



(A Local Group within the Geologists' Association)

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NEWSLETTER MAY 1992.

This letter begins with the sad report of the death of our Chairman Wally Stedman on Saturday 14th March. Wally's interest in Geology started in 1979 when he attended evening classes in Farnham. He joined the Society in 1980, served as Field Secretary from 1984 till 1987, becoming Chairman in 1988.

He was a cheerful and friendly person and a very capable Officer of our Society. In spite of his illness he carried on right to the end.

We shall all miss him and our deep sympathy goes out to Cath.

Once again we are indebted to Colin Wilson for his very thorough report on the Cumbrian section of our Northern Britain Field Trip last June. We also thank Cath for the report on our Devon Field Trip last October and John Williams for the final part of the itinerary in the U.S.A.

David Caddy.

NORTHERN FIELD TRIP JUNE 1991.

In the last Newsletter the account of this trip left us en route from High Force in Teesdale to our next base in Penrith.

We continued along B 6277, passing some spectacular scenery on our left in fine afternoon sunshine. At the little town of Alston we joined the A 686 and proceeded south-westwards for Penrith. We stopped at a view point 1903' above sea level by a pub with distant views of the Lake District. Photography proved disappointing because of the extreme distance of the Lakeland hills (20 miles) and the wide, rather featureless foreground. We arrived at Penrith in good time for our evening meals. Most of us were comfortably accommodated in Moorcroft Guest House, a well-appointed building made of red Penrith sandstone. The remainder of the party were at the nearby Woodlands Hotel.

The structural geology of the Lakes, in very broad outline, is that of a massif built upon a Pre-Cambrian basement, surrounded by Carboniferous sediments that dip off the block in all directions. The massif itself consists of three main groups of rocks trending north-east/south-west. To the North are Lower and Skiddaw slates, in the centre volcanic deposits of the Borrowdale Volcanic Group and in the South a thick series of Silurian marine sediments, together with a number of igneous intrusions. To the North and East of the massif and thinly to the West lie Permian-Triassic rocks.

During the Pleistocene glaciation four major and many local icing incursions took place, leaving many erosional and depositional features. Two principal ice sheets were the Scottish and Irish sheets. These combined with the ice sheets generated by the massif itself to give a radial flow direction superimposed on the prevailing north/south trend.

Next morning we set off in lovely weather for Lake Ullswater to pick up our leader Dr Richard Clark of the Cumberland Geological Society. He had chosen the Furness area in the South-West to illustrate the effects of glaciation. He joined the coach near his home at Brothers Water. Our journey through Kirkstone Pass and then down the East side of Lake Windermere gave us a feast of breath-taking scenery. In the south-west the road from Greenwood follows what was essentially the old coastline to Bardsea, where we were joined by an enthusiastic group from the local Societies, some of whom accompanied us for the remainder of our stay in Lakeland.

The first three sites visited were taken to represent a late phase in the last glaciation.

At Bardsea (301743) a number of strata were identified in the cliff face, ranging from a matrix-dominated sedimentary rock with various clast types giving the characteristics of till, through very fine bedded sandstone, to more energetic bedding units and a final very energetic sorted fluvial unit. There was no evidence of palaeocurrent direction. This was interpreted as a high energy deposition with later till deposited on top as the ice melted to form a glacier-aqueous cored drumlin.

At the next site, Sea Wood (296734) the Elswick limestone, which does not carry striations very well, showed a southerly direction of movement of diamicton (till). With further erosion this could have become a limestone pavement.

The third of this series, Moat Scar Cliff (278698), is mainly a long cross-section of a till drumlin. Turbulent flow in the melt-water under the ice gave rise to domes and caves which led to boulder-clay filled drumlins. It is not understood why lines of drumlins similar to this one should be deposited as discrete entities and not incorporated into single units.

Lunch was taken at Rampside (2466), some eating packed lunches in pleasant sunshine while others patronised the Concle Inn.

Our party then walked north-west to Westfield Point (225666) and back along the beach to Concle Bank (230662). Recent beach defences were made of Shap Granite and a plentiful supply of "offcuts" lay on the beach. At the northerly end of the cliff-side exposure the till, the second kind in this area, is found only some two miles to the north-east in a small valley. Overlying the till is a fine-grained sand unit, possibly a pro-glacial outwash deposit. The till may represent an ice re-advance from the north-west, the sand being washed beyond the front of the advancing ice mass.

Further south there is a possible Holocene raised beach, and beyond that a till sequence with core sand over. By this time it was raining heavily and by common consent the visit was brought to a close. It rained all the way back to Penrith.

