Gold in Britain: past, present and future

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Abstract: Britain is a country with modest gold deposits. At least six tonnes, possibly up to ten tonnes, of gold have been recovered from numerous localities in Britain. Recent discoveries have revealed another six tonnes in Scotland and over 30 tonnes in Northern Ireland, with the likelihood of more to be found. A new mine in Northern Ireland is producing several thousand ounces of gold per year. These are small figures compared to the current annual new mine production of around 2500 tonnes and the total world tonnage of gold mined to date of around 180,000 tonnes.

Gold has long been prized for its colour, durability, malleability and density. It has been recovered from streams by simple hand methods such as hand picking and panning. One origin of the legend of the Golden Fleece of mythology is the use of sheep skins to collect gold in gold-bearing streams. This paper contains an overview of the past gold production in Britain, the current position with several recently discovered deposits in Scotland and Northern Ireland and a brief view of future possibilities. Gold in Britain belongs to many genetic types, and has been recorded at many localities (Fig. 1); not all of these are described in this brief review.

Historic gold production

The discovery of Pre-historic, Bronze and Iron Age gold artefacts in various parts of Britain, such as beautifully wrought torcs, rings and other ornaments, often associated with the burial of high status people, shows that gold mining and working was active during those times and had reached considerable sophistication. The gold must have come from somewhere, and it may not all have been imported. Alluvial sources are the most likely as they are the easiest to work and the most likely to be discovered. Even today, a number of river valleys in Scotland, Wales and Ireland, as well as on mainland Europe, contain pannable gold. There are considerable problems in trying to date and assign early mine workings, especially alluvial deposits, as later workings as well as normal erosion under climatic variations may have removed or considerably altered any traces left behind.

The earliest known production in Britain was in Roman times from the Dolaucothi deposit (also known as Ogofau) near Pumpsaint in southwest Wales. Here undoubted Roman artefacts have been discovered and the remains of sophisticated dam and leat systems. The dams were to hold back water that was suddenly released to wash downhill, ripping off the topsoil and exposing bedrock. Water would also have been extensively used in washing the ore to release gold, and in operating crushing and pumping machinery. The Romans built a fort at Pumpsaint and were apparently in the area within six years of the Roman invasion. This may mean that they were already aware of gold at the site, and there may have been prior active mining. The Romans were expert prospectors and miners, and had numerous gold mines in Spain and elsewhere. They would have preferred to work alluvial deposits and also the shallow weathered gossanous zones containing free gold, above deeper primary deposits where the gold was contained within pyrite and other minerals. This ‘locked’ gold would have required quite sophisticated smelting techniques to liberate it, as well as supplies of fuel and water.

It has been estimated that the Roman workings at Dolaucothi produced up to a tonne of gold from about half a million tonnes of rock (Annells and Burnham, 1995). This was probably from the oxidised gossanous

