ITINERARY FOR FIELD VISITS TO THE ST AUSTELL GRANITE AREA BY EDUCATIONAL PARTIES

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Itinerary for field visits to the St Austell granite area by educational parties

The St Austell granite is one of the most interesting granites in South-west England, with field visits being a splendid way of instructing of student parties in granite geology and related subjects such as geography, geomorphology, economics and environmental science. However, in recent years, Health and Safety considerations have made visits by educational parties into the active china clay workings, other than to specific viewing sites, impossible to arrange. Also, the demands on china clay company staff time for these visits are such that, realistically, only a proportion can be accommodated (Imerys tel: 01726 818000 and Goonvean Ltd: 01726 822381).

In order to overcome these problems an itinerary has been devised which allows parties to see the china clay areas, without needing to visit restricted areas at all. Essentially the party can freely follow this itinerary at any time, within the limitations of the opening hours at Wheal Martyn Museum ("The China Clay Country Park"). The entrance fees for parties visiting the Museum can be found by telephone (01726 850362). It is helpful to book in advance and in some instances a guide can be provided by the Museum (for the Museum grounds only).

This general purpose itinerary is not intended as a handout for students; the party leader should prepare his/her own handout tailored to the educational level of the party being led, using the information provided by this guide and, where appropriate, the references quoted in it.

It will be helpful if the party leader is familiar with the following book, which will provide a useful briefing on the sort of topics which can be dealt with:

Bristow, C.M. 2006 **China Clay – a geologist's view: geology, minerals, environment and world kaolins.** ISBN 1 900147 459. Published by Cornish Hillside Publications, St. Austell. pp60. Price £7.99, obtainable from all good bookshops and from the Wheal Martyn bookshop (add £1.50 for P. & P.).

The following book will also help in describing the china clay industry (as it was at the time of publication):

Thurlow, C. 2005 **China Clay from Devon and Cornwall.** ISBN 1 900147 42 4. Published by Cornish Hillside Publications, St. Austell. pp64. Price £4.95, obtainable from all good bookshops and from Wheal Martyn bookshop (add £1.50 for P. & P. if ordering separately, only one £1.50 if ordering both).

The 1:50,000 geological map for **Bodmin and St. Austell (Sheet 347)**, published by the British Geological Survey will also be of help for the more geologically inclined groups.

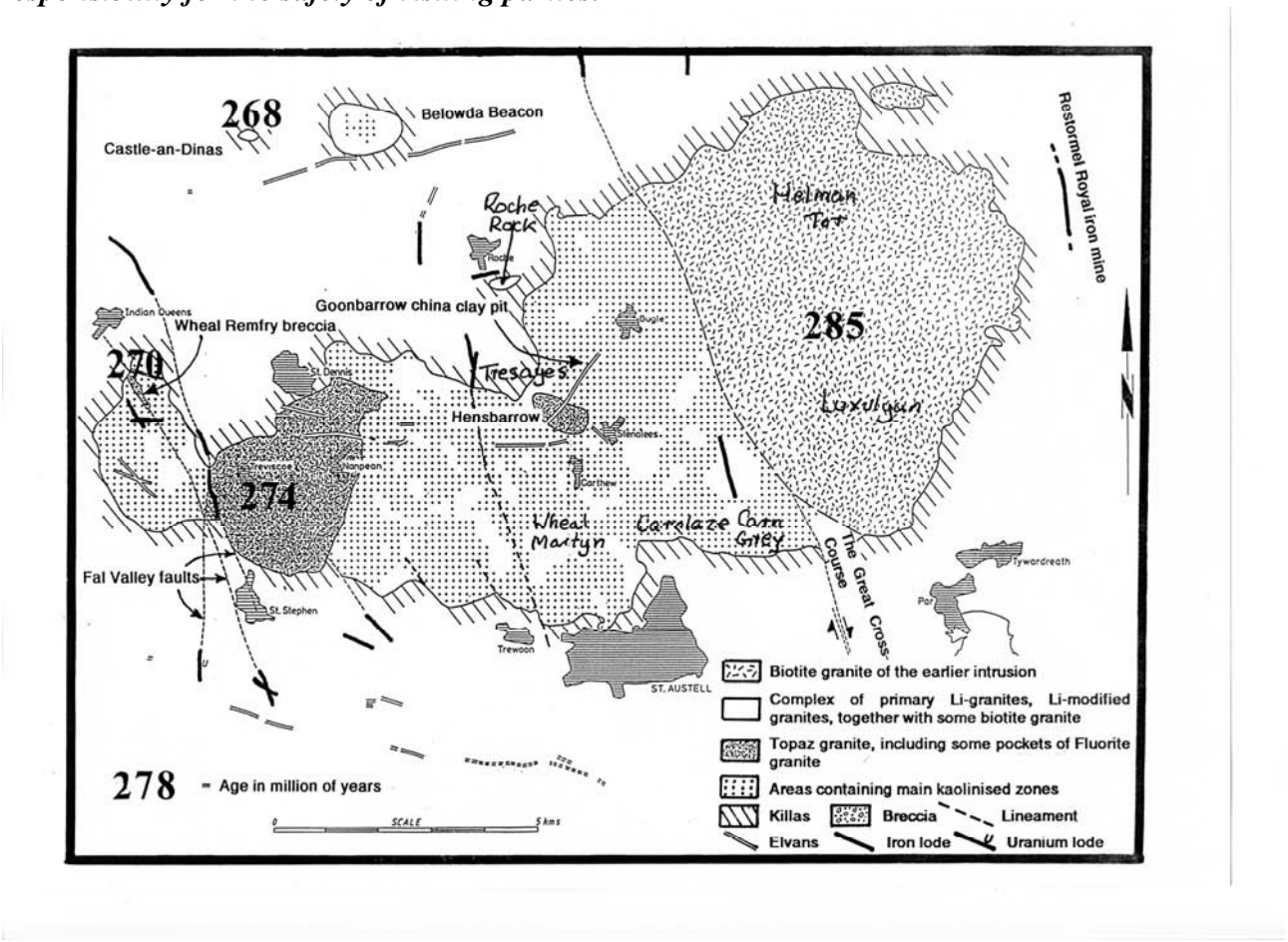
By reading these books the party leader should have enough background knowledge to lead the party and answer most commonly asked questions. The sort of topics which could be covered include:

