Farnham Geological Society

(A Local Group within the Geologists' Association)

NEWSLETTER WINTER 1997

Vol 3 – No 19

This is the second and final Newsletter for 1997.

Our Society had a very enjoyable Field Trip in August to **Pembrokeshire** in South Wales. Our leader was **David Cronshaw**, familiar from the Shropshire trip of 1995. There was spectacular cliff scenery and much foot slogging but we were never troubled by rain. **Roger Ashcroft** will provide a full report on this trip. Pembrokeshire was the subject of our Society's display at the **Annual Reunion of the Geologist's Association** in London on 8 November. A joint trip with **Devonshire Association** to **Gower** was also shown.

Peter Cotton has been conspicuously absent from our Summer Field Trips and several lectures because of serious ill health. This culminated in a stay at Brompton Hospital in London where he underwent open-heart surgery for aortic valve replacement. He returned home ten days later and we were delighted to welcome him and Olivia at my 80th birthday dinner held in the Refectory, Milford, on 3 October.

This Newsletter includes some of my non-geological impressions of our **US** trip together with a map of admirable clarity showing our full itinerary. This was kindly provided by the son of **David and Shirley Stephens** which required much work at his computer.

We must also thank **Alan Comer** for an article on **Terranes**, a word perhaps more used in America than Britain. **Cyril Dutton** has also kindly written about **Garnets**, of which we present the first part of his contribution.

There will be more items about our US trip in a later edition.

Finally we provide **Clerihew Corner** with an invitation for contributions. The first one is from **I. H. C.** !

Some Non-Geological Aspects of our US Field Trip

Our first view of **Salt Lake City** by day was from our bedroom windows fifteen floors up and what an impression it made! Imposing buildings in the foreground, residential areas beyond and snow covered mountains in the distance. We had had a pleasant if cool night thanks to the formidable power (and noise) of the air conditioning. The day was our own to allow us to recover from jet lag. We made for the shopping centre to get some necessary items. Myself for a "Pakamac" which I obtained from an Australian in the ZCMI or Zion's Co-operative Mercantile Institution; he actually came from Tasmania. I never had the occasion to use it.

The wide roads and fast morning traffic (going the wrong way) made use of the illuminated and audible crossing places essential. I was usually worried at these places as Isabel refused to run when the lights changed back. Once when we had stopped at an out of town shopping area we found no crossing places. We waited until we had about six people to cross in a body - safety in numbers.

Hotel staff or shop staff were always helpful. I was wished "have a splendid day" by a shop assistant when he could not supply the article I wanted. Could it have been our Transatlantic accents that appealed to them?

The Double Tree Inn was superb - I'm sure the equivalent of a five star hotel in the UK. The ball point pens provided for guests in the bedrooms were much appreciated. We still have them.

Our leader **Ivan Dyreng** kept firm but fair coach discipline. Punctuality was important: last one in to be "garbologist" - that sort of thing. The calling out of our numbers according to our place in the alphabetical roll before the coach started off anywhere was a sensible precaution. We never lost anyone. Would that this had been in operation some years ago when I got lost in a large overgrown brick pit in darkest Sussex. When at last I reached the entrance the coach had gone. To my chagrin my absence had not been noticed till the coach reached its destination at Brighton some twenty miles away at which point our then Field Secretary announced, "I don't know if you'll believe this but I think we are one short!" How I got back with a heavy piece of rock is another story. Those of you who were on the US trip may recall an occasion by the Grand Canyon when I could have cheerfully sunk through the floor.

A sensible idea was to make everybody change places by three rows every day to promote social intercourse. Looking back at the trip I wish I had got to know the American contingent better. As it was our Society members were on the whole older than the Americans who joined the party.

While we were at **Grand Canyon** North Rim **Veronica Kilgour** celebrated her 80th birthday. I quote from Isabel's diary.

> "8th July 96. There's a dinner party this PM at 4.45 in honour of Veronica Kilgour who is 80 today. She has been kind and helpful to me over rough places... Got ready at 4.15 and went to party. Choose from menu: pork medallions, big salad first. Ate my pork medallions. D. ate all his salad so couldn't finish his pork .[Dessert] Choc fudge pudding. Speeches all round. Veronica replied very prettily. At end of dinner restaurant was full [about 500] and **John** [Linse] invited whole hall to sing Happy Birthday which they did with great gusto!"