For the next day our leader, Dr Jim Cockersole, of the Cumberland Geological Society, took us on a Permian excursion.

The Pennine fault controlled the western face of the Alston Block to form the Crossfell Escarpment. Land to the west was downthrown, thereby preserving the New Red Sandstones consisting of the Penrith Sandstone, Eden Shales and St Bees Sandstones; these sandstones resting unconformably on Carboniferous strata from a broad asymmetric syncline trending north-west.

Starting in the Bowscar Quarry (520343), large scale cross stratification is well exposed showing basal foresets of a large crescentic barchan dune tapering away asymptotically to the west, lying above a clear bounding surface. The truncated foresets of another dune could be seen below the bounding surface trending towards the east. The aeolian sandstones consist of large red well-rounded quartz grains (millet seed), frosted from abrasion and well sorted. The old working faces of the quarry, set at right angles, are accessible and this feature is invaluable for determining wind direction. At this point the leader demonstrated his novel clinometer for measuring dip. All it needs now is marketing! A discussion concerning a possible reptilian footprint was a distraction from the steadily falling rain.

We then drove to the Fox and Pheasant at Armathwaite (509459), for lunch. Many afterwards admired the placid River Eden from a nearby bridge.

Mr Eric Skipsey, from the Open University, led the party for the rest of the day. At High Flats (504454) on the River Eden a small weir is formed by the Tertiary Armathwaite dyke. Running south-east from Mull through to the Yorkshire coast here the very fine dolerite with amygdales is intruded into the base sandstone. Nearby (506452) the cliff exposures are aligned north-west/south-east, and foresets belonging to at least eight units can be recognised with bounding surfaces at the base of each, representing erosional deflation. A second series of cliff exposures, named the Coombe Clints (506451) are found nearby, giving a three-dimensional view.

Close by the village of Holmwrangle (515487) the sandstones pass laterally into water-laid flat-bedded sandstone and coarse breccias, locally known as brockrams. The fan deposits are laid down by flash floods sweeping through wadis onto the plains and, characteristically, have unsorted angular and quite large clasts in the country matrix.

Further east, at Low House Woods (516492), a range of alluvial sediments can be seen. The sequence is thinnish and consists of cross-bedded dune sands intercalated with water-lain strata and lenticular beds of conglomerates often representing the infilling of old channels cut in the underlying sandstones.

The weather had now improved and group photographs were taken with the beautiful River Eden and wooded cliffs behind it as a backdrop. It was a long walk back to the coach which we could now see about a mile away and a good 300' higher up.

On the last day in Cumbria Mr Tom Shipp, joint author of the Lake District Geological Field Guide, led the party in a circular tour around the Skiddaw massif itself, Saddleback and Carrock Fell. The massif, formed by intensively folded slates, has two igneous sequences, the Skiddaw granite and the Carrock Fell Complex, with accompanying metamorphic aureoles. The lack of roads restricted us to peripheral sites.

At Further Gill Syke (355334) the leader posed a series of questions aimed at identifying the local Geomorphology. After some prompting it was agreed that in the bed of the syke was a contact between banded gabbros to the south and the intruded granophyre to the north. A few yards further north, at Dutchman's Moss, at an old mine spoil heap (352342) some copper minerals were found, but the real interest lay in the history of the German team who were contacted to search for copper and lead in the area in Elizabethan times.

We took lunch at the Oddfellows Inn at Caldbeck (326398) and got warm for the first time.

At Faulds Brow Quarry (303407) the sequence is dominated by limestones with interbedded shales and sandstones. The rock is mainly fine grained and contains marine fossils. Of particular interest was the upper part of the quarry where, on a weathered surface, was seen the zone fossil Zoophycos, thought to be the feeding burrow of an unknown organism. At the base of the limestone small horizontal elongated cavities merge with vertical joints. This is believed to be due to sub-surface solution action as water flows down the joints to the shale layer and then dissolves the limestone laterally.

It was at this quarry that we endured the worst that British summer could throw at us - ice-cold rain falling roughly horizontally.

In Green How Quarry (262376), after some prompting, we agreed that the exposures were, indeed, a marine sandstone and part of a cyclothem before embussing for what was to be the last exposure.

At Long Close (241267) on the south-western slopes of Skiddaw we were invited to consider and discuss a road-side outcrop. In essence this was either a sill or a dyke (the bedding could not be proved), intruded into Skiddaw mudstones with boulder clay resident in the hollows to the left, other outstanding surfaces having been cleared by subsequent ice flows.

The next day we returned home without incident. Our thanks go to those who made this a memorable and enjoyable field trip.

HALLSANNERY 12th to 16th OCTOBER 1991.