- How granites are formed and how they flow into place.
- Different types of granite
- The minerals found in a typical granite.
- How mineral veins are formed, including those containing metals.
- How granites can be altered to form china clay.
- Geomorphology and landscape in granite areas (moorland, tors, planation surfaces, etc.).
- Environmental impact of metalliferous and china clay working.

- The ecology of former china clay workings.
- Economic history, especially the industrial revolution.
- The economic factors controlling tin and china clay working.
- Renewable energy.

Obviously the type of group (primary, secondary, college, university or leisure interest) and the subjects being studied, together with the curriculum, must be taken into account in devising the kind of explanation offered by the leader of the party and also the emphasis placed on the different aspects. What may seem obvious to a party of University geology students, will probably be way over the heads of a 10 year old.

Some of the localities have hazards associated with them and party leaders must make their own risk assessment and assume responsibility for the safety of their groups, because what is safe for one group may be hazardous for another. The publishers of this guide cannot take any responsibility for the safety of visiting parties.



STOP 1 – Carn Grey granite quarry.

At the second roundabout on the A391 down from the top of the hill at Carclaze, east of St. Austell, take the exit marked Trethurgy and Luxulyan and proceed towards Trethurgy. About 0.5km before Trethurgy, a gravel track on the left leads to a small parking area (SX 035/551) for about half a dozen cars (see Google photo). This parking area is not big enough for a coach, which should either be left on the road or there is a parking area behind the village hall a few hundred yards on the right further towards Trethurgy).

Take the left hand footpath from the parking area and walk westwards towards the quarry – about 100 m or so.

This quarry is an Site of Special Scientific Interest (S.S.S.I.) in granite. Because it is an S.S.S.I. hammering is not allowed. For younger parties it is important to explain that granites were once so

hot that they melted and could flow, the crystals were formed as the granite cooled. The Cornish granites flowed into place many kilometres below the surface between 285 and 270 million years ago in the period of geological time known as the Permian. Volcanoes probably formed above where the granites were moving into place, all long since removed by erosion.

Carn Grey granite is an intermediate type between the coarse grained biotite granite of the eastern part of the St Austell granite intrusion and the unusual biotite-deficient granites of the western part of the intrusion, which host most of the china clay occurrences (see map attached). It has the texture of the western granites but the chemistry of the eastern granite, so it contains the dark coloured iron-bearing mica called biotite. The make-up of the granite should be noted – try to identify quartz (grey), biotite mica (shiny black) and feldspar (creamy white). Note the large creamy white phenocrysts of feldspar. Prominent jointing is another noteworthy feature. Some minor tourmaline veins can be seen.