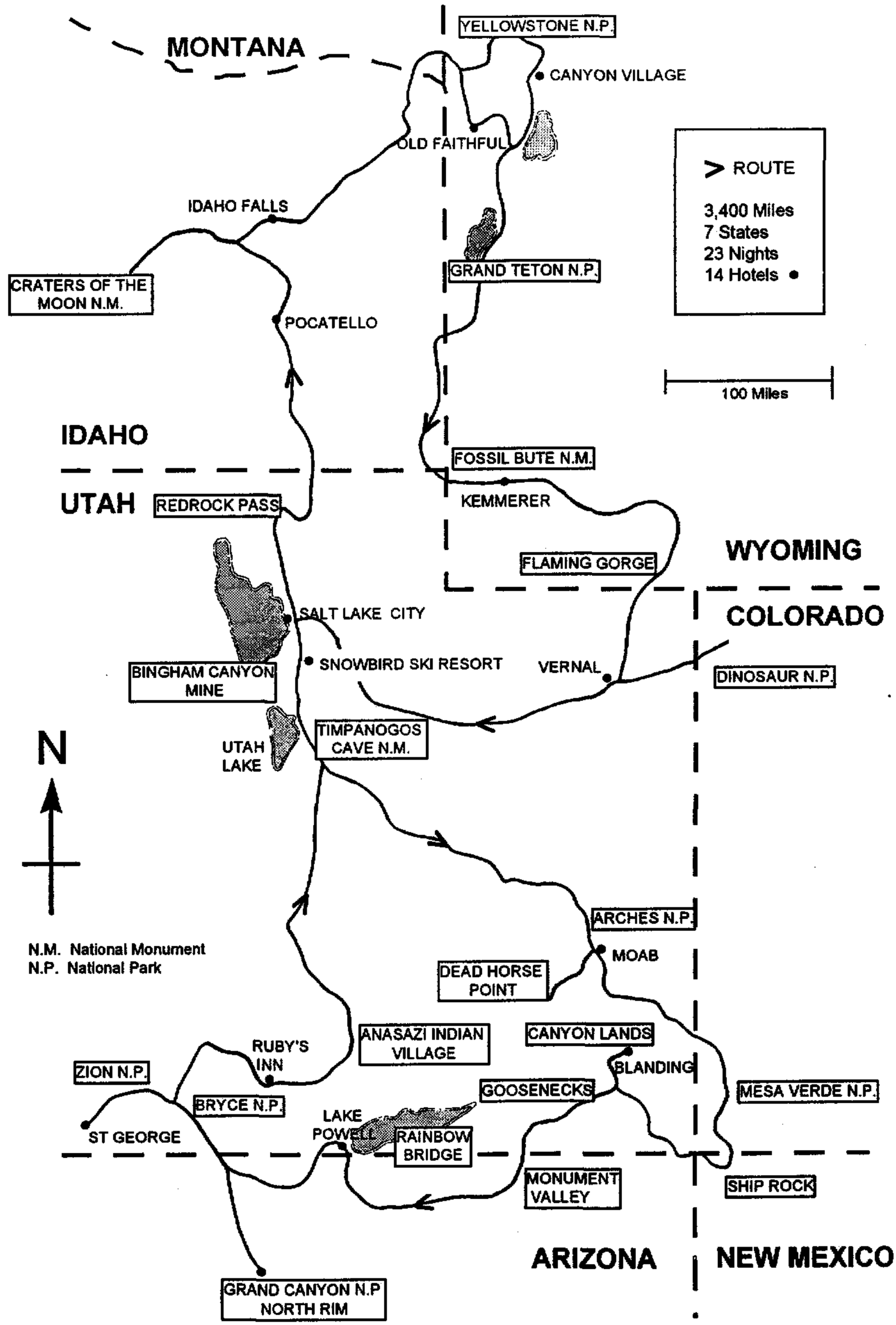
American helpings are generous by our standards.

On our tour we visited 15 American National Parks and Monuments. We usually made for Visitor's Centres first. They are invariably superb and well patronised.

Our coaches and the buildings we stayed in or visited were all air-conditioned. Outside it was HOT.

