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THE ROGERLEY MINE

Beautiful green fluorite specimens j%m this classic locality are once again on the collector market, thanks to a new find in the summer of 1999.

The Northern Pennine orefield has been an important source of lead, fluorspar (commercial fluorite), and other metallic and nonmetallic ores for many centuries. The earliest records of mining date from the twelfth century, with the high point of lead mining occurring in the eighteenth and nineteenth centuries, followed by a rise in fluorspar production during the late nineteenth through midtwentieth centuries (Dunham 1990). Mineral specimens have long been a byproduct of these mining operations, and the area around Weardale is particularly noted for the production of many exquisite, well-crystallized specimens of fluorite that exhibit a strong daylight fluorescence unique to fluorite from this region. Mines such as the Heights, Boltsburn, Blackdene, Cambokeels. and Frazers' Hush are famous among mineralogists and collectors, and specimens from these locations now grace most major mineral collections worldwide.

In recent years, however, large-scale commercial mining has seen a serious decline throughout the Weardale area, along with the rest of the United Kingdom. As a result, the supply of crystallized mineral specimens for the collector's market as a byproduct of mining for lead and fluorite ores has largely ceased. Those specimens that do make it to market these days are, for the most part, recycled out of old collections. The one exception to this has been specimens from the Rogerley mine, which was worked by partners Lindsay Greenbank and Mick Sutcliffe (operating as Cumbria Mining and Mineral Company) on a part-time basis between its discovery in the early 1970s and 1996. The Rogerley is, to date, the only mine in the United Kingdom that has been operated specifically for the recovery of mineral specimens on a commercial basis, and during this time the mine produced a limited but steady stream of high-quality fluorite specimens, most of which are an attractive emerald-green color.

By 1996 the partners had decided to retire from mining and generously offered to assist in transferring the operation of the mine to a group of interested Americans. After completing the re-negotiation of all lease agreements, the current operators (a partnership of Cal Graeber, Paul Geffner, the lead author [JF], and the mining crew of Byron Weege, Otto Komerak, and Jonina and Bill Pogue), operating as UK Mining Ventures, began full-time operations at the Rogerley in May 1999. After spending approximately six weeks rehabilitating the mine, they began drifting and almost immediately encountered a large cavity lined with green fluorite. Excavation of this pocket lasted throughout the summer and produced literally hundreds of specimens of finely crystallized fluorite. This lind shows that, despite centuries of mining activity, the Weardale area still has the potential to produce large amounts of high-quality fluorite specimens; it also demonstrates the viability of commercial mining aimed at specimen recovery in this historic district.

Location and Geography

The Weardale district of the Northern Pennthe orefield is located in the largely rural northwestern portion of County Durham, not far south of Hadrian's Wall in northern England. The Wear Valley runs east-west, following the course of the River Wear, beginning near the town of Wolsingham in the east and continuing westward for more than 20 miles.

Although at one time heavily forested, much of this area was cleared centuries ago, and the region is now predominantly open moorland, divided by stone walls and the occasional stone cottage. Inhabited towns and villages, for the most part, occupy the valley floor, and Stanhope is the center of commercial activity for the valley. A few miles north of Stanhope is the picturesque village of Rookhope, formerly the center of much of the local mining. A number of the most productive mines in the Weardale district, including the Boltsburn, Stotsfieldburn, Groverake, and Frazer's Hush, were located at or near Rookhope, but with the closure of these mines, the village is now fairly quiet.

With the decline of mining, tourism and the raising of sheep and cattle are now the mainstays of the local economy. Evidence of past mining abounds, however, and the hills surrounding the valley are covered with numerous long-abandoned quarries, pits, and mine dumps, the names and histories of which are mostly lost in antiquity. Mineral specimens brought from the mines as curiosities by miners can still occasionally be seen as decorations in yards and along walls surrounding cottages in the dale. On rare occasions specimens can be found that have actually survived the vicissitudes of time in reasonable shape, and though the owners are usually aware of their value, purchases can sometimes be negotiated.

