A mineralogical tour of the Kingdom of Fife.

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A Mineralogical Tour of the Kingdom of Fife

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The Kingdom of Fife on the eastern coast of Scotland has a varied geology and has produced a considerable variety of mineral species many of which are the result of volcanic activity. The north Fife hills are particularly rich in agates. Pyrope and zircon are present in a volcanic vent near Elie. Hydrothermal activity associated with volcanism has produced quartz, calcite, dolomite and barite veins at several coastal localities. At Orrock Quarry, apophyllite, pectolite and prehnite are found in lavas. Some of the best pyrite crystals found in Scotland were collected at Goat Quarry in the 1990s and traces of copper and uranium mineralisation have been found in felsite at Balmullo Quarry.

The the ancient and historic Kingdom of Fife, located between the Firths of Forth and Tay is one of the prettier parts of the Central Lowlands of Scotland. Its excellent road and rail connections and its proximity to major population centres makes it a popular tourist venue. Few tourists, however, know about the minerals that are present beneath their feet.

Fife is blessed with a varied geology and has produced a considerable diversity of mineral species. The majority of its mineral localities are in igneous rocks and owe their existence to volcanic activity spanning several geological epochs. The Carboniferous sediments, which cover much of the region, have been intruded by volcanic vents, dykes and sills. Some of these have risen from great depths, bringing assemblages of high pressure minerals normally associated with the lower crust or upper mantle to the surface. The excellent shoreline exposures of some of the Late Carboniferous to Permian vents makes the east Fife coast a popular venue for geology students.

In the north, Devonian volcanic activity has produced a range of low hills composed of basaltic and andesitic lavas. These have been known for fine agates since Victorian times and they continue to attract collectors from local lapidary clubs.

Heddle (1901) describes numerous mineral occurrences in Fife, but many of these are long lost. Quarries have been abandoned and filled in, and mine sites obliterated. Fife was not a significant metal-mining area, its metal mines comprise a few insignificant trials for lead, and one for pyrite which was mistaken for gold.

Rather than cover every historic site, this article describes those localities that have yielded specimens in modern times (since ca. 1970). These include classic Victorian locations and a few new ones which are the result of more recent quarrying, or prospecting by amateur collectors.

LOCALITIES

The North Fife Hills

The highlight of Fife's mineral treasures are its agates and so it seems appropriate to commence in the northern hills. The north Fife hills are the eastern extension of the Ochils, a range composed largely of Old Red Sandstone, lavas, and agglomerates of basaltic and andesitic composition. In places these are highly amygdaloidal, the gas cavities being filled with quartz, chalcedony and agate. Jasper also occurs, possibly as veins, but exposures are rare.

Figure 1. Agate from Luthrie Bank Farm collected by Stephen Moreton. Field of view 35 x 36 mm.