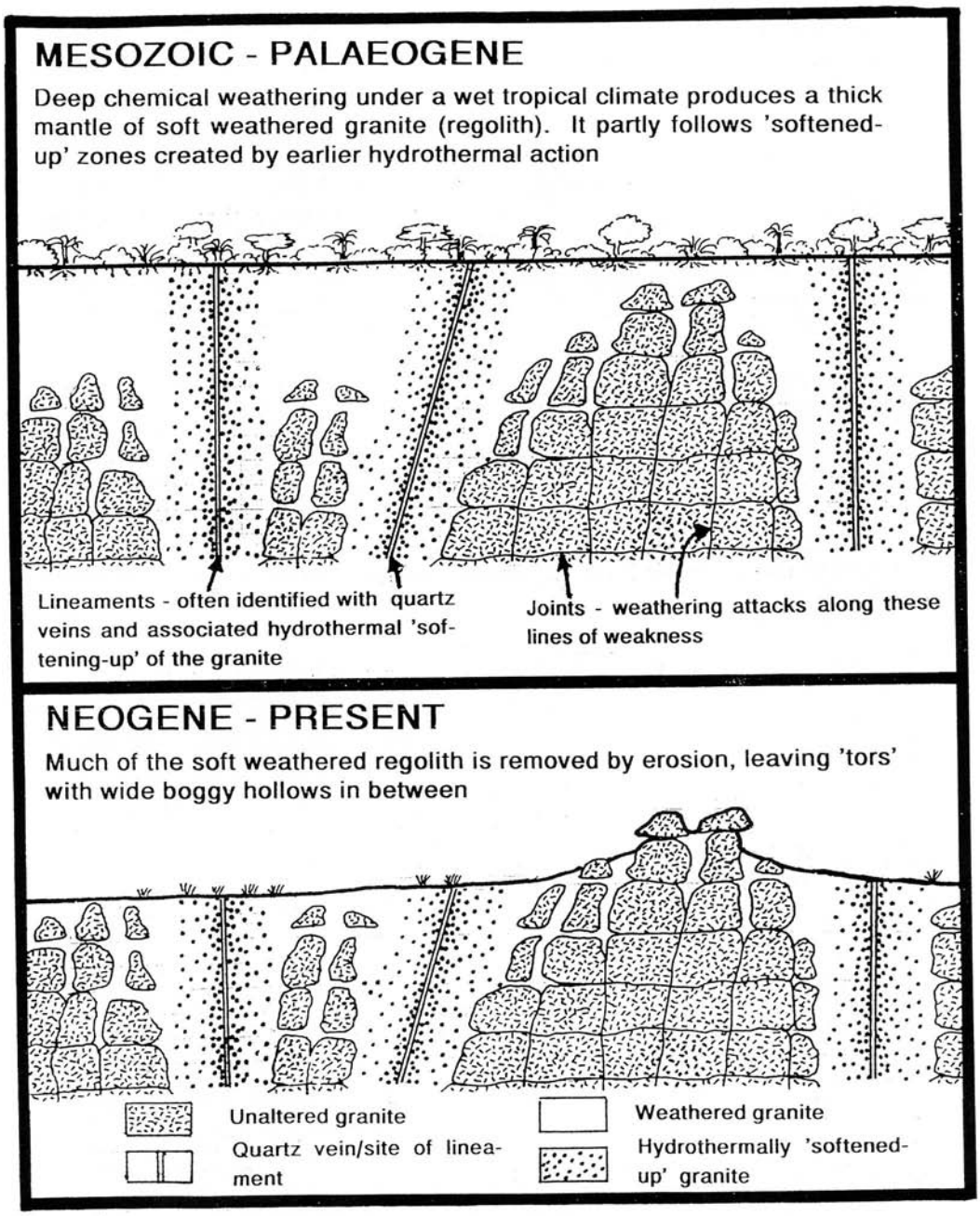
Many of the older buildings in St Austell, such as the Market House, were built with granite from this quarry. Note that this was a dimension stone quarry used for producing building stone, as

opposed to an aggregate quarry, which produces crushed stone for concrete or asphalt. It may be worth asking the party to speculate on how long since the quarry was last worked (up to the 2nd World War) and to discuss the ecology of the recolonisation by vegetation.

For the serious geological party the following reference will be worth consulting, notably for the remarks on the mineralogy and petrogenesis:

Floyd, P.A., Exley, C.S. and Styles, M.T. 1993 *Igneous Rocks of South-west England – Geological Conservation Review Series No. 5.* Chapman and Hall. Pages 187-188 cover the Carn Grey S.S.S.I. This book also contains a series of general reviews of SW granite geology with some helpful diagrams.

By returning to the car park and taking the right hand footpath one can skirt around the northern rim of the quarry to the tor, which is the Carn Grey (Grey rock). ***Beware of the unprotected quarry edge.*** How tors were formed is shown on the attached diagram. Many of the granite megaliths in this area (Penrice, Karslake [now at Roche] and the Tristram Stone near Fowey) are of the Carn Grey granite type – why is this?



From the tor one can obtain a superb view across the eastern part of the St Austell granite, including Helman Tor and further away (on a clear day) to the northeast it is possible to see the granite upland of Bodmin Moor, including the two major tors of Rough Tor and Brown Willy.

If the party wants to walk to the next locality and send their transport round to the parking area for Stop 2, take the small footpath westwards from the tor, pass through the style in the hedge, bear right and then follow round to a gate. From there ascend the grassed over sand tip in front of you to a group of stones at the summit of the tip. Note how well the vegetation of grasses, heather, gorse with the occasional rhododendron has colonised the sand tip. A scene from the TV programme '*The Natural History of Britain*' was shot here. From the top of the tip a view westwards shows Carclaze pit. The history of this pit is dealt with in the explanation for Stop 2 and Diagram 1.

From the summit of the tip descend southwards and follow round the perimeter fence to Stop 2, noting the way vegetation is re-establishing itself on both the faces of the china clay pit and the tips to the south. It may be worth at this point initiating a discussion about invasive non-native plants – such as Rhododendron, Japanese knotweed and Himalayan Balsam – and the problems they can cause.