History of Mining in the Northern Pennines

There is considerable evidence of mining in southern England during the Roman occupation, but there is no direct evidence that mining was conducted in the northern Pennines during that time. It may or may not be coincidental, however, that Hadrian's Wall (built A.D. 112) was constructed along a line marking the northern limits of the Northern Pennine orefield. The first documented evidence of mining in the area dates from the twelfth century and records the presence of silver mines in the areas of what are now Alston Moor, just west of Weardale, and Northumberland. Weardale was at this time a forested area that belonged to the Bishops of Durham, who used it as a hunting preserve. The villages of Eastgate and Westgate mark the former entrances to this forest preserve (King 1982).

Lead mining in Weardale reached its greatest levels during the eighteenth and nineteenth centuries. The London Lead Company acquired its first leases in the area in 1692 and continued mining and smelting activities until 1882. The Beaumont Company had its beginnings around the same time and was active until 1884. Oxidized near-surface deposits of siderite and ankerite provided economic deposits of iron ore in some mines and were exploited by the Weardale Iron Company from 1842 until around 1920, with the majority of activity occurring prior to 1880. During the 1880s the declining prices for lead forced both the Beaumont and the London Lead Companies to give up their leases in the area. Some of these were picked up by the Weardale Lead Company, which continued lead mining and smelting until 1931. According to Dunham (1990), twenty-eight separate lead-smelting operations were active in the region during the height of mining in the nineteenth century, but by 1919 the last one had closed.

The mining of nonmetallic ores--fluorspar, witherite, and barytes (commercial barite ore)--in the northern Pennines began about the time lead and iron mining were in decline. Fluorspar mining was begun in 1882 by the Weardale Iron Company, which continued operations until being taken over in 1964 by Imperial Chemical Industries, which was, in turn, taken over in 1977 by Swiss Aluminum Mining (UK), Ltd. Shortly after the Second World War, British Steel Corporation was also actively mining fluorspar in the region. By the early 1990s the area's fluorspar mining was in serious decline, largely due to competition from overseas sources, and during the summer of 1999 the last ore-producing mines in Weardale-Frazer's Hush and Groverake--had closed.

Total production values for lead and fluorspar from the Weardale district over the years are impressive. According to Dunham (1990), almost 1 million tons of lead were produced from 1666 through 1985. Almost 2 million tons of fluorspar were produced between 1850 and 1984. For more information on the history and production of the many individual mines in the Weardale area, the reader is referred to the recently published monograph by Fairbairn (1996).

Geology and Mineralogy of Ore Deposits

The Northern Pennine orefield is a fault-bounded block covering an area of approximately 550 square miles. A series of Paleozoic faults that were reactivated during the Tertiary form the southern and northwestern margins of the block, tilting it eastward with a maximum displacement along the fault margins of up to 3,000 meters (Sawkins 1966). The Pennine block can be further divided into northern and southern portions by the east-west trending Stainmore syncline. The northern portion, containing the Weardale district, is known as the Alston block, while the southern portion is known as the Askrigg block (Dunham 1990). The ore-beating deposits of the Pennine block are hosted by a series of Lower to Upper Carboniferous sedimentary units--sandstones, limestones, shales, and coal beds. These sediments form rhythmic sequences, or cyclothems, that were deposited during repeated marine transgressions. The ideal transgressional sequence, indicating a progression from deep marine to shallow marine to terrestrial, would be limestone right arrow shale right arrow sandstone right arrow coal, but this sequence is often incomplete. The Carboniferous sedimentary sequence rests unconformably on the Weardale Granite, which has a K/Ar age of 362 +/- 6 m.y. (Dunham 1990). This granite is not exposed at the surface, but its existence was proposed because of a negative gravity anomaly in the region and was later confirmed by borehole. Though the Weardale Granite is not believed to be genetically related to mineralization in the northern Pennines, its location is coincident with the later fluorite/galena deposits, and King (1982) suggests that its presence may have exerted a structural control on the emplacement of orebodies. Dunham (1990) describes the Weardale Granite as having an anomolously high heat flow and suggests a mantle source for the heat. Though the Weardale Granite had been intruded, exposed by erosion, and reburied prior to the emplacement of the Northern Pennine ore field, it is probable that the granite acted as a localizing conduit for the heat driving the mineralizing process. Several igneous dikes and sills have been intruded into the Carboniferous sedimentary sequence, the largest of which is the Great Whin Sill, a quartz-orthopyroxene diabase (dolerite in British usage) of Late Carboniferous age.

