FIELD EXCURSION TO THE FAL VALLEY, IN THE WESTERN PART OF THE ST AUSTELL GRANITE, 4TH JANUARY 1995

C.M. BRISTOW AND J.H. HOWE

C.M.Bristow, Camborne School of Mines, Redruth, Cornwall, TR15 3SE.
J.H.Howe, ECC International Europe Ltd., St Austell, Cornwall, PL25 4DJ.

INTRODUCTION

Development of Wheal Remfry and Rostowrack china clay and china stone pits in the western part of the St Austell granite has provided new exposures which throw fresh light on the geological evolution of the area. A paper by one of the authors (Bristow, 1989) provides a background to the geology of the area, and an earlier paper by Allman Ward *et al.* (1982) describes the Wheal Remfry breccia in terms of the exposures available in the early eighties.

WHEAL REMFRY

Recent overburden removal in the north-east corner of Wheal Remfry china clay pit has exposed the contact between the eastern side of the western lobe of the St Austell granite and the adjoining metasediments [SW 927 577]. Previous structural interpretations have assumed that this contact is a major northwest — south-east strike-slip fault. A length of about 100 m of contact was seen, exposed on three benches over a vertical distance of about 20 m. The contact trends generally north-west — south-east, but is irregular in detail; it appears to be generally magmatic and unfaulted. A horizontal sill of granite about 2 m thick was seen intruding tourmalinised metasediments. Towards the southern end of the area examined [SW 927 576], within the granite, there was some evidence of north-west — south-east faulting. Taken together with other evidence from the Fal valley and elsewhere (Bristow, 1989; Bristow and Robson, 1994), it is believed that the Fal valley is aligned along a major north-west —south-east fault which had a major phase of movement immediately prior to the intrusion of the granites. The granite then stoped up to the line of weakness represented by the fault. Subsequent minor movements on the fault affected the granite later, and the Wheal Remfry breccia is a north-west — south-east elongate body (750 x 50 m) aligned along a line of weakness parallel to the fault.

Zones of kaolinization affecting both granite and metasediments were seen in the north-east corner of the pit to be associated with late north-west — south-east quartz veins. Not far to the north, in the excavations for the Indian Queens by-pass [SW 924 591], intensely kaolinized metasediments were seen at an early stage in the construction work (not seen on this field trip and no longer visible, but one of the authors [CMB] has photographs).

Soliflucted head up to 5 m thick was draped over the upper part of the section in the north-eastern corner of Wheal Remfry pit. Formerly, in the southern part of Wheal Remfry pit, and in Virginia pit, a stack of soliflucted sheets of kaolinised granite up to 15 m thick, composed of sheets about 0.5 m thick, was seen underlying the valley bottom.

The large west-north-west — east-south-east felsitic elvan in the north-west corner of Wheal Remfry pit [SW 923 579] was visited next. This vertical elvan dyke, about 4 m wide and partly altered by pervasive kaolinization, was seen to cut across the breccia and early sheeted vein systems and therefore must postdate them. The elvan was intruded into intensely greisened and tourmalinized granite and metasediments; the intensity of the alteration was such that it was difficult to pick out the western contact between the granite and the country rocks. This greisened mass is known to be rich in topaz and a nearby natural tor (Carliquioter Rocks, Collins, 1878, p.8) shows material similar to the topazfels of St Mewan Beacon. These pervasively greisened areas at the contact seemed to have arisen due to the fluids responsible for the greisenization being ponded up at this point. On a practical point, it was noted that much of the hardcore for the road foundations of the new A30 Indian Queens by-pass had been quarried from this large greisened mass.

Segregations of tourmaline were next examined, ranging in size from a few cm up to about 20 cm. [SW 923 580]. These were interpreted to represent immiscible blobs of borosilicate fluid which had developed in the microgranite host, possibly by a mechanism which involved boron gathering in a hydrous phase. Larger blobs up to several metres across are known from other china clay pits (e.g. Goonbarrow), and the ultimate development of an immiscible borosilicate phase could be represented by masses such as Roche Rock or the Wheal Remfry breccia.