On 12th October some twenty Society members converged on Hallsannery Field Centre near Bideford where we were welcomed by Chris Cornford and his wife, Sally. Most of the party had arrived by coach but several came by car, for one reason or another.

When we had all settled into our rooms we had tea and Chris outlined his plans for us for the next four days. Before dinner that evening we had climbed a 500' hill from which the general lie of the land was explained. It was well worth the effort.

For mid-October the weather was pretty good. We had two warm, sunny days, one at Westward Ho! and Hartland Quay and the other on the South Devon coast round Torquay and Dawlish.

As you can see, we travelled quite long distances by coach, right across Devon and, on the last morning, to Watchet on the North Somerset coast. Some people followed the route on their maps, others did crosswords, some chatted or watched the scenery go by.

The catering was in the able hands of Sally Cornford and her sister. The food was well presented and tasty. We made our own packed lunches from piles of bread and fillings and Chris carried large bottles of fruit drink for our liquid refreshment.

In the evenings we sometimes had a lecture from Chris, followed by scrabble or cards in the lounge and dining room. The bar was "help yourself", with paper to write down what you had had.

Now for the geology!

This was based on the effects of the Variscan Orogeny, including the deposition and folding of the flysch sedimentation (culm) in the pre-mountain fore-deep (Westward Ho! and Hartland Quay); the granite intrusion (Dartmoor) and associated mineralisation in the roots of the mountain chain (Ramsley Mine Tip and Meldon Aplite Quarry); the New Red Sandstone alluvial fan breccias and fluvial/Aeolian sandstones (Dunchideock, Torquay, Shaldon Ness and Dawlish), finishing with the Rhaeto-Liassic transgression at Watchet.

We started at the "bottom" of the sequence at the top of Coddon Hill. How often do Field Trips start with a really strenuous climb or trek, just to get you in the mood?

At Westward Ho! we saw a good example of a Namurian-Westphalian turbidite flow, starting with the deep water (distal) sediments, walking "up" the flow, along the beach to the sandy "top" with cross-bedding and a hint ? of rootlet beds and bio-turbation.

Lunch was taken at Hartland Quay where Pat Bennett and Allan Comer joined us for the afternoon. Here we saw some super folds and faults in the Namurian Crackington formation. We searched the bottom of the Tunnel Slab for sole marks and other way-up criteria, and walked along the beach, wondering at the force which had caused such folding.

On the edge of Dartmoor at Ramsley we were let loose on a fairly well picked over mine tip. Most of us picked up the odd piece of chalcopyrite and arsenopyrite and some quartz and grossular garnet, and we learned of the horrific conditions under which the arsenic was recovered for use in the U.S.A. to exterminate the boll-weevil. The arsenic ore was heated and the arsenic oxide from the fumes was condensed in horizontal chimneys from which it was scraped by young boys. Life expectancy was 25 years!

At Meldon Aplite Quarry we identified aplite dykes cutting across Lower Carboniferous muddy cherts and looked for evidence of chilled and baked margins and the associated mineralisation, such as Tourmaline, Blue John, Lepidolite and Epidote. This quarry was the only source of Lithium for the U.K.

The afternoon was spent around Burrator. The edge of the granite batholith shows up well on two sides of a rock wall which separates two disused quarries. On one side we could see tongues of granite intruding into the country rock, and amorphous tourmaline at the junction. Round the corner was more evidence of the granite/country rock junction with quartz veins near the junction and tourmaline veins further away. The active members of the group then walked past Burrator Reservoir and up Burrator.

On the way back to Bideford we stopped for a brief visit to the famous Merrivale Quarry and stone cutting operation. We picked up some good samples of both Merrivale granite and other imported material.

The next day was warm and sunny and we had a pleasant drive through Devon, past the Haldon Hills, towards Exeter. We looked at Lower Permian volcanics at Dunchideock, a Middle Devonian Reef at Torquay, Lower Permian wadi deposits at Shaldon Ness and Lower Permian conglomerates and alluvial fan deposits at Dawlish.

At Meadfoot Beach near Triangle Point, Torquay we worked our way from the reef edge with mounds of reef building organisms in a limey mudstone, through fore reef bedded bioclastic limestone/mudstone where we could see different fossils on different layers; stromatolites, corals, bryozoa.

We ate our lunch, sunning ourselves on the warm, dipping limestone, while studying in detail the rock faces we could reach from where we sat.

On the last morning, having packed and stowed the luggage, we bade Sally "au revoir" and set off for Watchet. It was raining all the way but, luckily, it had stopped by the time we were ready for the Geology of the day. While we were waiting for the coach to arrive, Wally and I wandered round Watchet and looked at the Museum (closed) which had exhibits relating to the local iron industry, oil from oil shales and importing limestone and coal from Wales through the harbour, all of which ended around the beginning of this Century.