The ore deposits hosted by the Carboniferous sequence are of two types: near-vertical veins of hydrothermal origin and horizontal metasomatic flats. The ore-bearing veins have been intruded as open-space fillings along a series of regional fractures believed to have been created by regional doming at the end of the Carboniferous Period (Sawkins 1966). The main series of fractures trends east-northeast while a secondary set trends west-northwest. Ore minerals were preferentially deposited within the more competent stratigraphic units, typically limestones and hard sandstones. In less competent units such as shales, the ore-bearing veins usually break up into small, poorly mineralized stringers (Dunham 1990). Although the veins were often rich sources of ore, crystallized mineral specimens found in vein cavities were, with a few exceptions, not of the quality found in the flat cavities (King 1982).

The flats are sheetlike metasomatic mineral deposits emplaced along favorable horizons in limestones adjacent to veins. They appear to occur most frequently around the intersection of two or more veins (Dunham 1990). Although flats have been found in nine different limestone units, the majority occur within the Great Limestone, a thick unit forming the base of the Upper Carboniferous series. From studies made at the Boltsburn mine, Dunham (1990) further correlates the occurrence of flats in the Great Limestone with regions where the overlying Coal Sill Sandstone is thin and replaced by shale. Unlike the vein deposits, the metasomatic flats are frequently vuggy and are the source of most crystallized mineral specimens from the district.

The mineralogy of both the veins and flats in the Weardale region is relatively simple. Galena, fluorite, and quartz are common and widespread, and sphalerite, ankerite, siderite, and calcite may be locally abundant. Other sulfides, including pyrite, marcasite, chalcopyrite, and pyrrhotite, are occasionally found as well. Galena was the principal ore recovered from the Weardale mines until the late nineteenth century, and although the silver content of Weardale galena is generally low (averaging 4-8 ounces per ton [Dunham 1990]), some silver was recovered along with the lead. Local concentrations of sphalerite have been mined for zinc, and where sufficiently concentrated by oxidation processes, deposits of ankerite and siderite have proved economic as ores of iron. Fluorite was not an economic commodity until the advent of modern steel-making processes during the late nineteenth century created a demand for it as a fluxing agent. Before that, fluorite encountered in mining was considered waste (or "deads") and used as backfill or dumped. The rise in demand for fluorite coincided with a declining market for lead and helped extend the life of the mining district into the twentieth century.

Barite and witherite also occur in economic concentrations in the northern Pennines, but the distribution of barite-rich deposits is peripheral to the concentrations of fluorite; little, if any, has been mined in the Weardale district proper. Dunham (1937) states that there is a sharp boundary dividing fluorite and barite zones, and the two minerals do not overlap in distribution. Sawkins (1966) has shown that fluorite from the Northern Pennine orefield formed at higher temperatures than the barite, suggesting that a temperature gradient, along with the mixing of hydrothermal solutions with Ba-rich connate waters present in areas surrounding Weardale, resulted in this concentric pattern of mineral deposition.

Based on fluid-inclusion studies, Sawkins (1966) determined that, for the most part, fluorite, quartz, galena, and sphalerite from the Weardale area were deposited at temperatures between approximately 200 degrees and 100 degrees C. In addition, he determined that the Na/K ratios of the included fluids were low, suggesting that the minerals were deposited from hydrothermal solutions of meteoric rather than connate origin. The low temperature of deposition, the presence of meteoric hydrothermal solutions, along with the geographic and temporal relationship of ore deposition to regional doming, and a lack of apparent igneous source indicate that these deposits are genetically similar to the Mississippi Valley-type lead-zinc-fluorite deposits of the central United States. Moorbath (1962) reports a mean lead isotope age for northern Pennine galena of 280 +/30 m.y., suggesting that regional mineralization occurred during the Permian Period and may be related to Hercynian orogenic activity (King 1982).