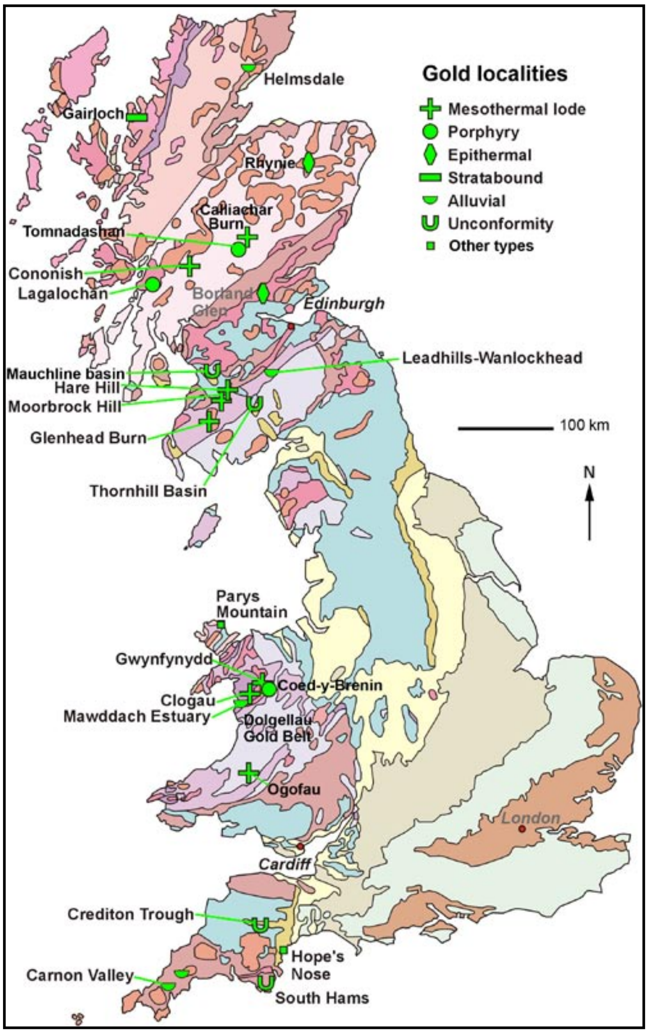

Figure 1. Gold localities in Great Britain; other types include mafic hosted, breccia pipes and volcanogenic massive sulphide deposits (after BGS).

zone above the unweathered primary material. A 'Roman Lode' has been inferred at Dolaucothi, and shallow workings to a depth of about 45 m are attributed to Roman working. They did not have explosives and therefore had to use metal picks to break the rock. They also used fire setting, where the rock is heated with a wood fire before water is poured on to split the rock as it contracts. Wooden objects, one of which appeared to be part of a drainage wheel, have been radiocarbon dated at 90 ±70 BC (Burnham, 1997), showing the Roman, and possibly pre-Roman, age of the site.

Following the Roman occupation there is little hard evidence of gold mining in Britain. After the Norman conquest, all the land and contained minerals belonged to William the Conqueror "in right of The Crown" because he was king. Despite centuries of change in law and custom, the underlying ownership of The Crown still exists and there is always a presumption in favour of The Crown unless it can be proved that the land belongs to someone else (that is taken verbatim from the Crown Estate website).

In the 16th century Beavis Bulmer obtained a licence from the King of Scotland to mine gold at Crawfurd Muir near Leadhills in Scotland. This area became known as 'God's Treasure-House in Scotland'. The activity naturally revived interest in gold in Britain, as well as in other metals. The development of armaments, such as cannon and small-arms, increased the demand for all kinds of metals, as well as gold and silver to pay for them and provide for the expanding currency requirements. German miners were employed to prospect and develop copper mining in the Lake District. and inevitably the question of ownership of minerals was raised.

The Case of Mines (R v Earl of Northumberland) in 1568 decided "that by the law all mines of gold and silver within the realm, whether they be in the lands of the Queen, or of subjects, belong to the Queen by prerogative, with liberty to dig and carry away the ores thereof, and with other such incidents thereto as are necessary to be used for the getting of the ore."

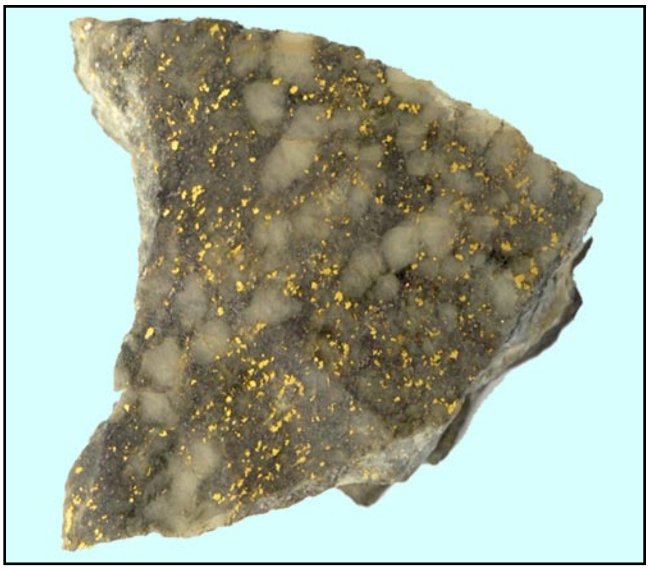

***Figure 2**. Gold with quartz from the Clogau deposit.*

Since the Royal Mines Act 1688 all naturally occurring gold and silver in Britain has been owned by the Crown, and has been administered by the Crown Estate since 1760, currently through the Crown Mineral Agent. This includes Wales, Northern Ireland and Scotland (apart from Sutherland in northern Scotland where the Duke of Sutherland owns all mineral rights).

The record from the 16th Century until the middle of the 19th is neither voluminous nor clear. There may have been spurious 'gold mines' caused by discovery of pyrite or fool's gold, such as a reported gold discovery near Ampthill in Bedfordshire (Calvert, 1853).