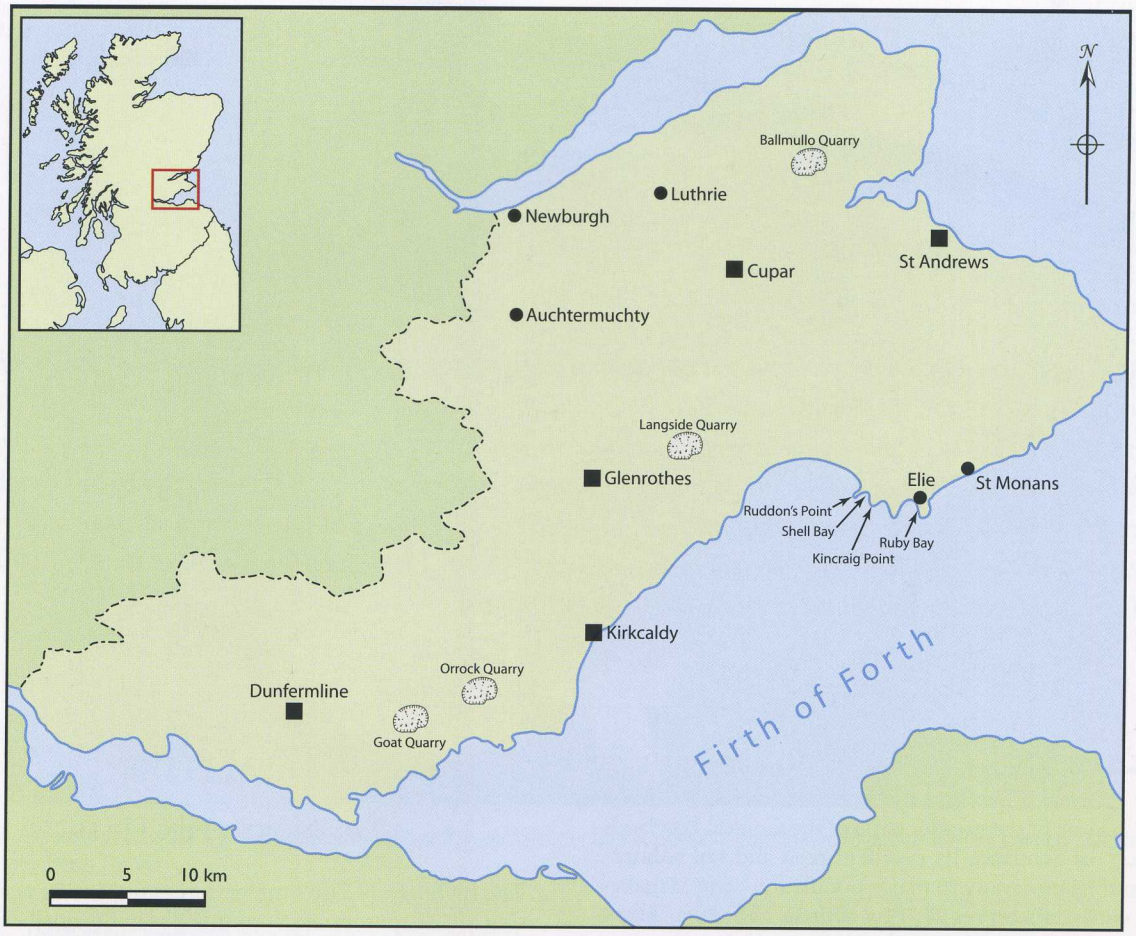


Figure 2. Sketch map showing the principal localities described in the text.

The scarcity of bedrock exposure is no handicap to the collector. The hard and resilient nature of the agate, and associated minerals of the quartz family, means that the amygdales weather out of the enclosing rock and remain in the soil as nodules. With a little experience these can be spotted after ploughing. For many years the strategy of lapidaries has been to visit fields in winter time, a few weeks after ploughing, when the rain has washed the mud off the nodules. Systematic searching of the more productive fields can result in bags full of nodules and agate fragments. Distribution is, however, erratic. Whilst some lava flows may be highly amygdaloidal, most are barren. Consequently, a field may be prolific in one spot only, whilst everywhere else for hundreds of metres around may yield nothing. Good locations tend to be closely guarded secrets and the best policy for seekers of 'Scotch pebbles' is probably to join one of the local lapidary societies and attend their fieldtrips.