The Rogerley Mine

The Rogerley mine is located within an abandoned quarry of the same name, just west of the village of Frosterley. The quarry was originally operated during the mid-nineteenth century as a source of limestone as flux for steel mills in the nearby towns of Tow Law and Consett. There is no evidence that the quarry was ever worked for lead or fluorspar, which were considered impurities in the limestone. These ores were not found in commercial quantities within the quarry, and when encountered, they appear to have been discarded in a series of old tailings piles on the south side of the quarry. Reasonable-quality specimens can sometimes be recovered from these dumps, but the dump piles have recently been planted over, and the property owner is understandably loath to have pits dug around the bases of his new trees.

Cumbria Mining and Mineral Company

The Cumbria Mining and Mineral Company was formed in 1972 by Lindsay and Patricia Greenbank and Michael "Mick" and Brenda Sutcliffe with the intention of mining mineral specimens on a commercial basis. The concept of operating a mine solely for specimens was quite novel in the United Kingdom at the time and was not taken seriously by many mineral agents. After unsuccessful attempts to obtain leases on properties in both Caldbeck Fells and Alston Moor, the partnership obtained permission to explore a previously unworked fluoritecontaining vein in the Rogerley quarry in Weardale.

Fluorite specimens were originally discovered along the base of the quarry wall in the early 1970s by mineral collector

Raymond Blackburn. He determined that the source of the specimens was a spot high up on the north face of the quarry; however, being somewhat adverse to high places, he did not attempt to collect at the actual source. The second author [LG] was aware of the occurrence, having purchased specimens from Blackburn. As he did not share Blackburn's aversion to high places, he and partner Mick Sutcliffe began investigating the occurrence by roping down from the top of the quarry.

Leases for mineral rights were obtained from the mineral agents for the Church Commissioners of England, trespass rights were arranged with the local landowner, and the mine was operated on weekends for specimens over the course of the next twenty-five years. The source of the fluorite specimens was found to be cavities in the flats extending latterly from a north-south-trending vein exposed on the quarry wall. This vein is split into two stringers, separated by about I meter where exposed on the quarry face, and has been named the Greenbank vein by Sir Kingsley Dunham. Work initially focused on cavities along a flat near the top of the Great Limestone, a competent rock unit that supports the wall of the quarry. During the early to mid-1970s a bench about 10 meters long was cut into the face approximately 20 meters above the floor of the quarry, and three fluorite-producing zones were encountered.

A second vein, named the Sutcliffe vein by the current authors, can be seen on the face of a western extension of the quarry, several hundred meters west of the Rogerley mine. This vein trends to the northeast, and it is likely that it intersects the Greenbank vein somewhere to the north of the current mine workings. A limited amount of surface work was done on the Sutcliffe vein during 1976, resulting in the recovery of goodquality specimens of green and purple fluorite. Because access to this outcrop was difficult to control, and highgraders were a constant problem, work was soon shifted back to the original location.

During the late 1970s a cavity containing exceptional bright green fluorite was discovered near the surface directly below the previously cut bench level. Over the next eighteen months the partners, working on weekends, drove a tunnel northward about 20 meters in search of more fluorite at this level. Unfortunately, the tunnel proved barren for the rest of its length, and no work has been done there since.

The focus of mining then shifted back to the upper level, and during the 1980s a tunnel was driven northward into the quarry wall. Between 1982 and 1990 the partnership was also engaged in a zinc-mining operation at Force Crag in Cumbria, so work at the Rogerley was limited to one or two weekends a month. During this time a series of cavities along the tunnel produced a high volume of material, resulting in a steady cash flow for the company. Most of the recovered fluorite specimens were large, opaque green crystals, some with smaller, gemmy green crystals on the surface. To the east of this section of the tunnel the fluorite crystals tended to be smaller and more transparent, and some excellent-quality specimens were recovered. By the early 1990s the tunnel had been extended to near its current length of about 35 meters, but during the winter of 1992-93 the area around the portal collapsed, requiring the better part of the next year to reopen.

UK Mining Ventures

Not long after reopening the upper tunnel the second author [LG] contracted a near-fatal illness. Although he has since recovered, he was forced to conclude that the rigors of hardrock mining were a thing of the past. He was in the process of closing the mine and selling off the equipment when the situation came to the attention of the current operators. After successfully completing agreements to secure mineral and trespass rights with the various parties involved and purchasing the necessary equipment, full-time mining for specimens began in May 1999.