Dolgellau goldfield

In the early 1840s a number of copper and lead mines were working in the Dolgellau area of central Wales. Problems with processing the ore at Cwm-Heisian mine caused the mine manager to call in Arthur Dean as a consultant in 1843 (Hall, 1988). He examined the jigs that were being used to separate the heavier ore from the lighter waste and noticed specks of gold with the galena (lead ore). Dean then published a paper at the 1844 British Association meeting in which he claimed that large numbers of gold veins existed in North Wales. This did not apparently lead to increased interest in the area.

The state of gold mining in Britain was reviewed by John Calvert in 1853. This attracted the derision of some of the professional geological establishment as shown by the following passage Albert Frederick Calvert (1893), possibly a relation of J Calvert: 'Now, in 1853, Mr John Calvert was the subject of fierce attack and insult at the hands of Professor Sedgwick at a British Association meeting in Hull, mainly based on the fact of Mr Calvert not having passed through a college curriculum. But the Professor met his match, and both he and Sir Roderick (Murchison) came off second best in a sharp verbal encounter. John Calvert at once disclaimed the college blinkers, and challenging Sir Roderick's assertion, said that if the speaker's arguments were sound what became of the Silurian system of Wales. Mr. Calvert went on to say "Mr President, although you have written much to prove the identity of the Welsh rocks with those of the Ural, still you have been silent as to their being auriferous". He concluded his speech by asserting that Welsh rocks were extensively auriferous, and offered to meet Sir Roderick and his friends on the Welsh mountains, where he would point out rich veins of quartz. This challenge was duly accepted. They met at Dolgelly and Mr. Calvert took them to Clogau, broke gold from the rocks and turned the tables on his scientific antagonists.'

The two major deposits in the Dolgellau area were Clogau St Davids and Gwynfynydd. They consist of complex mesothermal quartz-sulphide veins hosted in Cambrian carbonaceous shales - the Clogau Formation

Figure 3*. The main lode at Gwynfynydd (photo: BGS).*

(Fig. 2). High-grade ore shoots appear to be concentrated where the shales are intersected by pervasively altered Ordovician dolerite dykes or 'greenstones'. The area is characterised by small bonanza-type deposits separated by relatively barren quartz vein. There were two speculative gold rushes in 1853 and again in 1862 (well documented by Hall, 1988). The highest annual production was by Clogau with 18,714 ounces in 1904 (Hall, 1988). The mines were closed by the early 20th Century after producing about 130,000 ounces of recorded gold. Gwynfynydd reopened in 1981 and was worked intermittently on a small scale, until it finally closed in 1998 after producing around 2000 ounces of gold (Fig. 3). Clogau was briefly worked in 1966-67 and reopened by Caernarvon Mining who raised £2.25 million by floating Clogau Gold Mines plc in 1984. Protracted underground exploration and trial mining to find new oreshoots over the next 30 months yielded only 41 ounces of gold, and the mine was closed at the end of 1987 (Hodgkins, 1988). The mine was then worked intermittently in the 1990s by Welsh Gold, who extracted small amounts of gold for their jewellery business in Dolgellau. Limited investigations by small companies such as Stoic Mining and Cambrian Goldfields are continuing in the area.

The quartz veins in these deposits mainly trend ENE and occur in anastamosing clusters with a strike length that may exceed 5 km. Their width is normally between 1 and 2 m but can vary from thin stringers to large bodies of quartz 10 m in width. They often show multiple phases of deposition implying repeated phases of mineralisation (Mason et al, 2002). The gold-bearing veins are mainly composed of quartz with minor calcite, chlorite, white mica and a variety of sulphide minerals, including pyrite, pyrrhotite, chalcopyrite, galena, sphalerite and arsenopyrite. The sulphide content varies widely. For example, at Clogau, sulphides are relatively minor, while at Gwynfynydd they are more abundant. The veins dip either NNW or SSE. The angle of dip varies with the competence

Stage 1	Cobaltite-arsenopyrite-pyrite
Stage 2	Au-Ag-Bi-Te-Pb-Sb 'bonanza-type' gold-silver; minerals include bismuthinite, galena and tetrahedrite, as well as various tellurides of bismuth, lead and silver.
Stage 3	Pyrrhotite-chalcopyrite
Stage 4	Galena-sphalerite

Table 1*. Dominant phases in the paragenetic sequence for the Dolgellau gold deposits (after Mason et al, 2002).*

of the host rock as veins typically steepen to almost vertical when passing into "greenstone" and flatten out to 60-80º when passing into shale beds. A paragenetic sequence has been deduced (Table 1).