STOP 2 – Carclaze pit

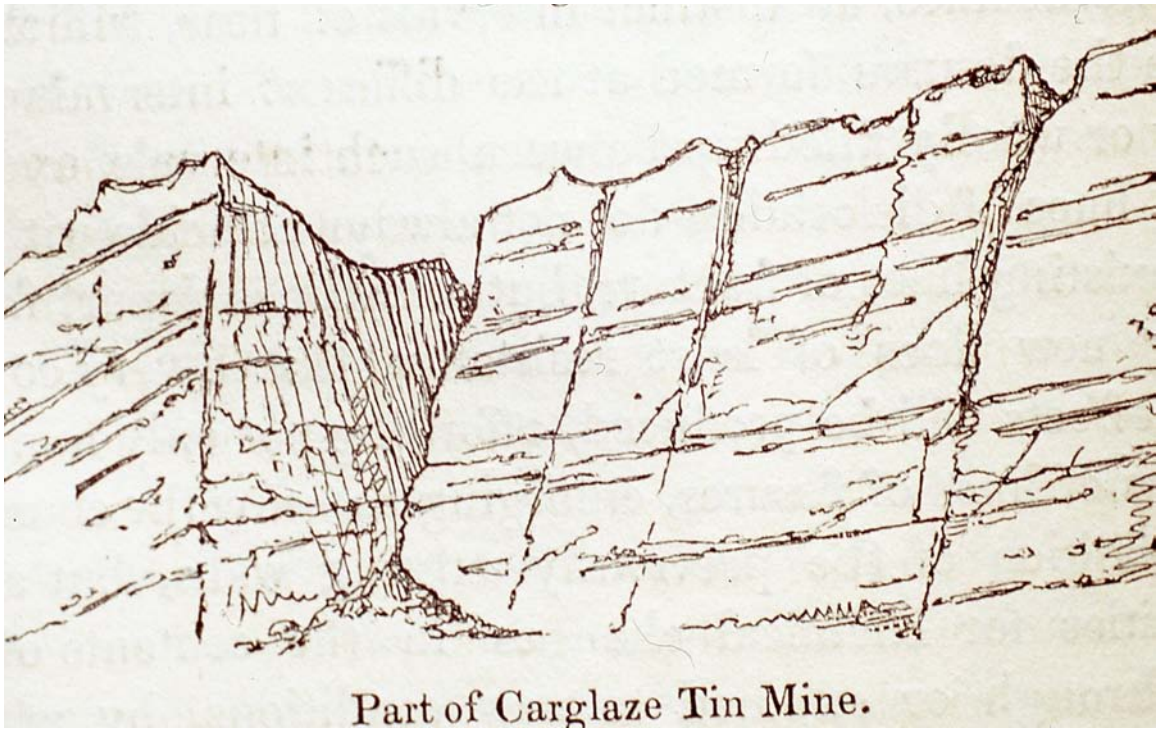
At the top roundabout on the A391, opposite the Carclaze Inn take the minor road to the west, and after about 50 yards, turn right onto a minor road (signposted 'Scredda')and then after another 80 yards turn right again into a road labelled as a cul-de-sac (shown on the attached satellite image). Proceed for 100 yards and there is adequate parking on the right for half a dozen cars or so on the old main road at SX 021/548 – make sure you have an up-to-date map as the adjacent A391 is new. Coaches may have difficulty turning round, so may have to back out.

A footpath leads down to the A391, cross with care as this is a busy road. Follow the footpath up the other side until a T-junction with the Clay Trail around Carclaze pit, turn left and proceed for about 30 yards to where it is possible to look down into the pit (SX 022/549). On the right hand side the south face of Carclaze Old Tin Pit can be seen; ahead and to the left all the workings were for china clay. The Old Tin Pit is described in the following publication, the abstract is also given below:

Bristow, C.M. 2008 Late 18th and early 19th century forays into economic geology – some little known Franco-German papers describing Carclaze Old Tin Pit, near St. Austell, Cornwall. *Geoscience in south-west England*, **12**, part 1.