The mine had been fallow for several years, and natural deterioration, along with occasional visits from highgraders, had left it in need of considerable rehabilitation. This process involved mucking out and retimbering portions of the tunnel, re-laying the track, rebuilding the stairs to the upper tunnel entrance, having equipment delivered to the site and hoisted to the mine by crane, and installing a steel plate security door in the tunnel. By mid-June most of this had been accomplished, and the crew began mining for specimens.

The mine tends to be very wet year round, and during cleanup one of the more beneficial tools proved to be pressurized water for washing the mud off everything. While the tunnel walls were being cleaned, two areas of mineralization became apparent. At the north end of the tunnel was an area in which several pockets had previously been opened but not completely collected. One, named the Weasel pocket after a former inhabitant (a stoat) who was forced to vacate on very short notice, contained large clusters of purple cubic fluorite crystals, up to 7 cm in size, coated with druzy quartz. The fluorite crystals were, unfortunately, opaque except around the edges but made attractive specimens nonetheless.

The other area of mineralization occurred midway between the mine entrance and the end of the tunnel, in the area successfully worked during the 1980s by the Cumbria Mining and Mineral Company. On the west side of the tunnel, a series of cavities was exposed that contained large, opaque green fluorite cubes, some coated with calcite. On the east side of the tunnel, green fluorite was exposed in numerous stringers and pocket remnants. These crystals were smaller and clearer than those on the west side of the tunnel, and it was obvious that this area had been productive in the past because an alcove of about 1 meter had been driven eastward from the tunnel. On 12 June the miners pried loose a dangerous portion of the alcove roof and put in a timber set to stabilize the area. While washing the area during cleanup, they noticed a mud seam on the eastern face of the alcove. As the mud was washed away and a few slabs of rock were removed from the face, it became apparent that this was the opening of a fairly large cavity completely lined with crystals of green fluorite.

Over the course of the next few days, the pocket, now named the Black Sheep pocket in honor of a very good local ale, was opened up to approximately 1 x 1.5 meters. The floor was fairly broken up, and numerous specimens, ranging up to the size of small boulders, were removed by hand. Some of the floor and most of the pocket ceiling were intact, however, allowing large plates of crystals--many with fluorite-coated, stalactitelike fingers of matrix--to be removed using a diamond chain saw. The pocket proved to be an interconnected series of solution cavities, and extraction lasted through the summer. As of this writing (mid-August), the cavity has been opened up to approximately 1 meter high by 1.3 meters wide by 5 meters deep and has yielded hundreds of exceptional specimens.

Fluorite from the Black Sheep pocket is dark emerald-green with a strong purple daylight fluorescence and an even stronger purple-white fluorescence under shortwave ultraviolet radiation. Under incandescent light, the fluorite tends to be uniformly green, though some larger crystals have a pale purple core and/or a thin purple layer at the surface. Crystal size ranges up to approximately 3.5 cm. The habit is always cubic, and crystals are invariably penetration twins on {111}. Some crystals that were oriented facing upward from the floor of' the cavity are a bit etched and dull, but most of those from the roof are very lustrous. Clarity of the fluorite is generally good, particularly in the unetched crystals from the roof. Larger fluorite crystals have been found elsewhere in the mine, as previously mentioned, but these are typically at least partially opaque and rarely twinned. Aside from minor amounts of druzy quartz, the only other mineral found in the pocket was galena, which occurred as small octahedral crystals--typically no larger than 1 cm and invariably coated with a thin alteration layer of anglesite. Spinel twins were rarely found.

Paragenetically, quartz appears to be the earliest mineral to have formed in the Black Sheep pocket, as fluorite and galena typically occur on a surface of druzy quartz. The crystallization of galena appears roughly contemporaneous with that of fluorite, and many of the galena crystals are partially imbedded in fluorite crystals. In the Weasel pocket, the earliest mineral to form appears to have been one of the iron-bearing carbonates that has since been oxidized to limonite. Pale green fluorite, progressing to pale yellow fluorite, formed next. A quartz druze was deposited on the surface of the yellow fluorite, which was then overgrown by a final layer of purple fluorite. A second generation of druzy quartz was the last phase and covered the euhedral purple fluorite in the pocket.