The Dolgellau goldfield drains into the Mawddach estuary and several schemes to recover gold from the estuary have been proposed, including one by the grandly named Mawddach Gold Dredging Syndicate in 1896, but none appears to have been successful (Bennett and Wilkinson, 2007). In the early 1970s RioFinex, an exploration subsidiary of RTZ, carried out some exploration in the estuary during its investigations of the copper deposit at nearby Coed-y-Brenin, but abandoned the area in 1972.

Dolaucothi (Ogofau)

After the Romans left Britain, the Dolaucothi deposit appears to have been left untouched, or at least unrecorded, until 1844, when the Geological Survey recorded gold for the first time. The deposit then had a history of intermittent and minor production (Table 2). Since the 1980s, Cardiff University has used the underground workings for training mining surveyors,

1872	Minor gold production.
1887-97	South Wales Gold Mining Co: 200 t ore.
1905-06	Mitchell mined 381 t ore for 44 oz gold.
1907-09	Ogofau Proprietary Gold Mining Co: 360 t ore for 28 oz gold.
1909-12	Cothi Mines mined 96 t ore for 23 oz gold.
1933-34	Roman Deeps Ltd carried out exploration.
1935-36	Roman Deep Holdings Ltd mined 300 t ore for 260 oz gold, and outlined 150,000 t ore at a grade varying 8.5–17.0 g/t.
1937-38	British Goldfields (No 1) Ltd raised capital of £200,000, but had only £44,000 after buying the lease and equipment; mined 16,862 t ore for 1388 oz gold; funds were exhausted by the end of 1938.
1975-1990	Anglo Canadian Exploration carried out geological, geochemical and geophysical studies (with the Mining Department at Cardiff University) and drilled at least six holes to depths of 250 m; no significant gold mineralisation was found.
1995-2005	Anglesey Mining took over the lease and drilled two holes.

Table 2*. Outline history of gold production at Ogofau (after Annells and Burnham, 1995).*

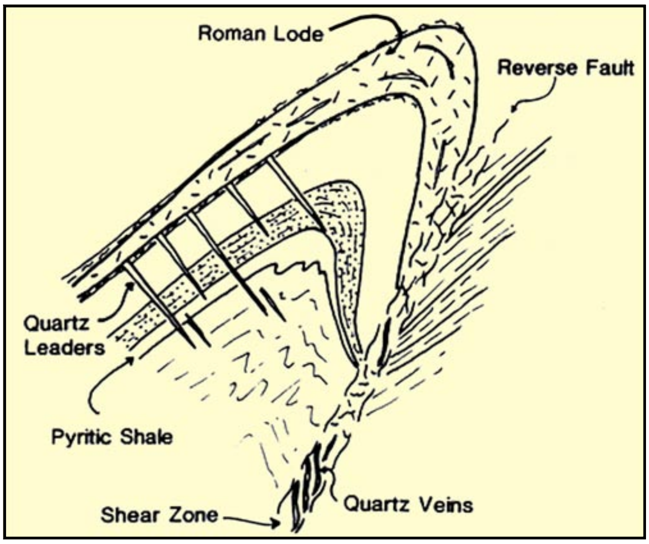

***Figure 4**. The Roman Lode and associated features of the Dolaucothi gold deposit (after Annells and Burnham, 1995).*

and in 2006 the remaining drillcore was moved to BGS Keyworth where Jan Zalaziewicz of Leicester University used it to investigate glaciogenic sediments at the Ordovician/Silurian contact.

The Dolaucothi deposit occurs in tightly folded black pyritic turbiditic shales of Llandovery age. It comprises heavily folded and faulted gold-bearing pyrite and arsenopyrite bands, and also a complex series of quartz veins referred to as the Roman Lode and interpreted by Annells and Roberts (1989) as a classic 'saddle-reef' structure plunging south-west at a shallow angle (Fig. 4). The Roman Lode was the main target for mining at Dolaucothi. Where it is intersected in New Shaft, the Roman Lode is a 1.2 m thick quartz vein with pyrite, arsenopyrite and galena assaying 19.14 g/t (grammes/tonne). The Roman Lode can be traced laterally over several hundred metres and was mined to a depth of about 150 m. The complex structures and sulphide-locked gold made economic development of the mine and treatment of the ores both difficult and expensive, resulting in the ultimately unsuccessful ventures listed in Table 2.