The last sentence in the introduction to the glossy brochure on Salt Lake City reads "enjoy it all - and come again soon....We did and we would love to. DAVID CADDY

YELLOWSTONE & CANYON LANDS



Terranes

By A.T.F.Comer

In science a new word is often needed for a new concept, leading to confusion if a word in common use is given a different scientific meaning to that available in the dictionary, as is unfortunately often done. The situation can become even worse in translation to a different language.

The word 'terrane' is therefore a deliberate corruption of the common word 'terrain', which refers only to a land surface. Its scientific meaning refers to a block of continental material from its surface right down to its base just above the mantle. An 'exotic terrane' extends the concept to a block of material that has broken away from a continent, and moved until it collides and fuses somewhere else, a process sometimes referred to as 'docking', where its presence can give rise to an apparently confused geology over a fairly small area.

Not all terranes are small, of course. India is a large example, and whilst on passage from Gondwanaland near the South Pole to its present location docked on to southern Asia, it must have been isolated like present day Australia, which is probably an undocked terrane destined to join on to another continent in the far distant future. Greenland and Cyprus may also be examples, with the Seychelles as further candidates as they are made of continental materials, although they raise special problems due to their present location

The idea of terranes was first developed in the United States, where the concept made an immediate impact on the understanding of the geology of western coastal regions. Indeed even the inexplicable geology of Alaska has lately succumbed to investigation. Alaska has been found to be "a collage of terranes dismembered and repositioned over the past 160 million years by the wanderings and collisions of crustal plates, the flotsam of the ancient, vanished ocean that preceded the Pacific". (This is a direct quotation from the paper also titled "Terranes" by David G Howell)

Locally, too, the idea seems to be fruitful. There are several areas of this country where geology appears to change too suddenly for ordinary explanations, or where other anomalies exist such as traces of volcanic rock with no apparent volcanoes, or ophiolites where rocks not far away show no sign of abnormality. Suspicions are arising that this country, in common with other areas fringing the continental basement, contain many exotic terranes, some of which docked a long time ago and therefore share much of their geological history with the region on which they docked, but some more recently so that they share at most only a thin veneer of local

sediments. Members of the Society may well have seen and puzzled over such features in Scotland, North Wales, Anglesey, and Cornwall, during field trips; the thought may now be entertained that adjacent areas may possibly have had a different geological history as part of a different territory or even a different continent.

Elegant, simple ideas like this deserve to be true, but there is still work to be done to explain how exotic terranes can cross oceans, if oceans always grow from mid-ocean ridges towards the continents under which they are subducted. Suggestions are being made that perhaps they move only along the edges of continents, in the way that, for example, Baja California is moving because of the San Andreas Fault, but this certainly does not fit for India, Australia, or Alaska.

It occurs to me, also, that there is still room for amateur speculation in such recent ideas. For example, the stability of small pieces of continent once they have developed an independent existence does not seem to have been investigated. Pieces of continent floating on the mantle will not be exempt from the general rules governing flotation and stability, of which some insight can be gained by floating odd-shaped pieces of wood on water. A thin flat slab will not float with its surface vertical, but will roll over until the surface is parallel with the water. A squarish block is unlikely to have any surface parallel to the water when it becomes stable, and might even finish with its diagonal vertical. Thus, a wide slab broken from a continent will obviously remain level as it floats on the mantle below, but a piece narrower than the continent is thick, typically about 35 kms, would be expected to roll over on to its side, no doubt revealing some very interesting rocks in the process, although no reliable example can be found. An intermediate slab up to perhaps twice as wide as it is thick would not remain level, raising one edge and lowering the other, causing a regional dip to stratified rocks that would probably be preserved after docking. The high side might also raise fragments of ocean floor - this would be the place to look for ophiolites, the presence of which would also suggest that neighbouring granites may well have been uplifted rather than intruded.

No doubt time will resolve these problems. New work like this shows once again that Geology is not a dry, static subject, as many suppose, but is dynamic and entertaining. Membership of a Society such as ours can be very rewarding, to keep us up to date with new developments.