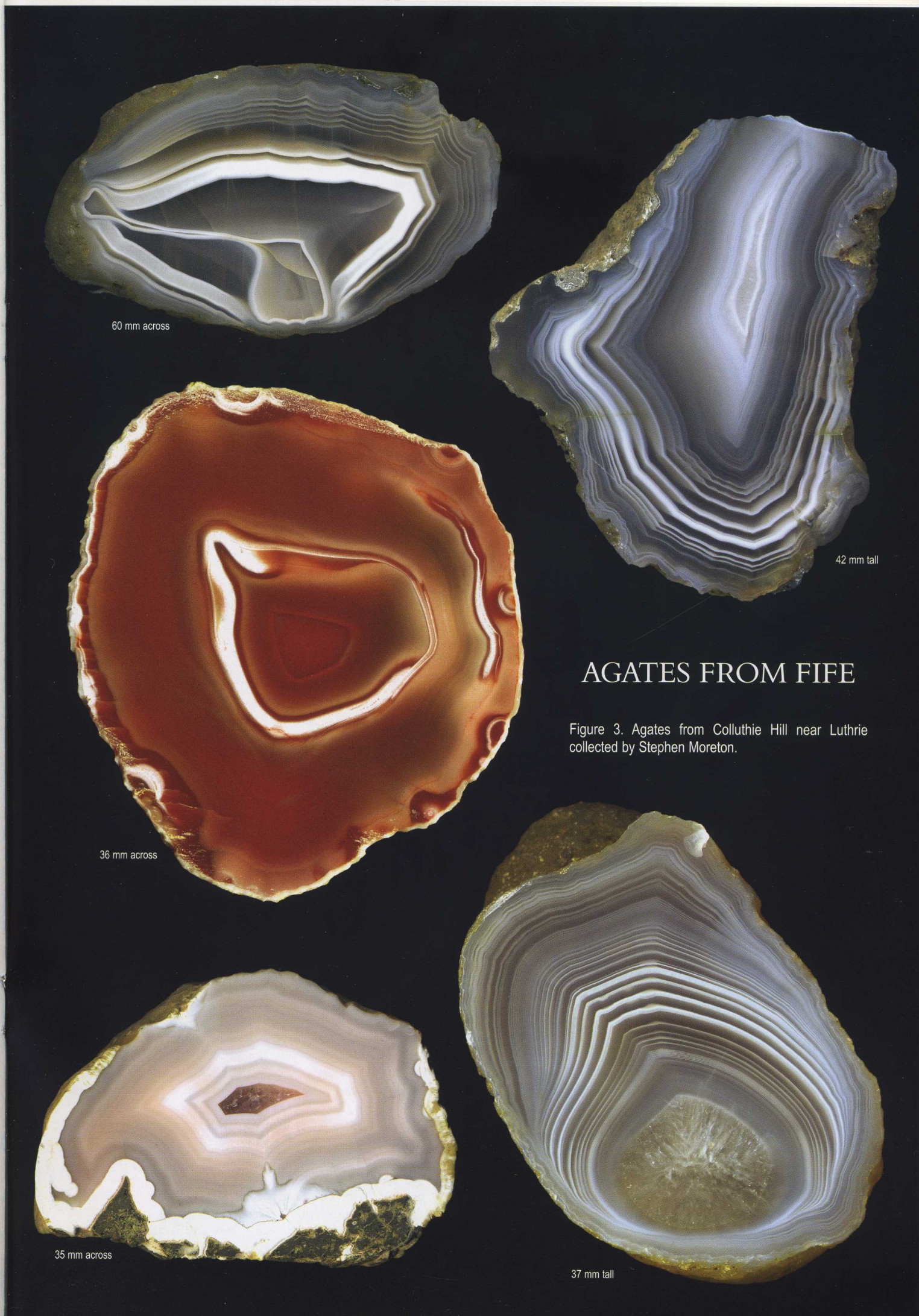
Unfortunately, changes in agricultural practice have hampered collecting in recent years as farmers have increasingly tended to sow crops immediately after ploughing. The importance of seeking permission cannot be overstated. Local lapidary clubs have spent years building up good relations with the landowners. This could easily be undone by the irresponsible few.

The richest agate area in Fife is in the hills around Luthrie. Some specific localities are given by Heddle (1901) and some more recent examples in Rodgers (1975) and Macpherson (1989). Colluthie Hill, Luthrie Bank, Pittachope and Denmuir on Norman's Law have been productive in recent years. At the last named locality occasional fragments of the rare zeolite mordenite also turn up. The full range of agate varieties may be found, including onyx, carnelian and moss agate, although not necessarily at every site. In addition, there is a chance of finding amethyst and smoky quartz in geodes, although these have always been rare.

