South Terras Mine, Cornwall

[SW 933 522]

Introduction

The South Terras Mine (also known as 'Resugga and Tolgarrick Mine' and sometimes 'Grampound Road') lies in the valley of the River Fal about 1.5 km south-west of St Stephen (see (Figure 7.44)), and approximately 8 km west of St Austell, at the southern margin of the St Austell Granite. South Terras Mine was one of the few mines in Britain that was worked commercially for uranium, and in the final period of activity, in the 1920s, the main product was radium.

At the present time it is the dumps containing minerals from the various South Terras lodes which are of considerable mineralogical interest (see (Figure 7.45)). Small but good samples of uranium secondary minerals and mime uraninite (pitchblende) can still be found in the dumps. A further suite of unusual and rare nickel and cobalt minerals also occur on the various dumps, including, for example, rammelsbergite, smaltite, skutterudite, gersdorffite and the bismuth mineral bismuthinite. The rare nickel arsenides aerugite and xanthiosite have also been reported (Davis *et al.,* 1964). However, Ryback *et al.* (2001) have demonstrated that the late A.W.G. Kingsbury falsified the localities of numerous rare mineral species. This deception affects a number of locations in the South-west England, including South Terras Mine. Therefore care should be exercised when considering claims by Kingsbury which have not been substantiated or duplicated by subsequent collectors.

The South Terras Mine has attracted much interest over the years and has been described by Collins (1912), and Robertson and Dines (1929), while a detailed summary was provided by Dines (1956). The site also represents an example of the U-Co-Ni-Bi-As-Ag suite of deposits recorded by Alderton (1993).

Description

South Terras Mine was sited in country rock ('killas') (Meadfoot Group) of Lower Devonian age, which also contains greenstones (altered basic igneous rocks), recorded at a depth of 37 m. It is reported also that the rocks were cut by a quartz-feldspar porphyry 'elvan' dyke. Records indicate (Dines, 1956) that mine workings intersected three mineralized structures, namely a uranium lode trending approximately north–south (N10°W), a tin lode trending N15°E, and a lode of iron ore (magnetite) ranging E30°S. These were reported to intersect about 115 m south by east of Tolgarrick Mill.

Nothing is known of the nature of the tin lode or of its workings, and the earliest workings appear to have been on the iron lode. The iron lode is recorded to have been up to 3 m wide with rich ore in the centre, being poorer near the walls. The lode was partly in killas and partly in intrusive greenstone, and the country rocks appear to have been partially metamorphosed by the intrusion.

Near the surface the iron lode ore is weathered to ochre (to 50 fathoms depth), and is reported to contain, in addition to magnetite, some tourmaline, cassiterite, chalcopyrite, arsenopyrite, sphalerite and some silver ore. Where the lode cuts greenstone the arsenate minerals scorodite, pharmacosiderite and olivenite have been recorded. Workings on the iron lode encountered the uranium lode in 1873. Stoping on the latter commenced in 1878. The South and North shafts were sunk shortly afterwards.

The uranium lode is recorded as being up to 1 m wide running approximately north–south with a westerly underlie of about 60°. Quartz generally occupied most of this width. During mining there was evidence for several stages of vein infilling, and areas of crushed killas also occur in the vein. The age of this late-stage cross-course mineralization has been given at 225 Ma, but a much younger age of 47 Ma has also been recorded (see Alderton, 1993). According to Collins (1912) the secondary uranium minerals autunite, torbernite and zippeite occurred at high levels in the lode, and at depth massive uraninite (pitchblende). The chief ore minerals were uraninite, and the secondary minerals torbernite and autunite. Uranium ore appears to be late stage in the veins. The uranium-bearing fissure-vein is said to have extended some 18 m. Richest ore was found at the 240-fathom level, although even here ore was sporadic, forming irregular ore swells of a few centimetres. Traces of chalcopyrite, pyrite and galena can be found on the dumps, and nickel, cobalt, bismuth and chromium ores were also reported from the mine associated with the uranium lode. In the 1920s uranium ore was shipped to France for treatment. However, at this time (1922–1925), a treatment plant at the mine site continued to recover radium. Total uranium production has been estimated at 736 tons of uranium ore, including 286 tons from the dumps.

True 'minter' lodes, that is lodes at a trend to the main lodes of the area forming fissure systems to the recorded elvan dykes, appear to be the latest phase of mineralizing activity, forming a bifurcating and altered ore-bearing fissure. The recorded elvan dykes intersect the country rock from east to west, and the elvans sometimes carry cassiterite. It is thought possible that where the lode cuts through the killas it is rich in uranium, but in granite it is barren; this is certainly indicated by the evidence from specimens on the dumps.

Interpretation

The South Terras Mine is perhaps the most important of several recorded uranium and Ni-Co-As orebodies associated with the southern margin of the St Austell Granite. Locally, at Egloshellen Mine [SW 950 528], Dines (1956) reported uranium mineralization, and during the exploration programme by the Geological Survey Atomic Energy Division in the 1950s, uranium mineralization was disco'vered at the Resugga Lane-End site [SW 942 519]. In addition, uranium mineralization is relatively widespread throughout the South-west England orefield and reported from many other parts of the mining field, for example Geevor Mine, St Just, Old Gunnislake Mine near Calstock, and Kings Wood Mine near Buckfastleigh.