The host limestone surrounding the pockets has been largely replaced by silica and iron oxides. This material is very tough, and extracting undamaged specimens is time consuming, even with the aid of the diamond saw. Stalactite-like structures were common in the Black Sheep pocket, forming knobs and fingers of matrix covered with druzy quartz, fluorite, and galena crystals. The core of these formations was often hollow or filled with iron oxides. King (1982) reports a similar occurrence of these formations in the flats in the Boltsburn mine. Here, on rare occasions, fluorite has been found on a matrix containing the fossil remnants of rugose (horn) corals.

The unique colors and daylight fluorescence of Weardale fluorite have long been noted, and it is generally accepted that these properties are related to the presence of rare-earth elements (REE) in solid solution (King 1982). Dunham (1990) reports elevated levels of yttrium (150-1,200ppm) and europium (20-110ppm) in Weardale fluorite and suggests that lattice defects caused by these elements may create color centers. He also notes that fluorite from the Derbyshire orefields to the south does not fluoresce, and its REE content is less than that in the Weardale fluorite. Bill, Sierro, and LaCroix (1967) suggest that the presence of samarium and gadolinium may be important in green Weardale fluorite as well. A Note on British vs. U.S. Terminology

Though most British and U.S. citizens speak English, it is often said that we are two people divided by a common language. While one would expect this to be the case with the vernacular, it is often the case with technical terms as well. In British literature, fluorite is often called fluorspar, though this term is usually in reference to fluorite as an industrial commodity rather than to the mineral itself. A similar case holds true for barite: The industrial commodity is referred to as barytes, while the mineral itself is spelled baryte. The mineral siderite sometimes goes by the name chalybite, particularly in older literature. References to the Great Whin Sill call it a dolerite--a petrological term equivalent to diabase in North American usage. The British mining term deads refers to what an American might call the spoils, muck, or waste, and tip is sometimes used to refer to the dump.

ACKNOWLEDGMENTS

The partners of UK Mining Ventures would like to thank numerous individuals for their assistance, without which this project would not have happened. Timothy Troman of Wardell Armstrong & Co. was of great help in securing the lease for mineral rights to the property, and Alistar Ward of Frosterley generously granted access to the quarry and helped with security and equipment storage. Lindsay Greenbank and Mick Sutcliffe helped in numerous ways with equipment, blasting permits, introductions, and general encouragement. Jeremy and Philippa Rowe showed infinite patience while having their holiday rental cottage invaded by a crew of miners for the entire summer and assisted greatly in helping them learn the "lay of the land." Mark Watson of Wolsingham provided much-needed automotive support and garage services as well as detailed critiques of all the local pubs. Isabelle and the staff of the Golden Lion in St. John's Chapel deserve much thanks for a never-ending supply of support, beer, and cheer throughout the summer. Jane Kuestal contributed her much-appreciated cooking skills, and Floyd LeBar added his muscle power and ability to drive on the other side of the road. On the home front, Tim Sherburn and Bill Pogue helped greatly with logistics, and Noel Dedora aided in financing the venture. Dr. Robert Cook of Auburn University and Brian Young of the British Geological Survey provided critical reviews of the final manuscript.

All spouses were drafted into service and deserve credit for putting up with the disruption that a project such as this causes. Kerith Graeber spent much time researching local accommodations for the crew as well as providing the occasional gourmet feast and wrapping lots of specimens. Lisa Bennett kept the books with marvelous efficiency, and Joan Kureczka provided detailed review and editing of this article in its formative stages. Finally, the mining crew--Byron, Otto, and Jonina--deserve special recognition for working long and hard to make this happen in a place far from home. Without them, it would not have been possible.

REFERENCES

Bill, H., J. Sierro, and R. LaCroix. 1967. Origin of coloration in some fluorites. American Mineralogist 52:1003-8.

Dunham, K. C. 1937. The paragenesis and color of fluorite in the English Pennines. American Mineralogist 22:468-78.

-----. 1990. Geology of the Northern Pennine orefield. Vol. 1, 2d ed. London: British Geological Survey.

Fairbairn, R. A. 1996. Weardale mines. Keighley, U.K.: Northern Mining Research Society. British mining 56.