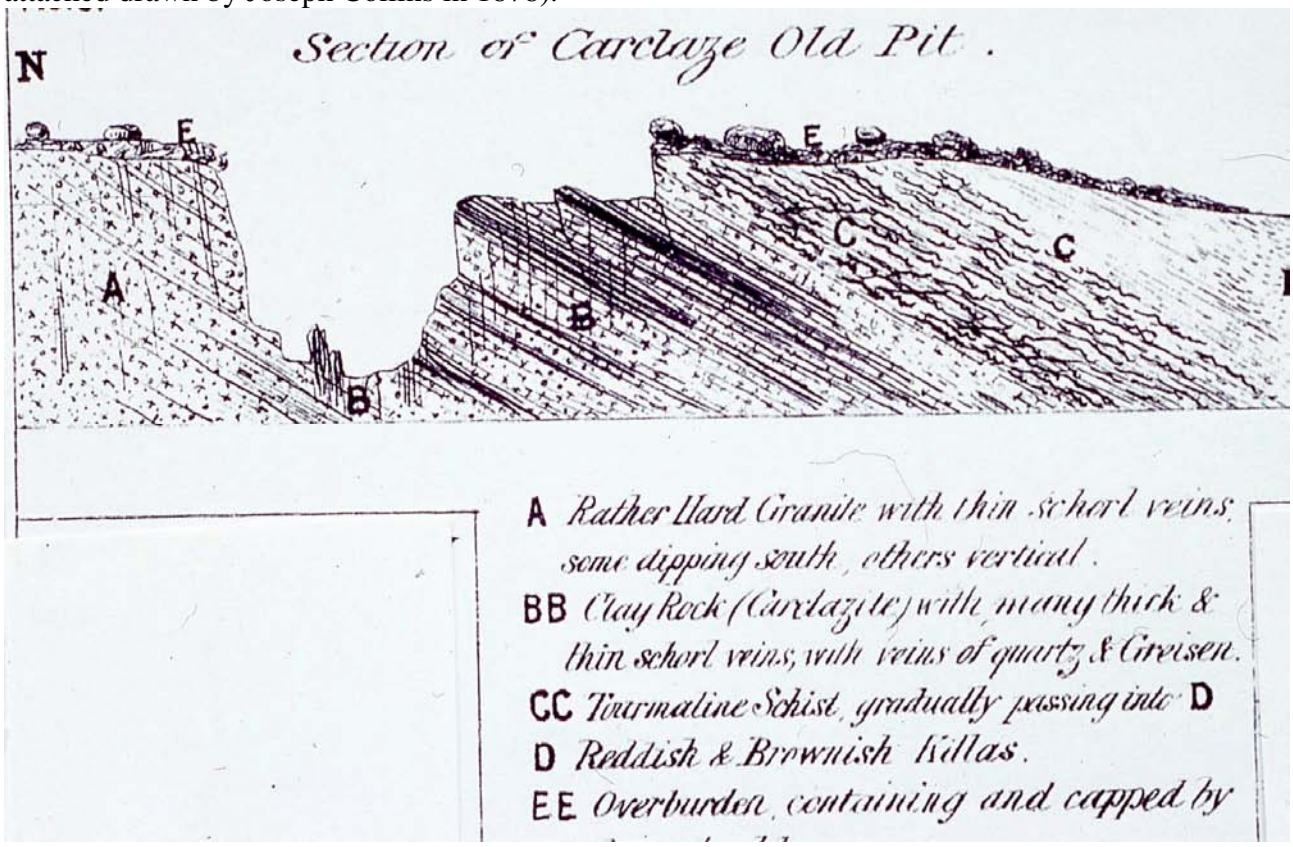
Carclaze Old Pit lies on the southern boundary of the St. Austell granite about 3 km NNE of St Austell. It probably originated from tin stream workings in the Sandy Bottom valley following a rich source of tin to the crest of the hill, where a massive stockwork consisting of a tin-bearing greisen-bordered quartz-tourmaline vein swarm, adjacent to the granite margin, was developed by an open pit. This was a 'must-see' site for late 18th and early 19th C geological visitors to Cornwall and there are many accounts and illustrations describing the pit and the method of working. The earliest scientific account was by a Frenchman, M. Jars from the Académie Royale des Sciences de Paris, who visited the pit in 1764. This was followed by other Frenchmen: Bonnard in 1803, Dufrénoy and de Beaumont in 1824-7 and Daubrée in 1841. Von Oeynhausen and Von Dechen from Germany provided the first geological map and cross-section of the pit in 1829, showing the layout of the veins. These accounts show a considerable understanding of economic geology; they are reminiscent of what would be called a 'feasibility study' today. They suggests that, in parallel with the development of stratigraphic geology and palaeontology mainly led by British geologists, there was a development of metalliferous economic geology, mainly led by French and German scientists. The earliest account of the pit by an English author was by Adam Sedgwick in 1822; in later publications in 1831 and 1835 he speculated on the formation of parallel vein swarms and schorl rock, partly based on his observations in Carclaze Old Pit. De la Beche provided a pen and ink sketch of the south face of the pit in 1839. Tin extraction from the Old Pit had practically ceased by the mid 19th C as production switched to china clay. These accounts also show how the technology of the early china clay industry evolved from large scale open pit tin operations. Below: Thomas Allom's lithograph of 1831.

The south face of the old tin pit, possibly dating back to the time that De la Beche sketched it (below), can be seen on the right hand side of the pit road.



Part of Carglaze Tin Mine.

If 19th century accounts are to be believed, around £100 million worth of tin was extracted from this small pit of 2 hectares; all the workings to the left were later and were for china clay. The south face of the old tin pit can also be seen from the viewpoint on the top of the tip described earlier. The steeply southward dipping veins of the stockwork can be seen in the face (see cross-section attached drawn by Joseph Collins in 1878).



The contact between the granite and the rocks of the metamorphic aureole also dips southward parallel to the veins of the stockwork and is near the top of the face, but is very difficult to pick out

because of the intense kaolinisation. This is planned to become a RIGS site but, at present, Imerys cannot allow access.

Notable features of this site are:

(1) Carclaze was one of the largest open pit tin stockworks being worked in SW England in the late 18th and early 19th centuries and it provided a uniquely informative location for early geologists to develop concepts concerned with the alteration of granites and metalliferous mineralization. The pit was a 'must see' site for late 18th C geological visitors from the continent and was visited by some of the founding fathers of geological science, such as Rev. Adam Sedgwick and Sir Henry de la Beche, in the early 19th century.

(2) The evidence from Carclaze indicates that the kind of practical economic geology which a present-day geologist working in the extractive industry would be familiar with, was evident in the late 18th and early 19th century accounts of Carclaze by French and German scientists. It could be argued that the rôle that this kind of geology played in the inception of geology in this country has not been sufficiently recognised.

(3) The 500m long underground canal at Carclaze, possibly constructed as early as the first half of the 18th C, is a strong candidate for the earliest underground canal in Britain. 16-18 small barges chained together took the ore from chutes under the pit bottom through a 500m long underground canal (adit) to a processing area further down the hill towards St Austell. At the lower portal of the canal a crane lifted each barge up in order to discharge the ore for further processing.

(4) Much of the 19th C open pit mining technology for china clay was inherited from the local open pit tin mining industry, which had developed it in the latter half of the 18th century. This greatly aided the rapid early growth of the china clay industry.

(5) The success of the Carclaze open pit operation for tin in the 18th C was crucially dependent on the engineering of an elaborate water supply system which provided both the power to crush the tin ore in 'Stamps' and the process water (renewable energy). It is worth asking the group to speculate on what other sources of power would have been available in the mid-18th C (Human, animal or wind – steam was, at this early stage, prohibitively expensive because of the prodigious quantities of coal needed for the early Newcomen engines).

(6) The unique historical associations with some of the founding fathers of geological science and the innovative mining engineering at Carclaze, mark it out as a significant part of the industrial heritage of Cornwall, representing pioneering developments at an early stage in the Industrial Revolution.