The party then descended to a lower bench where the relationship between the breccia and the microgranite was examined [SW 923 576]. The microgranite magma was seen to be intruding the breccia in places and fluidal wisps of microgranite were interbanded with tourmalinite breccia matrix. Many clasts of microgranite gave the appearance of having been fluid at the time they were entrapped in the breccia, others clearly were solid. On the field evidence there would appear to be little doubt that some microgranite magma and the tourmalinite breccia matrix were both fluid at the same time. An $^{4}_{0}Ar/^{39}Ar$ date of 270.3 +/- 0.8 Ma has been reported for the Wheal Remfry breccia (Chesley *et al.,* 1993); in view of the evidence of coeval fluid microgranite and breccia matrix, this suggests that the latest granite magmatism in the western lobe of the St Austell granite is of the same date as the breccia and therefore equivalent in age to the younger granite at Castle-an-Dinas, which Darbyshire and Shepherd (1994) reported, on the basis of Rb-Sr and Sm-Nd dating, as 270 Ma. Chesley *et al.* (p 1827) wrongly implied that the elvan pre-dates the breccia at Wheal Remfry; the field evidence now clearly shows that whilst the microgranite and breccia were coeval, the elvan magmatism postdates the breccia. This area therefore contains some of the youngest magmatism in the Cornubian batholith.

The main mass of the breccia was now examined and it was noted that in some locations [SW 923 577] the clasts in the breccia were entirely country rock (killas), whilst close by the clasts were predominantly of microgranite. A magnificent exposure in the southern part of the pit [SW 924 572] showed the full width of the breccia close to its southern termination and clasts up to a metre across were seen. Most of the clasts in this part of the breccia were of microgranite, but on the east side a silicified breccia, possibly a later phase as suggested by Allman-Ward *et al.,* was seen with clasts mainly of killas. Veins of breccia are also now known to occur in the north-western corner of Virginia [SW 932 559] and Melbur china clay pits.

The east-west iron lode associated with the former Wheal Edith iron mine was seen, as well as the collapsed adit leading into the mine.

ROSTOWRACK CHINA STONE QUARRY AND CHINA CLAY PIT

After lunch and a brief pause for blasting to be completed, the party descended into Rostowrack china stone quarry, which is the last working china stone quarry in the St Austell granite [SW 954 564]. Mr Charles Thurlow, a former manager of a china stone operation, gave a short talk on the working of china stone, which was used in the production of high-grade ceramics such as tableware. Most of the varieties of china stone were seen (Hard purple, mild purple, hard white and mild white), and the difference between shellstone (Li-mica granite) and china stone was demonstrated. Some joints coated were fluorite were seen. There was a lively debate over the origin of the fluorite in the fluorite granite - magmatic or metasomatic?

The china clay operations at the northern end of Rostowrack pit were then visited [SW 951 564] and the kaolinized zone was seen to be associated with a prominent quartz vein striking northwest — south-east. This vein is one of the cross-course veins which post-date the mainstage mineralisation, hence there is no tourmaline, but there is much iron oxide (Stage 4 veins, Bristow and Exley, 1994). In the past a breccia has been found associated with this vein, including rounded concretions of quartz.

ACKNOWLEDGEMENTS

The Society is grateful to ECC International (Europe) Ltd. and Goonvean and Rostowrack China Clay Co. Ltd. for the facility to visit the working pits, and to ECC for providing lunch and drinks at a hostelry in St Stephen.

REFERENCES

ALLMAN-WARD, P., HALLS, C., RANKIN ,A.H. and BRISTOW ,C.M. 1982 An intrusive hydrothermal breccia body at Wheal Remfry in the western party of the St Austell granite pluton, Cornwall. *In: Metallization associated with acid magmatism* Ed: A.M. EVANS, John Wiley and Sons, 1-28.

BRISTOW, C.M. 1989 The Fat Valley Lineaments. *Camborne School of Mines Journal,* **89**, 34-42.

BRISTOW, C.M. and EXLEY, C.S. 1994 Historical and Geological Aspects of the China Clay Industry of South-west England. *Transactions of the Royal Geological Society of Cornwall,* **21,** 247-314.

BRISTOW, C.M. and ROBSON, J. 1994 Palaeogene Basin development in Devon. *Transactions of the Institution of Mining and Metallurgy, Section B: Applied Earth Science,* **103**, B163-174.

COLLINS, J.H. 1878 The Hensbarrow granite district. *Lake and Lake,* Truro. Re-published in a facsimile edition by Cornish Hillside Publications, 1992.

CHESLEY, J.T., HALLIDAY, A.N., SNEE, L.W., MEZGER, K., SHEPHERD, T.J. and SCRIVENER ,R.C. 1993 Thermochronology of the Cornubian batholith in southwest England: Implications for pluton emplacement and protracted hydrothermal mineralization. *Geochemica et Cosmochemica Acta,* **57**, 1817-1835.

DARBYSHIRE, D.P.F. and SHEPHERD ,T.J. 1994. Nd and Sr isotope constraints on the origin of the Cornubian batholith, SW England. *Journal of the Geological Society,* **151,** 795-802.