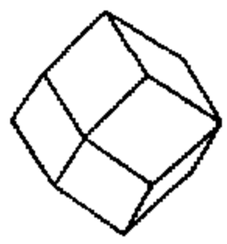
Discovering garnets along the shore

INCLUDING SOME RELATED MUSINGS

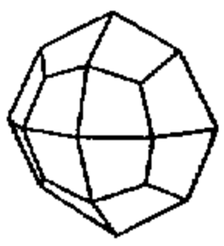
By Cyril Dutton

GARNET crystals are always interesting. Mostly they are found sandwiched between layers of schist in a rock we call garnet mica schist. But now and then we may discover them in pebbles of garnet gneiss along the east coast of England. There are many kinds of garnet, but the one we normally find is almandite garnet. Garnet gneiss is one of an interesting range of erratics deposited by the ice sheets during the Ice Age. Naturally, erratics can come from various places, so it can be fun working out their place of origin.

Boulder clay is frequently a good temporary home for these pebbles; then, as a result of a cliff-slide, their home becomes a resting place on the shore. As the Helm Winds blow the seas against the cliffs with tremendous power, erosion takes place. When chalk supports boulder clay, a cliff-slide leaves pieces of fractured chalk plus a pile of soft clay which is speedily sorted and washed by the currents. The clays are washed quickly away leaving pieces of rock material. . . . the erratics.



There was one type of rock that attracted my attention that afternoon. It was garnet gneiss. I suppose my interest was really a combination of three things: garnet crystals, gneisses, and the circumstances under which these rocks were formed. To quickly mention the elementary basics: we know rocks are classified as igneous, sedimentary, and metamorphic. And both igneous and sedimentary rocks can be changed into metamorphic rocks by heat or pressure, or by a combination of both. I suppose this is what makes them more interesting for me. But there is an added dimension: it is how the theory of plate tectonics is involved.



This last ingredient, for me, has a special interest because it takes me beyond mere description of rocks or geological environments; it opens the possibilities of considering not only how a rock was metamorphosed, but also it tempts the imagination to consider the backcloth of associated tectonic circumstances and events. The kind of events that must have taken place both during and *before* the metamorphism of this specimen of garnet gneiss.

Garnet gneiss is a metabasite

It is now general knowledge that garnet gneiss is a metabasite; that is, it is metamorphosed from basic rocks. Rocks like basalt. The sea floors are composed of basalt. In the language of modern Earth Science, they are called MORB, which is short for Mid Ocean Ridge Basalt since this kind of basalt is formed at mid ocean ridges. It is an