***Figure 5**. Alluvial gold from Helmsdale (photo: BGS).*

Helmsdale

In late 1868 news of a gold strike in the Helmsdale area of Sutherland in northern Scotland was published, and within a few months over 600 men were actively panning for gold in the Kildonan and Suisgill Burns (Fig. 5). In April 1869, the Duke of Sutherland introduced a system of licenses which cost one pound per month for each claim measuring 40 square feet. In addition to this, the prospectors were expected to pay a royalty of 10% on all gold found (Mason, 2007). The alluvial rush was over by the end of 1869 and, as no veins or other sources of hard-rock gold had been discovered, the field was abandoned. A full account of the Helmsdale gold rush is given in Callender and Reeson (2008). Recent investigations by Crummy et al (1997) indicated that the gold might have been sourced from a Devonian volcanic epithermal system similar to that at Rhynie in Aberdeenshire (Rice et al, 1995), though no bedrock gold has been found.

Gold in Britain today

Minor gold mining and prospecting have continued intermittently in the Dolgellau and Pumpsaint area from the cessation of the main mining period in the early 20th century until the present day. However, there was very little interest in gold elsewhere apart from recreational panning, especially around Helmsdale.

The abrupt rise in the gold price in the late 1970s from the previously fixed price of $35 per ounce (Fig. 6), coupled with the development of rapid and relatively cheap methods of analysis with low levels of detection caused a dramatic worldwide upsurge in exploration for gold. In 1983 the Irish company Ennex International (part of the group that had found the Tynagh and Navan lead-zinc deposits in the Republic of Ireland) announced that a potentially economic gold deposit had been found in Dalradian rocks at Curraghinalt near Gortin in County Tyrone (Clifford et al, 1990).

Ennex had been following up reports by the Geological Survey of Northern Ireland of widespread alluvial gold in the Sperrin Mountains (Arthurs, 1976). This was quickly followed by another discovery in similar rocks, also by Ennex, at Cononish, near Tyndrum in western Scotland. A third deposit was found in 1987

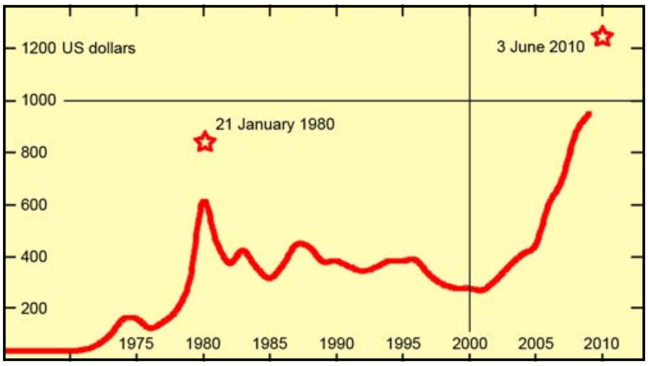

***Figure 6**. Annual average prices for gold (in US dollars) from 1965 to 2010, with spot values at the two notable peaks.*

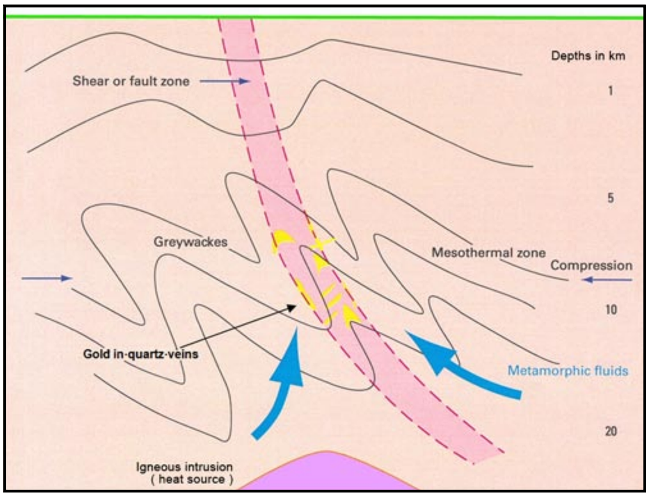

Figure 7. *Formation of the mesothermal gold deposits.*

by RioFinex at Cavanacaw, again in County Tyrone (Cliff and Wolfenden, 1992). All these deposits were found by conventional prospecting, with panning of stream sediments followed by searches for outcropping quartz veins and associated loose blocks in areas where gold had been panned.

