

tions, and a sophisticated division of the labour force.¹ Cassiterite, the principal ore of tin, on the other hand, frequently occurs in rich surface deposits. Floods, particularly during the glacial period, washed the tin from veins in adjacent hills and deposited it in layers of varying thickness in valleys. Layers of alluvial tin, consisting of stones ranging in size from a goose egg to the finest sand, were usually sandwiched between layers of earth, gravel, and stone, which often extended to a depth of more than ten feet and sometimes the width of the valley.

The extraction of alluvial deposits is called streaming, and is usually far simpler and cheaper than mining; furthermore stream tin is invariably of superior quality to mine tin. After determining the approximate location of a deposit, usually from outcrops of tin stones called 'shode', prospectors would generally sink a series of shafts or hatches to depths of perhaps 20 to 40 feet in order to survey accurately its richness and extent. Having decided to work the ground an open trench was first dug down to the deepest part of the valley to carry off the water and waste from the working, and then the overburden of stones and earth was removed. Water was crucial to streaming: it was sometimes used to remove the overburden after it had been loosened and broken up, and it was essential in the sifting of ore from its accompanying debris, called by the tanners 'gall, wundirk and dawegard'. Frequently streamers had to divert water considerable distances overland by means of conduits made of turves and wood, and sometimes the course of a river would even be altered. A stream work 'without water is like a windmill without wind' and long dry spells usually brought operations to a halt.²

These practices, apart from being costly to the tanners, frequently involved landowners and farmers in considerable losses,

¹ For accounts of the royal silver-lead mines of west Devon and east Cornwall see: L. F. Salzman, *English Industries of the Middle Ages* (1913 ed.), Chapter III: id., 'Mines and Stannaries' *The English Government at Work 1327-1336*, iii. ed. J. F. Willard, W. A. Morris, W. H. Dunham (Cambridge, Mass., 1950), 68-87; Lewis, *The Stannaries*, pp. 192-7.

² A long technical description of streaming would be out of place in this study; the reader is referred instead to W. Pryce, *Mineralogia Cornubiensis* (1778); R. N. Worth, *Historical Notes concerning the Progress of Mining Skill in Devon and Cornwall* (Falmouth, 1872); Lewis, *The Stannaries*, pp. 1-7; A. K. H. Jenkin, *The Cornish Miner* (3rd edn. 1962), pp. 41-5, 54-61. For a detailed description of contemporary techniques see Beare's account of Blackmore Stannary written in 1586: B. M. Harleian MS. 6380.

and complaints and litigation were common occurrences.¹ In 1361, for example, John de Treures petitioned the Black Prince, and it was reported to his council that:

fully sixty tanners have entered on his demesne and soil, which bears wheat, barley, oats, hay and peas, and is as good and fair as any soil in Cornewaille, and have led streams of water from divers places to Treures over part of his said demesne and soil, so that, by reason of the great current of water they have obtained and the steep slope of the land there, all the land where they come will go back to open moor, and nothing will remain of all that good land except great stones and gravel.²

Many of the richest stream deposits were exhausted at an early date in the Middle Ages,³ and from the mid-thirteenth century as deposits became more difficult to exploit many stream works taxed the skill and resources of the tanners. The maximum depth of stream works in the Middle Ages was probably fifty or sixty feet. Nevertheless many works were substantial and employed upwards of fifty labourers, and the discharge of silt and rubble from a series along the same valley could pose serious problems. Indeed so great was the flood of refuse from works on Fowey Moor in 1356 that the harbour of Lostwithiel was threatened and tin working had to cease immediately on the orders of the Duke of Cornwall.⁴ And once again in 1532 urgent action had to be taken to prevent grave damage to the harbours of Falmouth, Fowey, and Plymouth being caused by the discharge from neighbouring stream works.⁵

¹ R. Carew, *Survey of Cornwall* (1769 ed.), p. 90; *Rot. Parl.* i. 297, 312, 382, ii. 190; Finberg, *Tavistock Abbey*, p. 186; L. E. Elliott-Binns, *Medieval Cornwall* (1955), p. 222; C. Gill (ed.), *Dartmoor: A New Study* (Newton Abbot, 1970), pp. 115-16.

² *Registers of the Black Prince*, ii. 178.

³ This phenomenon explains, for example, the shift of the major part of tin-streaming activity from west Devon to Cornwall in the course of the early thirteenth century.

⁴ *Ibid.*, pp. 110, 121, 156. An inquiry into the effect of tin works on 'Fowey harbour' was held at Lostwithiel in 1356, and full details are contained in the court rolls of Blackmore Stannary (P.R.O. SC.2.156/26, court held at Lostwithiel, *de Merc. prox. post fest. St. Johannis ante portam latinam*). Although Fowey is mentioned specifically in the documents it is likely that it was the small harbour of Lostwithiel that was being damaged; Lostwithiel was technically within the port of Fowey.

⁵ W. Cunningham, *The Growth of English Industry and Commerce*, 3 vols. (Cambridge, 1903), i. 480-1. See also C. Gill, *Plymouth: A New History* (Newton Abbot, 1960), p. 21; Elliott-Binns, *Medieval Cornwall*, pp. 146, 222.

Both stream works and mines existed from the fourteenth century onwards, but there is little doubt that stream works remained the most important source of tin up to the close of our period in the mid-sixteenth century.¹ From the mid-fifteenth century, however, the progressive exhaustion of many of the more fertile alluvial deposits gradually necessitated a widespread tapping of lodes, sometimes to a depth of three hundred feet, with the result that by the close of the sixteenth century the great costs of sinking shafts, and of ventilating them and keeping them relatively free of water, were threatening the viability of the industry.²

The failure to exploit underground tin deposits on a significant scale before the late sixteenth century cannot be explained simply by a failure of technology, since deep underground mining was carried out in the Mendips, and in the royal silver-lead mines of Devon and Cornwall where, in the late thirteenth century, more than three hundred men were employed in a single operation.³ More detail on the silver mines is available from documents of the late fifteenth century from which we learn that the work force in Beer Ferrers mine consisted entirely of wage labourers, and included large numbers of pumpmen, carpenters, smiths, chandlers, sawyers, washers, roasters, refiners, charcoal-burners, and carters, in addition to seventy-nine miners.⁴ Special factors were at work in the silver mines, however, for not only did the ample resources of the Crown finance their operation, but also the value of the ore extracted frequently justified the high level of investment. The same would not have held true for tin mines in our period. The low level of tin production consequent upon the grave shortage of tanners and the large number of deserted tin works during much of the period between the Black Death and the early sixteenth century,⁵ proves just as conclusively as the sad experience of the industry in the face of rising costs in the late sixteenth and early seventeenth centuries that the lack of exploitation of under-

¹ Beare mentions only streaming; Carew writes of mines as well as stream works, but concentrates upon the latter.

² Lewis, *The Stannaries*, pp. 217-18; Jenkin, *The Cornish Miner*, p. 123.

³ J. W. Gough, *The Mines of Mendip* (Oxford, 1930), pp. 1-18, 66-8; Salzman, *English Industries*, pp. 52-8; 'Mines and Stannaries', pp. 71-2.

⁴ P.R.O. E.101.265/18; 266/25.

⁵ Appendix A, below.