyprus if it sorted out a union? Well it didn't happen in that way. The amphitheatre is completed with a screen of oak trees which seems a divergence from the stated aim of the 1992 celebration at the opening. Then it was said, *"Provision can be made to introduce further monoliths from other countries as and when they join the European Community"*
At that time, what had been achieved won recognition in a Duke of Edinburgh's Award. What stands today deserves a continued commendation by Geologists. Use it!

Godwin-Austen, R.A.C. 1865 *Possible Extension of the Coal Measures beneath the south eastern part of England,* Q.J.G.S. 12, pp 38 -73.

GEOLOGY HOWLERS FROM RECENT 'A' LEVEL EXAMINATIONS

In naming a faunal group which became extinct at the K/T boundary:
• "woolly mammoths", "pilchards"

Regarding rock, field and map descriptions:
• "limestone is an igneous crystalline rock"
• "the sill at Wards Hill has changed the relief by inturding into the surrounding area"
• "the difference in dip angles is 443^{0}"
• "young rocks contain coral, older rocks contain cheddar"
• "granite is a sedimentary rock"

In response to an essay on volcanic hazards, many students confused their case studies:
• "as a volcanic tourist attraction, Montserrat erupts like clockwork every 45 minutes"
• "Mount St Helens' main industry was fishing, and the volcano killed the fish, but the island was enlarged by 1/3 due to ash"
• "Mount St Helens is a volcanic tourist attraction in the Pacific ocean"
• "Many prediction methods were used on Mount St Helens, however one thing they couldn't prepare for was the actual blast which helped in the killing of 68 people"
• "Redirection of lava was used when the Helsinki volcano erupted on the tropical island Hawaii"
• The volcano formerly known as Monserrat is now "MONSTER RAT"
• a couple of students used the film Dante's Peak as their case study!

Name a geochemical method for locating minerals:
• "a metal detector"

In naming the Palaeozoic era:
• "Andezoic" "Pleistocene" "Densazoic" and "Caledonian"

Why did the dinosaurs die out?
• "disease spread though the dinosaurs causing a lot of them to die very suddenly, especially the living ones".

What is kaolin? Kaolin is so well known that everybody has seen it in a poultice, and I shall not waste the examiner's time describing it in detail. I expect the examiner has seen quarries of kaolin too, and probably could say how it was formed better than I can.

Mica: It is well known through the use of formica table coverings that mica can be split horizontally but not along the vertical plane.

Know your Fossils!
• This epifaunal shrimp-like creature has an exoskeleton of many parts. If it dies before it is eaten, its potential for preservation is fairly low.

• Lemmings all tend to migrate to the sea together for no apparent reason. Could dinosaurs have done this?

• In the USA dinosaur bones have been found 2 - 10 metres below the pollen grains on which they fed.

• It would be pointless for swimming, floating or burrowing trilobites to have legs, so any fossil with legs will be a benthonic one.

• The geologist has no way of knowing whether a fossilized organism could have bred to produce its own offspring.