These deposits, and those of the Dolgellau and Ogofau areas, are all variations of the mesothermal, turbidite-hosted class (now usually called orogenic), which are best known from the goldfields of Victoria in Australia (Phillips and Hughes, 1998). The average abundance of gold in the crust is about 4 parts per billion (ppb). Deep seated metamorphic fluids can contain up to 10 ppb Au in chloride and bisulphide complexes as rocks undergo various physical and chemical transformations at depth, often assisted by the presence of igneous intrusions. The fluids rise and migrate to fault zones in areas of lower pressure. As the faults move the pressure is suddenly reduced and the fluids rise to higher levels. This can also cause a drop in temperature, and contained gold can be precipitated when and where the gold complexes become unstable (Fig. 7). Quartz is the most common material in the veins as silica is the most abundant material in the crust. The gold-bearing quartz veins can take up a variety of shapes, including ribbons, breccias and 'saddle reefs',

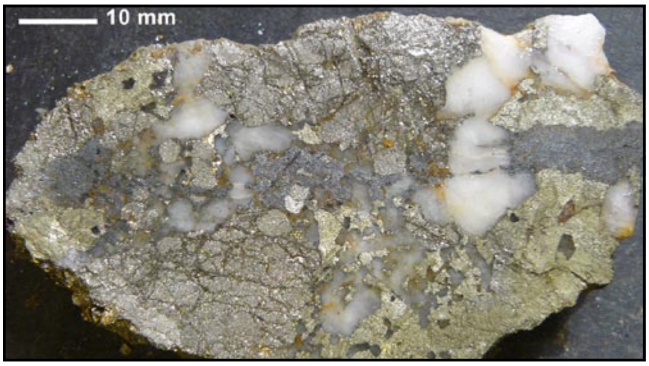

Figure 9. *Ore from the main vein ar Curraghinault, with quartz, pyrite and chalcopyrite.*

in various orientations and sizes. Economic grades of gold range from one to several tens of parts per million, implying a concentration factor of around 1:1000 from source to deposit.

Curraghinalt

The Curraghinalt gold deposit (Fig. 8) consists of a sub-parallel series of WNW-trending quartz veins up to 2 m wide in Dalradian psammites of greenschist facies. The gold is associated with pyrite, as inclusions, in microfractures and also in quartz (Fig. 9).

Ennex drilled a series of holes to prove the thickness, grade and continuity of the quartz veins which extend over an area of 3 km by 1 km. Then in 1985 they drove an adit 400 m into the hillside below the quartz veining (Fig. 10) to obtain bulk samples for metallurgical testing and resource estimation. A geological resource of 1 million tons at a grade of 0.28 oz/t (280,000 ounces) was announced in 1986. However, due to the continuing low gold price (Fig. 6), mine development did not proceed, and the project passed through a variety of Canadian owners in the following two decades, including Nickleodeon Minerals Inc and Tournigan Gold Corporation; it is now owned by SA Resources Ltd. Following additional drilling by Tournigan the mineral resource has been further defined, and now consists of an Indicated Resource of 570,000 t at a grade of 13.95 g/t (250,000 oz) and an Inferred Resource of 640,000 t at a grade of 17.15 g/t, making a total of

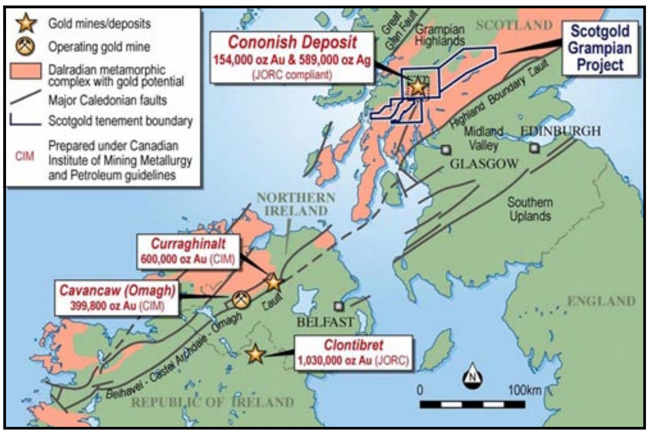

Figure 8. *Dalradian gold deposits in northern Ireland and Scotland (from Scotgold Resources).*