Before leaving the agate hills it should be mentioned that some of the local streams have yielded a few specks of gold, although the greatest concentrations of the yellow metal are over the border in the Perthshire section of the range (Coats *et al.*, 1991).

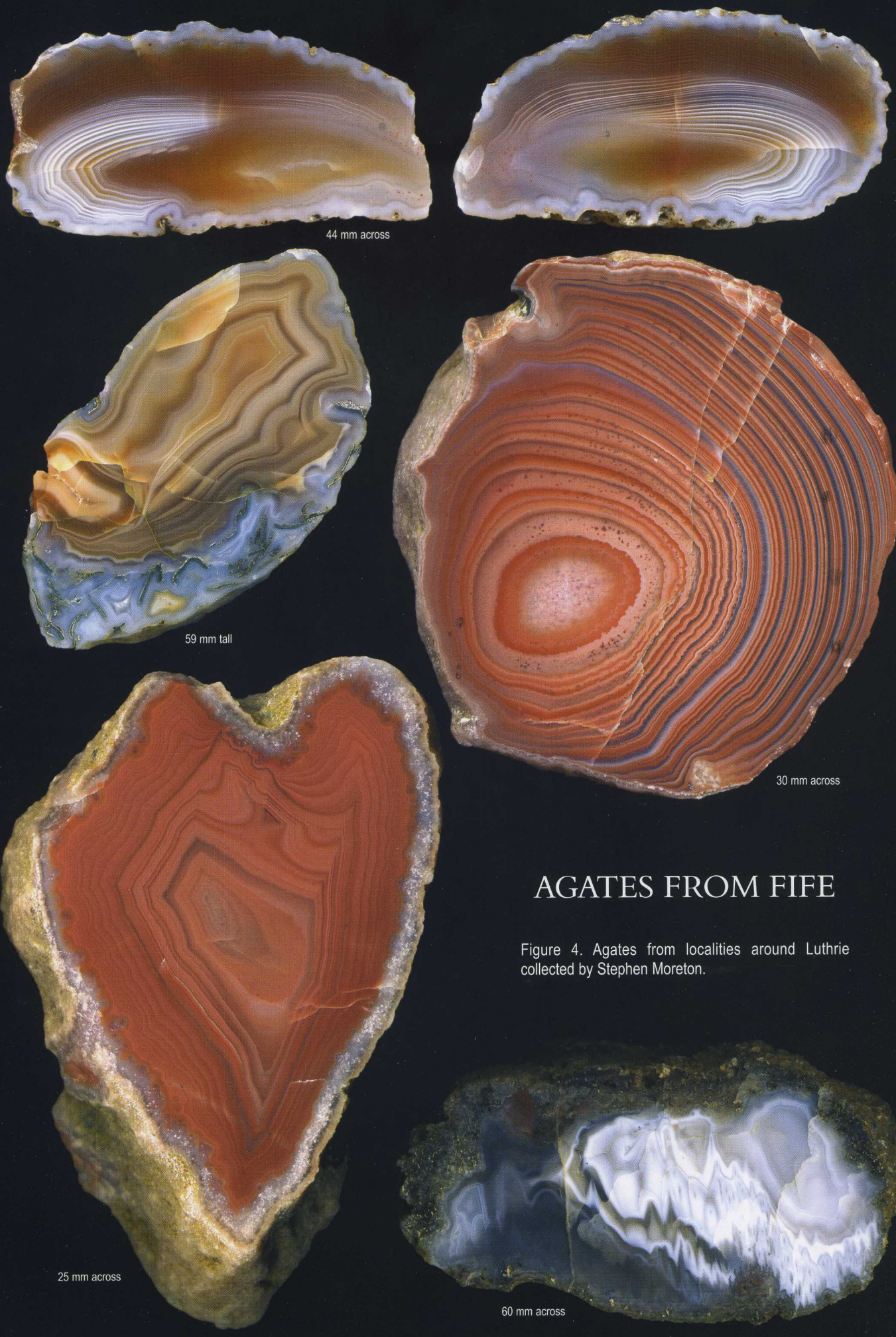
The Southeast Coast

Ruby Bay at Elie (NT 497 993) will, by its name alone, excite the interest of gem hunters. The rubies are, in fact, pyrope garnets and owe their presence to a volcanic vent that brought them up from many kilometres below the surface. The remains of the vent, now filled with agglomerate, can be seen on the shore between the lighthouse and Lady's Tower a few hundred metres to the east. The garnets are invariably anhedral, and often badly fractured. Flawless stones of facetable size, although not unknown, are very rare. Deep blood red fragments, up to several millimetres across can still be found by close inspection (on hands and knees, or lying on one's stomach) of the patches of black gravel that occur sparsely between the lighthouse and Lady's Tower. Common associates are cream feldspars, black pyroxenes and magnetite. Rarely, euhedral yellowish brown zircons, often smaller even than



AGATES FROM FIFE

Figure 3. Agates from Colluthie Hill near Luthrie collected by Stephen Moreton.



AGATES FROM FIFE

Figure 4. Agates from localities around Luthrie collected by Stephen Moreton.

Figure 5. A collection of Elie 'rubies', containing numerous anhedral fragments up to 3 mm across. Stephen Moreton collection.

the garnets, occur and can be recognised by their high lustre and yellow fluorescence under long wave ultraviolet. In fact this latter property may be exploited by using an ultraviolet lamp to look for them at night. Finding garnet or zircon *in situ* in the agglomerate requires the patience of a saint.

Elie is not the only volcanic vent in the area. Further to the north, near St. Monans, an agglomerate-filled vent may be seen on the shore just north of Newark Castle (NO 518 012). Whilst this lacks the high pressure minerals found at Elie, hydrothermal activity produced by local heating has resulted in minor barite mineralisation in two narrow (<1 m) limestone beds. Separated by a thin shale parting, the limestones stand up from the surrounding strata and are best seen at low