From this viewpoint proceed in a northerly direction along the Clay Trail for about 130 yards. A bank on the left exposes kaolinised granite *in situ*. It is worth asking the group how a solid granite like that in Carn Grey quarry can be converted into a soft, easily disintegrated rock which we see here (circulating water – for further explanation see the China Clay book).

A few veins can be seen *in situ*, these are composed of quartz and tourmaline. Several generations of veins in different directions are to be seen, indicating that stress directions changed between the two generations.

Return to the parking area and then rejoin the A391 and continue northwards on it for 1 km to a complex of mini roundabouts, turn left and continue on the A391 for a further 1.5 km to another roundabout (with a clayworks monitor on the north side). Turn left onto the B3274 and continue

down the hill through the village of Carthew. About 0.5 km south of Carthew on the right is Wheal Martyn Museum.

STOP 3 – Wheal Martyn Museum

Wheal Martyn Museum is dedicated to explaining the history of the china clay industry and has many displays and major artefacts such as clay dries, waterwheels and pumps, etc. A viewing platform allows visitors to view the currently active Wheal Martyn china clay pit.

After the entrance through the shop, a display presents the history of the china clay industry and various features associated with the present industry. Various 'talking' models tell their stories. It is worth trying to get a group to be quiet long enough to hear what William Cookworthy and the Kettle Boy are saying.

After leaving the display follow the signs past the large waterwheel. This is on its original site and provided the power via 'flat rods' for a pump in Wheal Martyn pit. Follow past another smaller waterwheel and take the path up the hill to the viewing platform (about 0.5 km and quite a stiff climb). On the way pass through a tunnel which formerly contained the reciprocating 'flat rods' which transmitted the power from the waterwheel to a pump in Wheal Martyn.

In front of the viewing platform and slightly to the right is the currently active Wheal Martyn china clay pit. To the left is Greensplat china clay pit, which belongs to a different company. Usually one or more monitors will be at work breaking down the kaolinised granite with a high pressure jet of water to create a slurry of sand, clay and mica in suspension. This runs across the floor of the pit to the gravel pumps, which pump it up to the classifiers, situated on the right. The sand is then taken away by dumpers. Nowadays a significant proportion of the sand is used for constructional purposes. Further detail on china clay processing will found in the second of the books referred to above.

It is usually possible to pick out swarms of quartz-tourmaline veins in the pit (they look like black lines) and the kaolinised and unkaolinised areas. A steeply dipping east-west stockscheider pegmatite crosses the centre of the pit (there is a boulder of it in the Boulder Park). Overburden can be seen at the top of the face, this has to be removed separately. Much of the overburden was formed during the colder periods of the Ice Ages and is known to geologists as Head.

Leave the viewing platform and descend towards the Museum, follow the signs and take the track on the **left** (do **not** descend the same way as you came up). This will then take you down to the Boulder Park and the S.S.S.I.

In view of the problems with taking parties of students into active china clay pits, the Boulder Park' has been set up in order to demonstrate the wide range of rock types to be found in china clay pits (no hammering please). At the top end of the Park the various types of granite are shown and further down other rocks types such as elvan, quartz-tourmaline vein, schorl rock and Wheal Remfry breccia. Details of the rocks are given in explanatory boards and in the China Clay book mentioned above. Further information concerning the Boulder Park will be found in the following reference:

Bristow, C.M. 2006 The Wheal Martyn 'Boulder Park' and its role in geological conservation. *Geoscience in South-west England*, **11**, 252-254.

Below the Boulder Park is a small quarry which is the Wheal Martyn S.S.S.I. This has a useful explanatory panel put there by Natural England. The following reference deals with this S.S.S.I.:

Floyd, P.A., Exley, C.S. and Styles, M.T. 1993 *Igneous Rocks of South-west England – Geological Conservation Review Series No. 5.* Chapman and Hall. Pages 185-187 cover the Wheal Martyn S.S.S.I.

The small quarry shows granite which, if kaolinised, would yield a reasonable quality china clay. It is a slightly megacrystic lithium-mica granite, where a Li-mica takes the place of the biotite mica which is found in most of the more normal granites of south-west England. However, the granite is slightly weathered.

The party can then descend through the clay processing area and dries which form a large part of the Museum site. A boulder of luxullianite can seen in the lower courtyard behind the clay dries. This is a striking rock, much favoured by the Victorians for ornamental use, composed of pink orthoclase feldspar and black tourmaline. It was probably caused by boron-containing fluids altering the granite at a late stage in the crystallisation process.

Before departing, it is worth looking at two large pillars either side of the entrance to the drive up to Carthew House, which is about 100 yards north of the entrance to the Museum. These are composed of the coarse grained biotite granite which forms the eastern part of the granite intrusion and was intruded earlier (285 million years ago) than the more complex western part of the St Austell granite (275-270 million years ago). Both granites were intruded in the early part of the geological period called the Permian.

After leaving the Museum, take the B3274 northwards to the roundabout passed earlier and turn left (still on the B3274) towards Roche. Continue on the B3274 for 3.5 km to Trezsaise Chapel.

STOP 4 – Trezaise pegmatite

Trezaise pegmatite and Roche Rock are both covered in a free pamphlet 'Roche Rock and the Tresayes Trail' published by the Cornwall Wildlife Trust. The Cornwall RIGS Group forms the geological conservation arm of Cornwall Wildlife Trust. If you order a book from Wheal Martyn Museum ask them to pop a copy of the pamphlet in with the book.