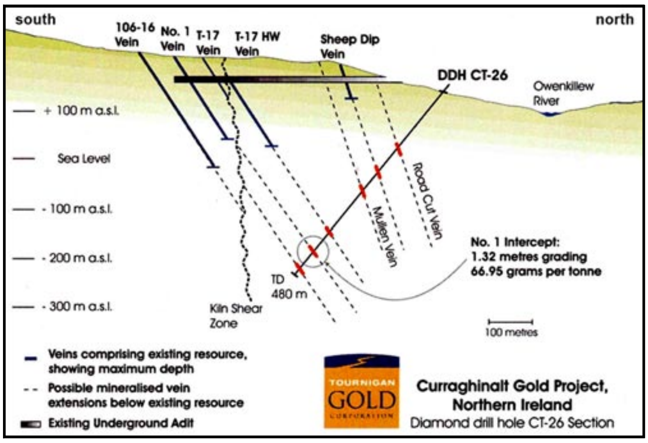

Figure 10. *Cross section of the veins and the new adit at Curraghinalt (from Tournigan Energy).*

600,000 ounces of gold. The veins have been proved to a depth of up to 400 m (Fig. 10).

Omagh (Cavanacaw)

The Omagh gold deposit (originally called Lack and then Cavanacaw) is about 5 km WSW of Omagh in County Tyrone (Fig. 8). Following the discovery of a gold mineralised quartz vein and high-grade loose blocks assaying up to 156 g/t gold (Cliff and Wolfenden, 1992), soil sampling and shallow drilling of anomalous areas located the north-south trending Kearney Structure. This is up to 20 m wide, and consists of a brecciated quartz vein with pyrite, arsenopyrite and galena up to 5 m wide in a shear zone of altered and brecciated and quartz veined Dalradian metasedimentary and volcanic rocks. Core drilling proved the continuity of the structure over a length of 900 m and to a depth of 300 m. The thick overburden prevented detailed sampling and so a trench was excavated to expose the vein and allow channel sampling across the vein at 1 m intervals over a 200 m length. This indicated a mean grade of 7.6 g/t gold, 19.9 g/t silver and 0.9% lead over a width of 5.1 m. The deposit was then sold to Omagh Minerals Ltd. who were granted planning permission for a mining operation after a protracted public enquiry in 1995. The depressed gold price prevented development until 2007 when a small open pit mine was opened by Galantas Gold Corporation (who currently own Omagh Minerals), and the operation produces a concentrate that is shipped to Canada for treatment. Production in 2009 totalled 5935 ounces gold, 15,120 ounces silver and 187 tonnes of lead.

Cononish

Following the Curraghinalt discovery, Ennex geologists extended their search to the Dalradian rocks of Scotland. Prospecting in the Tyndrum area in 1985 revealed gold-bearing blocks near the old Eas Annie lead vein southwest of Tyndrum (Fig. 8). Follow-up work, including core drilling, outlined a single NE-trending mineralised quartz-sulphide vein (Fig. 11) at the contact of Dalradian mudstones and quartzites. An adit was driven for 400 m into the hillside to provide additional information for resource estimation, and full planning permission for mine development was obtained in 1995. However, as with the other discoveries, the stagnant gold price deterred development and the deposit passed through various operators before Scotgold Resources, an Australian-based company, acquired it in 2007. They have carried out additional drilling and report current resources as in Table 3. The total gold resource of the Cononish Main Vein is estimated to be between 152,000 and 198,000 oz.

Reserves	*Ore*	*Gold*	*Silver*
Measured	53,000 t	17.9 g/t	75.0 g/t
Indicated	63,000 t	10.1 g/t	42.2 g/t
Inferred	285,000 t	11.2 g/t	41.0 g/t

Table 3. *Reported mineral resources at Cononish.*

Figure 11. *The Main Vein, dominantly of quartz, inside the Cononish adit (photo: Paul Lusty).*

Scotgold Resources have announced that they intend to start production in 2011 at a rate of 20,000 oz of gold per year. Their exploration has revealed additional prospects in the area, including a zone of mineralised breccias pipes at Beinn Udlaidh 5 km NNW of Cononish. Exploration is continuing (Scotgold, 2008).

Clontibret gold deposit

The Clontibret deposit (Fig. 8) in County Monaghan on the border between Northern Ireland and the Republic of Ireland was long known as a minor antimony-arsenic deposit (Cole, 1922). Gold was first recognised in 1957, and the area was investigated by various companies for the next three decades. Widely-spaced drilling proved a number of NW-trending quartz-sulphide veins with sporadic gold values exceeding 1 g/t. The licence was surrendered in 1992. A few years afterwards the Irish company Conroy Diamonds and Gold plc took up the Irish licences and also extended their interest across the border into County Armagh in Northern Ireland. The area lies in the Longford Down Massif and contains Ordovician and Silurian sedimentary rocks similar to those of the Southern Uplands of Scotland. A major structure, the Orlock Bridge Fault crosses the area from northeast to southwest. Conroy have explored the area over the past fifteen years and have recently announced a Total Resource in the Clontibret licence of 1.03 million ounces of gold made up of an Indicated 11 Million tonnes at a grade of 1.24 g/t for a total of 440,000