King, R. J. 1982. The Boltsburn mine, Weardale, County Durham, England. Mineralogical Record 13:1, 5-18.

Moorbath, S. 1962. Lead isotope abundance studies on mineral occurrences in the British Isles and their geological significance. Philosophical Transactions of the Royal Society of London 254: 295-360.

Sawkins, F. J. 1966. Ore genesis in the Northern Pennine orefield in the light of fluid inclusion studies. Economic Geology 61:385401.

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Jesse Fisher, an environmental geologist for the past nineteen years, has had a lifelong interest in mineral collecting, specializing in southern California pegmatite localities. His most recent article for Rocks & Minerals was titled "The Geology, Mineralogy, and History. of the Himalaya Mine, Mesa Grande, San Diego County, California" and appeared in the May/June 1998 issue, pages 156-80

Lindsay Greenbank is a longtime dealer and collector of northern English minerals. He and parmer Mick Sutcliffe worked the Rogerley mine from the early 1970s until 1996.

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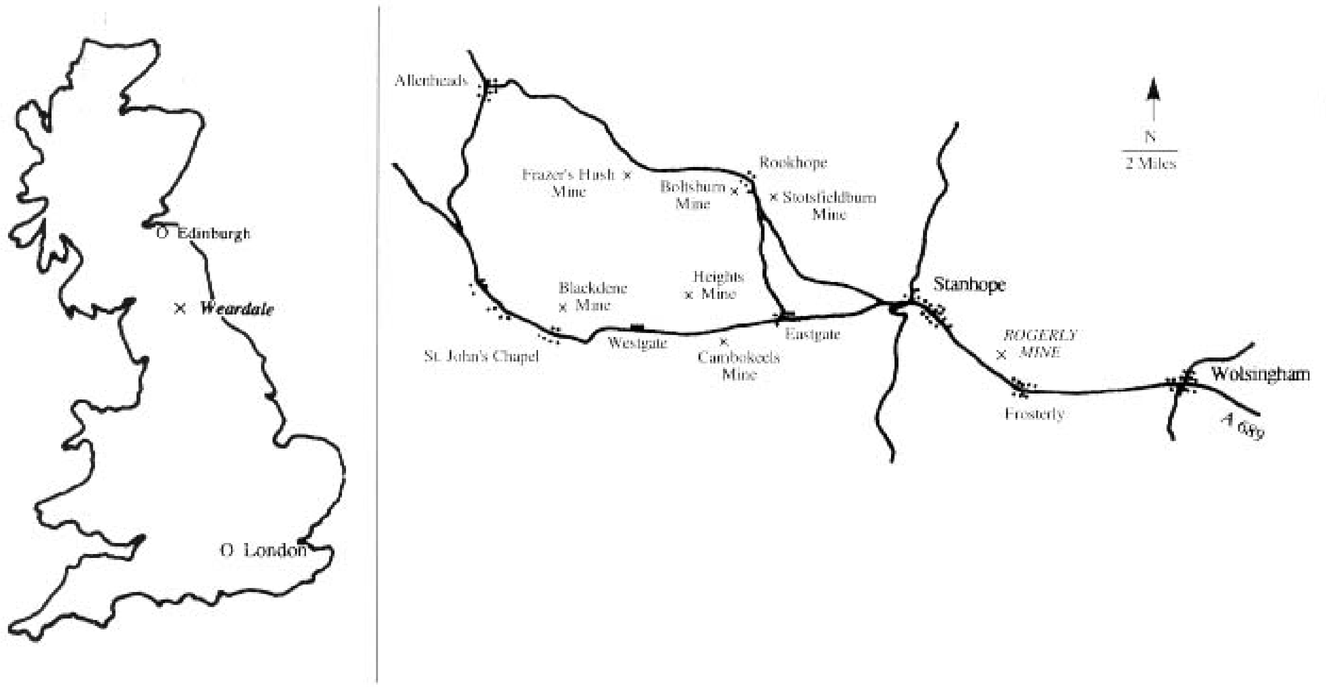
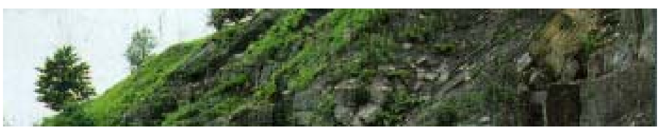