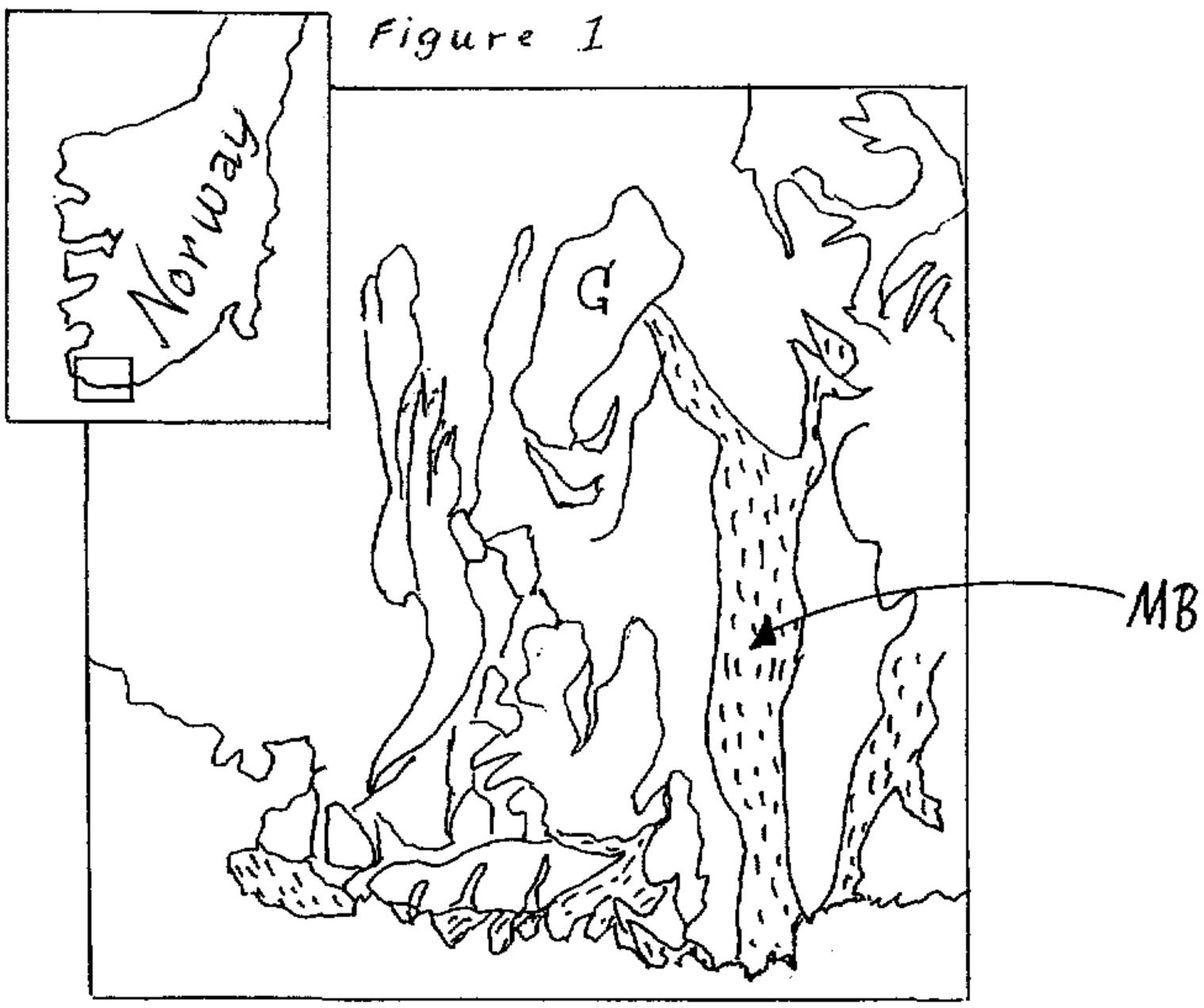
effusive activity. It depends upon the existence of a tensional regime in that part of the Earth's surface that allows hot molten basalt to reach the surface through small fissures or by rifting.

In this case, it is the rifting of the ocean floor, known today as oceanic crust as distinct from continental crust. But it can also happen on land, on continental crust. Iceland is a present-day example. The Scottish island of Mull is a Tertiary example. So where was this erratic of garnet gneiss originally formed? On which ocean floor or on which island?

So the ovate-shaped, and rather heavy (*i.e.* dense) erratic of garnet gneiss which I found along the shore, must have originated as a basalt melt in a tectonic situation: Either at a mid ocean ridge in some ancient yet now non-existent ocean, or erupted somewhere on land, or an island. And that existed many millions of years ago. Even its identity may no longer exist.

Walking along the shore, such history can be pondered as rocks are inspected in the hand and dropped to return to the shore. So, from where did they come? One clue is that larvikite is also found along the same stretch of coastline. Of course, this is an easy one since it has to come from the region around Lavik in southern Norway.

Figure 1



But larvikite comes from part of an area known as the Oslo Rift. The problem with this is that it is of Mesozoic age whereas my specimen of garnet gneiss is clearly so much older. Indeed, it looks like

a rock of Precambrian age. So this leads one to ponder the general area of southern Norway.

Having toured Norway, I remembered that the rocks of south Norway, south of the Caledonian mountains, are dated as of Mid to Late Proterozoic age. That is between 1750 Ma and 600 Ma. So this age-group appeared very promising. A study of some of my geological maps of the area show a terrain which has been highly compressed, deformed and folded, resulting in slivers of different kinds of rock.

Many rocks have been metamorphosed, and there are many kinds of gneisses. In addition, there are a few granites, a little norite, and anorsite. Naturally, all the original Proterozoic landscape has been considerably eroded down from the initial height of the mountains. So, we can only see the roots of those old mountains. A quick glance at Figure 1 shows an example of how this ancient landmass appears today. (The letter G indicates granite while MB indicates metabasite.)

Clerihew Corner

Rock Piles or a Wife's Lament: The trouble with rocks is they do not fit conveniently into small boxes. Our sitting room floor is becoming covered with rocks more and more.

A JINGLE IN TWO SHORT COUPLETS PURPORTING TO QUINTESSENTIALISE THE LIFE & CHARACTER OF SOME NOTABLE PERSON.

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