At West Bay we looked at Upper Triassic Keuper Marl and Lower Jurassic Lias. The most obvious feature was the white gypsum in the reddish-brown roughly-bedded deposits. The gypsum was nodular, fibrous or "chicken-wire" form with thin veins in

the form of a network. There is a fault, the Watchet fault, parallel to the present cliff about ten metres inland. We saw this in a washout, with red Keuper Marl on one side and Blue Lias on the other.

We had our picnic lunch, sitting on seats overlooking the harbour, watching the trains of the West Somerset Railway and the occasional activity on the boats in the harbour.

Wally and I left for home after lunch so we missed the last exposure at St Audries Bay where the Upper Lias sequence merges into the Lower Lias. This marked the return of fully marine sedimentation, and specimens of ammonites (*Psiloceras planorbis*), bivalves etc. were recovered by the rest of the party. Full details of the trip are available from our library. Ask Tony Brown.

The final part of John Williams' "Itineraries in the U.S.A." follows:-

**ITINERARY 9
GALLUP I40 FLAGSTAFF
ACCOMMODATION FLAGSTAFF**

This is however a gradual process as there are still some side trips to make. 67 miles West of Gallup on I40 is the entrance to the Petrified Forest National Park. At the Northern entrance fine views can be had of the Painted Desert and the Visitors Centre provides a film explaining the process whereby trees became petrified. A scenic drive runs through the Park and there are some detours to points of interest. The one to Blue Mesa permits you to view the wood at close quarters and also provides an opportunity to see parallel and dendritic drainage patterns, also a trail gives you access to the Badlands with safety.

Other detours will tempt you with enticing names like the Crystal Forest and Jasper Forest. Do not miss the Long Logs trail it gives you an opportunity to experience what a mesozoic forest must have been like. The scenic drive ends at a small museum with interesting examples of the flora, fauna and fossils from the area. From the Park you continue to Holbrook, where Petrified Wood may be purchased. Samples cannot be collected from any National Park Monument. Continue West to Flagstaff which is in the shadow of the San Francisco Volcanoes which can soon be seen on the horizon.

Thirty miles before Flagstaff a detour South may be made to view Meteor Crater, a 550ft deep depression caused when a meteor landed in the area approximately 22,000 years ago.

Around Flagstaff you can visit Sunset Crater (Volcanic Core) Wupatki National Monument and Walnut Canyon (Indian dwellings) if time permits. A chairlift is available to take you to the top of one of the San Francisco peaks - the Azassiz Skyride. Views only from South through West to North as the Azassiz is closed to protect an Alpine flower, - still the views from 11,500ft are spectacular and enable you to put the Grand Canyon in perspective as the North Rim can be easily seen. The Museum of Northern Arizona on the outskirts of Flagstaff concentrates on Indian Culture but does have a small Geology section.

ITINERARY 10

**FLAGSTAFF I17 PHOENIX OR US89a, WALNUT CANYON SEDONA, US89 PRESCOTT -
CONGRESS WICKENBURG US60 PHOENIX
ACCOMMODATION PHOENIX**

To return to Phoenix you may either retrace your outward route via I17 in about 3½ hours or try a scenic diversion by 89A, 89 and 60. The latter journey will give you a final close up of the red beds; an opportunity to see another section of the Verde formation with a side visit to a ghost town at a worked out copper mine at Jerome; an encounter with some granite; and finally first hand experience of Range and Basin topography. If required, I17 can be regained at various stages on this route and the more adventurous portions, for the driver, omitted. Range does imply mountain roads with bends and you will not be disappointed. The latter portion of the diversion enables you to view some very fine specimens of cactus and provides you with proof that Phoenix is the 10th largest metropolitan area in the US. with a population that is due to increase by 19.2% between 1988 and 1993. In part this is achieved by age restricted immigration and you will pass through both Sun City and Sun City West which are designated for adults of mature years.

Where is the Geology you may well ask at this stage, why haven't we got a list of exposures to halt at and details of what to see; or (if you have experience of the area), why weren't Shiprock and Canyon de Chelly substituted for Chaco Canyon, why include Durango ?

The Geology is everywhere, you do not have to stop to experience it or find the exposures. A book and map list at the end of this article shows what I found useful and was perfectly adequate for my level of background knowledge. They were also useful for non-geological members of the party - an essential if only one is an enthusiast.