S: Figure 2 (left). Map of the United Kingdom showing the location of the Weardale district. Figure 3 (above). Map of the Weardale district showing the locations of towns, villages, and major specimen-producing mines.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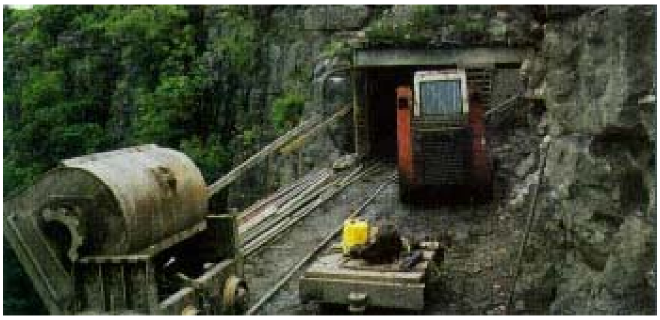

Figure 4. Entrance to the upper (main) tunnel of the Rogerley mine, Summer 1999. Jesse Fisher photo.

Figure 5. View of Rogerly mine during the mid-1970s. Lower tunnel was being driven by Cumbria Mining and Mineral Company at this time, and upper tunnel was inaccessible. Lindsay Greenbank photo.

Figure 6. Initial opening of the Black Sheep pocket, 12 June 1999. Field of view approximately 2 feet across. Jesse Fisher photo.

Figure 7. The Black Sheep pocket on the second day of excavation. Jesse Fisher photo.

Figure 8. Byron Weege using chain saw to extract fluorite specimens from the pocket. Jonina Pogue photo.

Figure 9. Byron Weege with a large fluorite specimen after removal from the pocket. Jonina Pogue photo.

Figure 10. Jonina Pogue and Otto Kamerak loading recovered specimens into the company car; Rogerley mine is in the background (June 1999). Byron Weege photo.

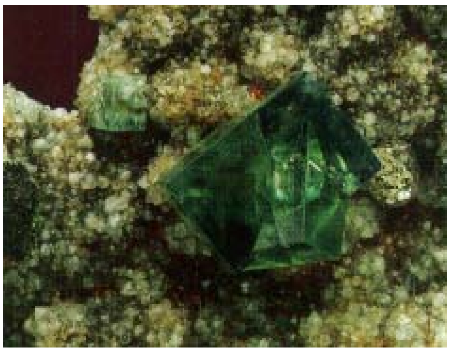

Figure 11. Twinned fluorite crystal, 1.6 cm across, on quartz druze, Black Sheep pocket. Jeff Scovil photo.

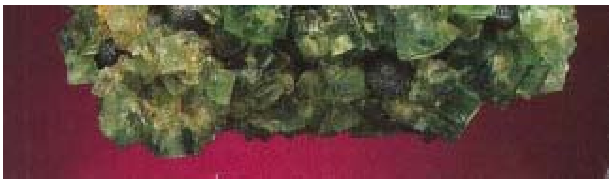

Figure 12. Twinned fluorite with spineltwinned galena, 6.5 cm across, Black Sheep pocket. Jeff Scovil photo.

Figure 13. Twinned fluorite with galena, 5.4 cm high, Black Sheep pocket. Jeff Scovil photo.

Figure 14. Fluorite "stalactite" with galena, 7.7 cm high, Black Sheep pocket. Jeff Scovil photo.

Figure 15 (left). Fluorite and galena cluster, 9.5 cm high, Black Sheep pocket. Jeff Scovil photo.

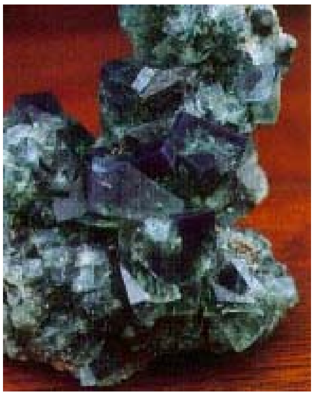

Figure 16 (right). Same specimen as figure 15 only photographed in sunlight to show color change associated with daylight fluorescence. Jesse Fisher photo.