tide. Where they come closest to the agglomerate they are extensively veined with strings of a ferroan dolomite carrying plates of barite and traces of pyrite. Small cavities contain platy crystals of gemmy, colourless barite up to 20 mm in length. A few hundred metres to the northeast, another mass of agglomerate, just a few metres across, contains occasional large (up to ca. 5 cm) subhedral feldspar crystals of a white to cream colour.

More volcanic rocks occur to the west. MacGregor (1996) records veins of amethyst, barite and calcite in the agglomerate at Kincraig (NT 464 996). A recent inspection by the author found only strings of poorly crystalline white quartz with minor barite and calcite, none of which is of collector interest, on the shore at this point. Strings of fibrous, pinkish calcite, several centimetres wide occur on the west shore of Shell Bay (NO 462 000) but are often buried under shingle and pebbles. East of these, the vent at Ruddon's Point (NO 452 002), has long been known as an analcime locality (Heddle, 1901). The analcime occurs as colourless to whitish crystals up to about 2 cm across, usually embedded in calcite. Attempting to dissolve the latter away with acid, however, leaves behind dull analcime. Collectors should note that this is a low tide locality.

The Quarries

Inland, the various igneous intrusions have been quarried for aggregate. These are mostly basalt or dolerite but there is one notable exception. Balmullo Quarry (formerly called Lucklaw Hill Quarry, NO 419 214) works a large mass of felsite. This carries strings and pockets of pink barite, rarely of any extent but just occasionally wide enough to allow the development of cockscomb form. Black dendrites, presumably of manganese oxide, and a white clay mineral are not uncommon. Of more interest is the copper and uranium mineralisation. Malachite stains are frequently met with and there are occasional traces of azurite on the upper benches. A unique discovery, in 1997, of a single boulder carrying a few tiny (ca. 1 mm) subhedral yellowish green plates of torbernite and metatorbernite has never been repeated. This same boulder was also stained green with copper. Some of the green stains are thought to be pseudomalachite (Peter Davidson, *personal communication*) but identification was hampered by lack of material.

