

CORRESPONDENCE

THE DUTCH GIN SCHISTS

SIR,—Recent correspondence by Wright (1968) and Crimes & Dhonau (1968) has discussed the problem of correlating the Dutch Gin Schists of Pembrokeshire (Claxton, 1963) with other Pre-Cambrian metasediments in the Irish Sea area. We consider that this discussion is based upon a mistaken premise since we have been unable to substantiate Claxton's interpretation, viz. that on the headland south of Dutch Gin the Johnston Series diorites are intrusive into an earlier series of regionally metamorphosed sediments. In our view this locality lies entirely within the outcrop of the diorites which have been intensely deformed along an internal thrust.

The area of about 90 square metres of headland mapped by Claxton as the outcrop of the Schists is a bare-rock surface sloping southward to sea-level and corresponding approximately to the sole of the thrust; the more cliff-like north and west sides of the headland show outcrops of diorite recurring beneath the thrust. Claxton's supposed junction of the schists with the intrusion coincides approximately with a vertical cliff at the base of which the thrust belt is exposed. This cliff shows that the massive diorite passes down into a foliated variety which abuts sharply against a quartz vein of irregular thickness (maximum exceeding 1 m). This is closely associated within the thrust belt with the only schistose rocks outcropping at this locality. Both the schist and the quartz vein have been folded so that the schists are crumpled in the core of a series of anticlinal structures formed in the vein. The principal folds have an amplitude of up to 2 m with fold axes plunging gently to the SE and a vergence to the NE. A well-defined planar surface dipping southwards at about 30 degrees cuts the schist and quartz vein as a result of late thrusting which appears to be a continuation of those movements which produced the folds.

The schists consist of a crenulated micaceous groundmass of very fine-grained chlorite and white mica which enclose macroscopic platy fragments of vein quartz in various stages of mylonitization. Small euhedral tourmalines occur in this groundmass.

The extensive sub-thrust surface shows a heterogeneous jumble of rocks which includes blocks of the schist, of vein quartz, and of diorite surrounded by basic schistose sheaths. Below this surface much of the diorite has escaped deformation, but in places irregular, sheared lenses of more basic rock appear to represent deformed dykes. In addition there are a few small lenses of micaceous rocks occurring at and below this thrust containing muscovite, biotite, chlorite, plagioclase, quartz and occasional remnants of garnet in chlorite. These medium-grained rocks possess neither a schistose nor a foliated texture, and the muscovite porphyroblasts show no preferred orientation. We regard them as metasomatized hornfelses, but their ultimate origin is obscure; there is certainly no proof that they are metasediments of any kind, including that described by Claxton.

As indicated by Claxton, the southern margin of the diorite is overthrust by Old Red Sandstone in Foxes Hole. This thrust plane is exposed clearly on the north side of the inlet even though the overlying marls are more extensive than Claxton records. Thus it is possible to show that this southerly sloping surface also approximates to the sole of a thrust, and that beneath it there is an assortment of deformed and schistose diorites similar to those associated with the lower, internal thrust.

There cannot therefore be any doubt that the deformation of the diorites is associated in both cases with the thrusting, and we believe that most of the rocks recorded originated by this deformation from the diorite. This appears to have been more extensive along the internal thrust, presumably on account of the massive nature of the diorite above and below it. The sequence of deformation involves the chloritization of the hornblende (giving schistose diorites) and release of quartz to give quartz veins. Progressively more intense movements cause the feldspars to break down leading to the formation of the chlorite-mica schists with interfoliated quartz bands; subsequent movements have been partially accommodated by the buckling of this schistosity, at which time the quartz foliae were ruptured. Since the Old Red Sandstone is involved in the thrusting, it is reasonable to suppose that it is Hercynian in age.

Whilst we cannot accept that the Dutch Gin Schists exist as a clearly exposed stratigraphical unit in the sense defined by Claxton, we recognize the possibility that the Johnston Series of plutonic rocks might have been intruded into regionally metamorphosed sediments and that such rocks could occur at this locality as either igneous or tectonic inclusions. The mica-rich "hornfels" could be interpreted as representatives of such country rocks, but no evidence has survived in them which could be used to unravel the pre-intrusion history. Moreover, we are not satisfied that either Claxton or Strahan *et al.* (1914) have recorded critical evidence to prove that the hornblende-plagioclase rocks (which carry sphene-rimmed iron-ore in addition to saussuritized feldspar) are igneous diorites rather than ortho-amphibolites, and therefore the possibility remains that, as implied by Wright (1968), the Johnston Series was involved in a Pre-Cambrian metamorphism. In any case, we cannot find any differences along the sole of the boundary thrust in Foxes Hole which suggest a change from "diorite" to "olivine-monzonite".

REFERENCES

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REVIEWS

- MANNING, THOMAS G. 1967. *Government in Science. The U.S. Geological Survey, 1867–1894.* 257 p., 4 line drawings, index. University of Kentucky Press, Lexington. Price \$7.00.

This volume is not, as might be supposed from a first glance at its title, a general account of the relationships between science and government, but a history of the events leading to the foundation of the United States Geological Survey, and of its first 15 years of existence. Like its counterpart in Britain, founded 44 years earlier, the U.S.G.S. was one of the earliest ventures of the central government into the scientific field, and it has remained to this day one of the most influential. The author, who is a Yale graduate, is professor of history at Texas Technological College. Yale University exerted considerable influence upon the development of geology in the U.S.A., by no means all of it favourable towards the Survey.

Events leading to its foundation began after the Civil War. The rich mineral resources of the trans-Mississippi West were being actively explored and the region was in the care of the Federal Government, prior to the granting of States rights in this territory. Thus, whereas many of the older States in the East had had their own geological surveys, some of them dating from the rise of the science itself, the mapping of the West was a Federal matter; and this applied, of course, to the topography as well as the geology. The Federal government already possessed agencies able to undertake research in the western