If you are travelling in a coach then you will have to leave the coach at Trezaise Chapel and walk to the pegmatite (just under 1 km). Alternatively you could walk in from Roche Rock – see route in the pamphlet mentioned above. If in a car or minibus, continue down the side road in an easterly direction, bearing right at a fork and continue until the tarmac runs out where you should park. A rough track on the right going southwards (uphill) should then be followed (do not continue into the clay works). Continue up the track for about 0.4 km. The very rough ground on the right is where tin streamers have worked the alluvial deposits in the valley bottom.

The sign for the wildlife site will be seen on the left. This is a wildlife reserve leased by Cornwall Wildlife Trust from Goonvean Ltd for an annual rent of a peppercorn, it is both of geological and biological interest. It is well signposted and will lead you onto a boardwalk, which crosses some very wet ground, to a face where the pegmatite is exposed.

The visible face shows large crystals of orthoclase feldspar, up to 0.5 m across, set in a darker coloured aplitic matrix. To quote from the Geological Survey Memoir for Sheet 347:

"At Tresayes Down there is a wide extremely coarse pegmatite vein in the killas a few yards from the margin of the granite. It consistes mainly of enormous orthoclase crystals, roughly parallel and arranged vertically, some of which are graphically intergrown with quartz. Some quartz occurs interstitially frequently associated with tourmaline and a little fluorspar. There is also a little pale mica. The vein has a north and south direction nearly parallel with the margin of the granite at this place, and is nearly 50 yards in width."

The vein was originally worked for feldspar for glass making, hence the local name 'The Glass Mine'. In the early 20th century it was worked primarily for ceramic use and a large team of 'bal maidens' trimmed the stone to produce a relatively pure feldspar product.

Retrace the route back to Trezaise Chapel. Turn right and continue down to Roche village. Just before the Church turn right at the mini-roundabout and after 300 m park beside the road. Roche rock is visible on the right.

STOP 5 – Roche Rock

Roche Rock is a tor-like mass composed not of granite, but of schorl rock, which is a relatively uniform medium grained borosilicate rock composed of varying proportions of quartz (grey) and tourmaline (black). The schorl rock forms the core of an outlying cusp of granite which rises up through the metamorphic aureole at this point. Pitting in the 19th century found that the schorl rock core is surrounded by kaolinised granite. The rock is surmounted by a late 14th/early 15th century Chapel dedicated to St Michael. The upper storey was the Chapel, with a room below where a hermit is supposed to have lived.

The Rock is a S.S.S.I. and is described in:

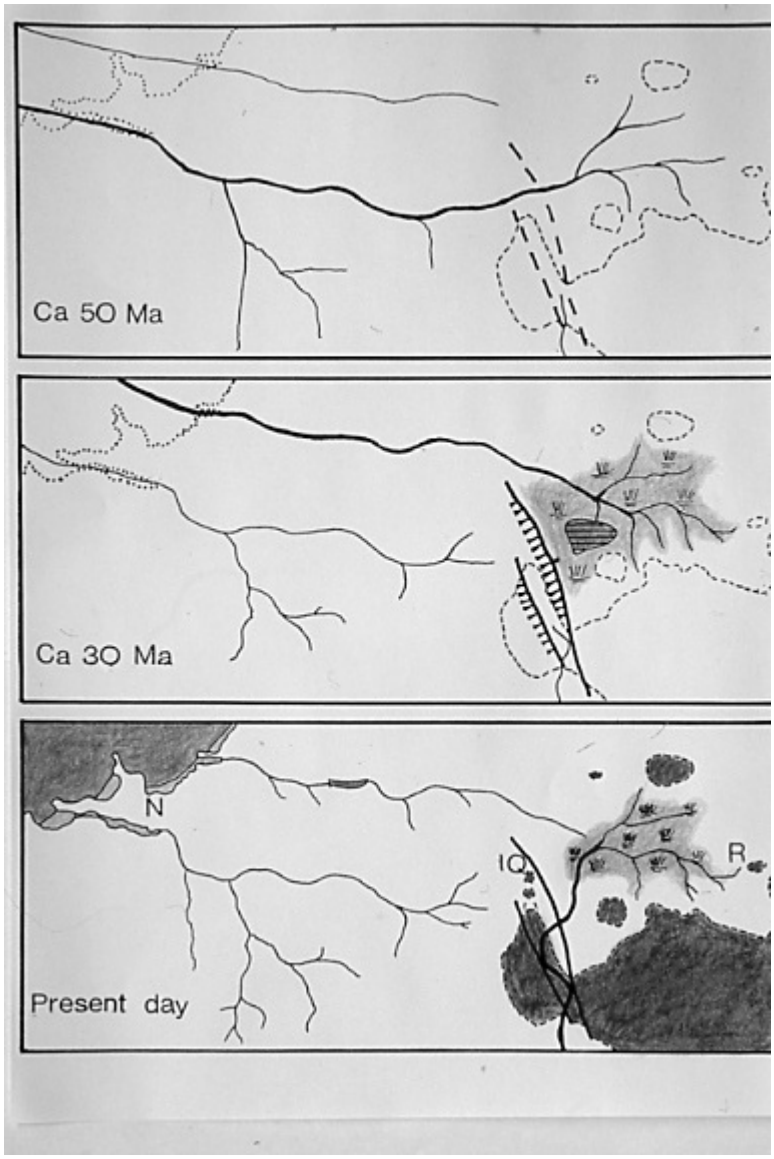
Floyd, P.A., Exley, C.S. and Styles, M.T. 1993 *Igneous Rocks of South-west England – Geological Conservation Review Series No. 5.* Chapman and Hall. Pages 192-194 cover the Roche Rock S.S.S.I.