Figure 6. Radiating sprays of columnar basalt exposed at Orrock Quarry. Photo Stephen Moreton.

Further south, Goat Quarry (NT 175 867) rose to fame in the early 1990s with the discovery of well crystallised pyrite in the shales overlying a dolerite sill (Ingram *et al.*, 1992). The crystalline masses attained considerable size (up to 13 cm) and were considered to be some of the best pyrite Scotland has ever produced. The occurrence is now mostly quarried away.

At nearby Orrock Quarry (NT 217 887) the development of columnar basalt is spectacular. Immense sprays of radiating columns, as well as the more usual vertical forms, are exposed. One would have to travel to the Western Isles of Scotland, or the Giant's Causeway in the north of Ireland to find something better. In the 1970s, a vein carrying apophyllite, pectolite and prehnite was exposed in the quarry floor (Wirth, 2003). This has long gone but the upper bench has yielded good specimens of rhombohedral cream-coloured calcite where the lavas have been hydrothermally altered. These are sometimes overgrown by drusy quartz, which is occasionally amethystine and may contain tiny inclusions of black goethite. A final generation of white calcite is present on a few specimens. A small vein, rarely more than 15 cm wide, of drusy quartz, occasionally amethystine and with a central calcite zone, is visible on a face on the right hand side of the quarry but would require rock-climbing skills to reach, something the safety-conscious management are unlikely to allow. As the quarry has been rather intermittently worked in recent years the production of specimens has been sparse and erratic.

Figure 7. A typical matrixless intergrown mass of pyrite 10 cm long from Goat Quarry. Stephen Moreton collection and photo.

Figure 8. A transparent apophyllite crystal 2 mm across from Orrock Quarry. Recent analyses show the mineral here is hydroxyapophyllite (Andy Tindle, *personal communication*). Stephen Moreton collection.

Figure 9 (above). Pyramidal crystals of amethyst up to 14 mm from Orrock Quarry. Stephen Moreton collection and photo.
Figure 10 (right). Calcite as rhombohedral crystals up to 3 cm, Orrock Quarry. Stephen Moreton collection and photo.

Finally, Langside Quarry (NT 345 036) near Kennoway, also exposes columnar basalt, although it is not in the same league as at Orrock. In the early 1990s the quarry would have been worth a visit as veins carrying cavities large enough for a man to lie in were found (at least according to a quarryman). These were lined with scalenohedral, white calcite crystals several centimetres long which were sprinkled with bipyramidal colourless quartz crystals up to several millimetres. Sadly, by the time the author learned of this (from a geologist in another quarry in the north of Fife) the bonanza was long gone, with just a few weathered fragments in a waste pile to indicate what once was. To add further to the disappointment, the same quarryman who told of the large cavities also referred to a refrigerator-sized boulder containing amethyst that had been taken away a few months earlier. A few patches of sticky hydrocarbon in calcite were all that was collected that day.

CONCLUSION

The Kingdom of Fife offers varied collecting for amateur mineralogists and lapidaries alike. The coastal localities are easily accessible (tides permitting) but the agate-bearing fields are on private land and permission to collect is essential. Likewise, the working quarries do not always entertain casual visitors and advance permission is strongly recommended. The quarries are active and doubtless will uncover interesting new material from time to time. Whether anyone is on hand when they do is another matter. The isolated uranium-bearing boulder at Balmullo and the lost giant vugs of Langside Quarry illustrate the hit-and-miss nature of collecting in quarries. Sadly one cannot monitor every site all the time and inevitably many minerals will be destroyed without anyone even noticing. Without the activities of amateur collectors, however, we would know nothing of the majority of the occurrences reported here.

ACKNOWLEDGEMENTS

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