The mineralization of the uranium lode, in common with that of other similar low-temperature cross-course mineral veins in South-west England, is of the nickel-cobalt-arsenic-bismuth-silver-uranium type. The long list of minerals recorded from the South Terras Mine dumps is representative of a complex mineralization history. Three groupings of minerals probably reflect the varied mineralized lodes, namely: a primary association of uranium with chalcopyrite and pyrite altered by supergene enrichment to Cu-As-U secondary minerals; an association of minor Fe-Ni-Co-Bi-As mineralization, forming a suite of unusual and rare minerals; and an association of the iron minerals of the iron lode (magnetite). A detailed study of uranium mineralization in South-west England was presented by Ball *et al.* (1982). In this study they cited two localities where Ni-Co mineralization and uraninite are actually inter-grown. The relatively frequent association of uranium with Cu, Ni, and Co has led some workers to believe the source of uranium to be associated with the greenstones (uranium mineralization has been found associated with greenstones). However, it might be that the greenstones are merely suitable hosts to hydrothermally-derived uranium deposits. Alteration processes associated with the St Austell Granite may be of importance to supplying uranium into convective fluids and precipitation into late-stage cross-course veins. Alderton (1993) noted these alternatives, but also added the underlying Permian alkaline volcanic rocks and associated lamprophyres as a potential source.

The nature of the iron lode (magnetite) is not fully known, but the described mineral assemblage might mean that it is a sulphur-poor magnetite skarn. The actual source of the uranium at South Terras Mine is probably the St Austell Granite, whereas the Ni-Co-Bi-As may be derived from the earlier iron-rich phase of mineralization.

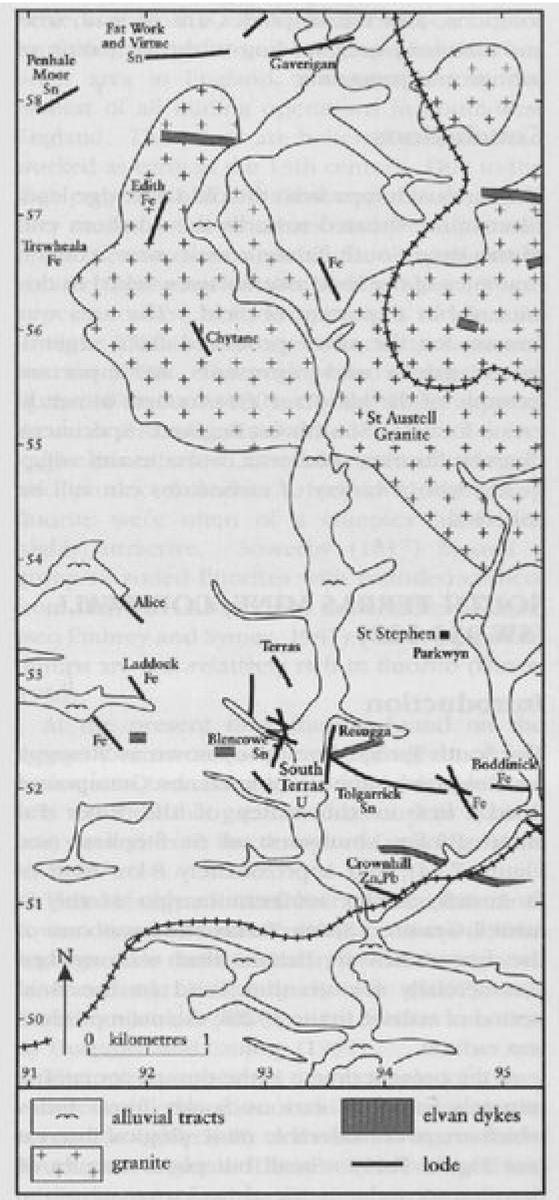
Ball and Basham (1979) strongly emphasized that uraninite was earlier than the associated sulphides in most uranium occurrences, including South Terras Mine. The models of mineralization for uranium put forward by Ball and Basham (1979) are important to developing a paragenetic scheme. The uranium mineralization can be seen as related to two discrete episodes. The first was a phase of cross-course mineralization where convective circulation affected both the killas and granite, and the main sites of mineralization were the cross-courses. Uranium was leached from local wall-rocks and earlier higher-temperature mineralization. In the second phase, uraniferous solutions generated by kaolinization or radiogenically driven cirulation were directed outwards from the granite until dammed by a suitable barrier, such as the elvans. It could be that the elvans present in the South Terras area might well have been an important feature responsible for mineralization forming along the N-dipping hangingwall of the elvans. However, there are a variety of models that can be used to first generate and then precipitate uranium in the cross-course veins and a variety of adjacent country rocks.

Conclusions

The nature and structural situation of the South Terras Mine uranium deposit, located at the southern magin of the St Austell Granite, is of considerable interest to gaining an understanding of uranium and cross-course mineralization in South-west England. From the specimens that can still be collected from the dumps, and material in museums and private collections, some idea of the structure and paragenesis of the South Terras Mine cross-course mineralization suite can be determined.

It is a conclusion that the site still provides considerable potential for scientific research. The variety of rare and unusual minerals reported to occur on the dumps makes this site one of considerable mineralogical interest. Recent biological work on the uptake of uranium by lichens found coating part of the dumps has been reported by McLean *et al.* (1998).

References



(Figure 7.44) Map showing the position of South Terras Mine. After Dines (1956).

(Figure 7.45) Photograph of a dump area at South Terras Mine (Photo: JNCC.).