The genesis of this rock is still controversial. One theory suggests that at a late stage in the crystallisation of the granite a separate immiscible borosilicate fluid was created. Certainly the textures and shapes of borosilicate 'blobs' seen in china clay pits, ranging in size from a gooseberry up to a mass like Roche Rock, support this idea. However, other theoretical considerations suggest that it could have been produced by widespread metasomatic alteration of pre-existing granite. The reference quoted above contains further discussion on this subject.

Further west lies the tourmalinite breccia in Wheal Remfry china clay pit. Unfortunately this is one of the locations difficult to visit at present, as it lies within an active pit. This breccia seems to have been caused by the explosive depressurisation of a borosilicate mass, which led to a breccia composed of granite (porphyry) and killas clasts set in a fine matrix of tourmaline and quartz. A boulder of the breccia was seen in the Boulder Park at Wheal Martyn. Roche Rock seems to have been the result of quiet crystallisation without the explosive depressurisation.
Below: the Wheal Remfry breccia.

This itinerary ends at Roche Rock, which is close to the A30 for onward travel to other destinations in Cornwall.

If the party is travelling westwards along the A30, then the new section of the A30 will take you around the north side of Goss Moor, which is a large area of wetland and a S.S.S.I. of outstanding biological interest. In former times this was a rich source of alluvial tin. This large area of flat ground is a planation surface developed over a long period of geological time by subaerial weathering. Most of the soft, thick weathering mantle was removed during the Ice Ages (Quaternary), but there are still deep pockets of weathering under the Moor, formed in Tertiary or perhaps earlier times. The low ridge at the western end may be a fault scarp and, as the A30 climbs after the Newquay turning, this may be the much degraded fault scarp, as the diagram below shows. The dotted line on the two older diagrams is the position of the present day coast. The earliest diagram (50 million years ago) shows the proto-Fal flowing out along what is now the Gannel estuary. Movement on faults belonging to the Fal Valley Fault System created scarps so that in the 30 Ma diagram the river is deflected to flow down what is now the Porth valley and a large area of swamp/lake is created. By the present day the Fal has been captured by a southward flowing stream exploiting the soft kaolinised area along the fault zone, so that the present Fal now flows southwards down the Retew valley (N = Newquay, IQ = Indian Queens, R = Roche).



Further information on the geomorphology of Goss Moor will be found in:

Bristow, C.M. 1999 Goss Moor and the evolution of the Upper Fal catchment. In: Scourse, J.D. & Furze, M.F.A. (Eds) The Quaternary of West Cornwall, *Quaternary Research Association*, 184-187.

The Luxulyan Valley and Helman Tor

If a further visit in this area can be fitted in, then it is worth considering a visit to Helman Tor and the Luxulyan Valley. This is in the area of the eastern (285 Ma) part of the St Austell granite. This is a coarse grained porphyritic granite, which is not extensively kaolinised. The approaches to the locations concerned are via narrow lanes which are not suitable for coaches.

Helman Tor (SX 062/616) All approaches to this location are via very narrow lanes, there is a small car park at SX 062/614. The tor has extensive outcrops which show the texture of the granite superbly. Note how the feldspar phenocrysts are aligned as if to show a flow direction. Tor formation was shown in the diagram earlier. Look at the 1:25,000 O.S. map; it shows how NNW-SSE lines of weakness cut through the granite (see tor diagram), with boggy areas overlying these areas which are less resistant to erosion, and high ground, including the tors, on the more resistant high ground in between. Helman Tor is at the northern end of one such area of high ground.

From Helman Tor one can look down on Breney Common (to the west) and Red Moor (to the east), which are both Nature Reserves belonging to Cornwall Wildlife Trust. They were created by extensive working for tin of the alluvial deposits under the marshy low ground from ancient times up to the early 20th century. The last phase involved large floating suction and bucket ladder dredges. One hundred years ago these sites would have been barren sites of the utmost industrial dereliction – but look at them now! It is a fact that many of the most interesting inland wildlife sites in Cornwall were created by past industrial activity.

Luxulyan Valley (SX 057/572) The Luxulyan valley is an area of outstanding scenic value as well as the scene of much past industrial activity, including quarrying and an early railway with the magnificent Treffry viaduct crossing the valley. There is limited parking under the viaduct and ascending the eastern side of the valley one quickly encounters leats which brought water to the lower part of the valley for the Fowey Consols copper mine and for powering the Carmears railway incline. Two quarries, Carbean and Colcerrow, provided stone for some prestigious buildings in London and elsewhere, but do not show much of geological interest (too much moss etc.).
At the head of the valley, east of Luxulyan, is Tregarden quarry, which was worked as an aggregate quarry until recently. Unfortunately it is difficult to obtain access nowadays and it is flooded. This is a pity as it was the only place where luxullianite could be seen *in situ*. However, there is the large boulder of luxullianite at Wheal Martyn Museum which was mentioned earlier.

One of the most interesting features of the area is the large number of core stones which can be seen in the fields around the village. Core stones are produced by deep weathering penetrating along the joints to leave 'cores' of unaltered granite (see tor diagram). When the soft weathered material (regolith) is washed away by later weathering large 'core stones' are left as huge boulders in the fields.