Any trip of this nature combines the interests of those participating in the experience, Shiprock and Canyon de Chelly were originally included but at that stage Cultural weariness crept in and the idea of visiting yet another Anasazi ruin took a back seat. We were searching for the Bisti Badlands, South of Farmington, and came upon Chaco by chance, it happened to be a worthwhile experience which was worth sharing.

Durango and Gallup appealed to the Transport Enthusiast in the party, it was quite fortuitous that the former had a Geological interest as well. Gallup provided the experience of seeing a freight train of 70 wagons hauled by a team of seven diesel engines, not only once but quite frequently, even to the extent of a distant view of the Santa Fe railroad from the Petrified Forest with two trains passing each other. Unfortunately, although distant, they could not be fitted into the frame of the camera as they were too long.

Was it worth going all that way for the experience ? Yes, I would go again and spend longer, at the end of the trip there was more to do and see but it did give an understanding to those things we see around the UK. In this area of the US it was around you in abundance and you could feel part of it - In desert you were in it for days on end and it was hot and you had to ensure that you kept water with you, - if it was a monocline you either descended or climbed a couple of thousand feet within a short space of time - if it was a plateau then it would be driving on the flat for the next few hours - the rivers for the main were dry but it was obvious that there had been water along the dried-up bed recently.

It was the unexpected that we learnt - the fact that there was an advanced American Culture prior to 1492: prairie dogs do pop in and out of their burrows as seen on the Nature programmes: there is an amazing amount of life in the desert; snakes are rare,

only one rattle snake seen and that was dead on the road: Americans do over eat: the scale of everything is larger than you imagine. Roads, even in this land of the automobile, can be free of cars - but above all you do not have to look for the exposures, bare rock is all around. A geologists paradise with enough of interest thrown in for the 'suffering' partner.

The itineraries cover the roads between each destination and provide a very select list of where to stay. Accommodation lists may be obtained from the US Travel Bureau Sackville Street and some of the large chains have central booking agencies in the UK. eg Holiday Inn: Travelodge (Trust House Forte) and Best Western. For a single chain at moderate prices I would recommend Best Western - camp sites are scattered throughout, particularly in the National Parks, these are well equipped but tend to be on a first come basis and are not bookable.

MAPS

Road: Hildebrand's Travel Map, USA.

The Southern Rockies and Grand Canyon Country 1: 700,000.

Geology. Geologic Cross Section along Interstate 40.
Petrified Forest Museum Assn. Holbrook, AZ.

Utah Geological Highway Map. Brigham Young University.

Geologic Cross Section of the Cedar Breaks Zion Grand Canyon region.
Zion Natural History Association.

BOOKS Geology

Cinders and Smoke - Doris B Osterwald (A mile by mile guide for the Durango to Silverton narrow gauge trip).
Western Guideway Ltd.

Geologic History of Utah. L F Hintze.
Brigham Young University.

Scenes of the Plateau Lands and how they came to be. Wm Lee Stokes.
Publishers Press.

Field Meetings to the Western USA 1981 & 1982
Duff & Ford
Geologists Association.

Roadside Geology of Arizona. Halka Chronic
(Also of Colorado
Utah
New Mexico)
Mount Press.

Utah and Northern Arizona - A field guide.
John Perkins.
Dept of Extra Mural Studies, University
College Cardiff.

GUIDE BOOKS

Arizona Travellers' Handbook. Bill Weir.
Moon Publications.
Utah Handbook. Bill Weir.
Moon Publications.

While missiles flew and winter trees were bare
A band of happy students did repair
To Urchfont Manor, in the Vale of Pewsey
To study Plato, mend some pots, and view the
Heights of Cypriot Olympos, and the southern shore
Where Aphrodite came, (it may be myth or lore),
(The sites of ancient copper mines did elude us).
We forged new alloys, using tin and copper,
We pictured clays, being born of wind and water.
Then with an instrument for polarizing light
Discovering crystals' colours, radiant, bright.
Towards the Dead Sea next we made our way
Where Sinai, Ararat and Golan Heights hold sway,
And then with blocks of halite and mudbrick,
With coloured sandstones, limestones smooth and thick
We saw how houses built of sedimentary stone
Each with its properties, could make a home.
The healing power of crystals caused a lot of laughter,
The lineage of the mineralogists came after-
Solon and Pliny and old Theophrastus
Led on to Dana I and II, Haüy and modern masters.
The symmetry of snowflakes and the ice of glaciers,
Erratic blocks and egg-in-basket structures,
Drumlins and roches moutonnes, nunataks and kettles
And lovely pictures, from archives and Reg's-
(Reg was our leader, Reg our guide and mentor),
Thanks be to Reg, and thank you Urchfont Centre.