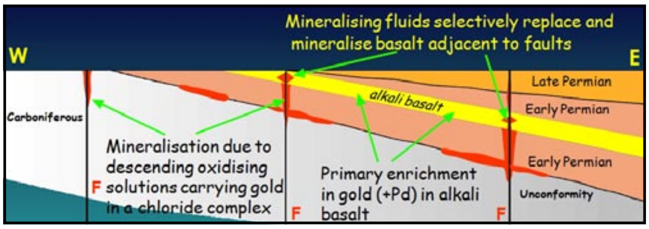

***Figure 12**. Concept model for gold mineralisation in the Crediton Trough; the block is about 15km long and 1 km deep (after Leake et al, 1991).*

ounces of gold and an Inferred 14 million tonnes at a grade of 1.32 g/t for a total of 590 000 ounces of gold. They also have found a 30 g nugget at Clay Lake in Co Armagh. This has been followed up by soil sampling and core drilling, with a best intersection of 6.94 m grading 4.14 g/t gold (Conroy, 2008). Exploration is continuing.

Crediton Trough

In the late 1980s the British Geological Survey Mineral Reconnaissance Programme was investigating the Carboniferous and Devonian rocks south of Dartmoor for stratabound, base-metal mineralisation. The extensive occurrence of an unusual style of gold in panned concentrates led to the exploration for a style of gold mineralisation previously unrecognised in Britain (Leake et al, 1988). The gold grains were found to contain palladium and tellurium at percent levels, a very unusual combination that had few parallels elsewhere in the world (Fig. 12). Further exploration showed that the gold appeared to be associated with Permo-Triassic basins, especially where these were affected by alkali-basalt lavas. The Crediton Trough in Devon and the Mauchline and Thornhill Basin in southern Scotland were the most promising in terms of gold grains in streams.

A model for the formation of the mineralisation from which the gold grains were derived was proposed (Fig. 13). Oxidising solutions from the Permo-Triassic sediments leached gold form a dispersed large-volume source by the breakdown of sulphide minerals and moved downwards, carrying the gold in a chloride complex (Leake and others, 1997). Where

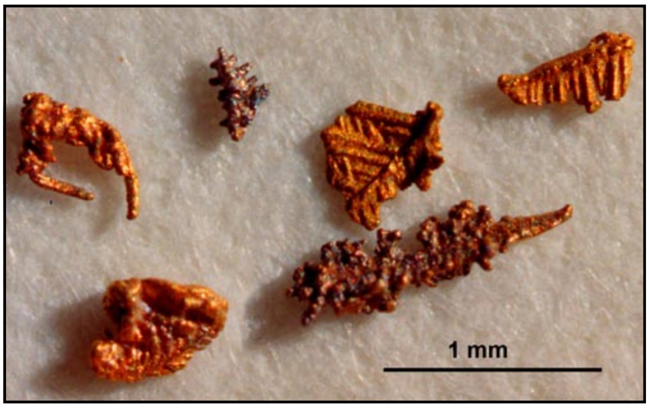

***Figure 13**. Tiny dendrites of gold from the Crediton Trough (photo: Don Cameron).*

the concentrated solutions met the underlying reduced Carboniferous they deposited the gold. In 1997 Crediton Minerals, a subsidiary of MinMet, drilled several holes in the Crediton Trough and intersected several thin carbonate veins carrying up to 2–3 g/t gold over narrow widths. No further exploration has been undertaken in these areas.

The future of gold in Britain

There is more gold to be found in Britain. However, any discoveries are unlikely to be of world class, as any really large deposit is unlikely to have remained undetected. Furthermore, the geology of the British Isles does not contain the large Archean greenstone belts, Proterozoic conglomerates or Tertiary-Quaternary destructive plate margins where the giant gold deposits occur. New discoveries will also depend on the amount of exploration effort and money expended; without exploration there will be no discoveries. It is likely that there will be more small discoveries likely in the 100,000 to 1,000,000 ounce range in the Dalradian rocks of Scotland and Northern Ireland. The recent Tellus geochemical and geophysical coverage of the whole of Northern Ireland and the publication and availability of its high-quality datasets has encouraged companies to take out additional mineral exploration licences for gold and base metals that now cover most of the land area (Beamish and Young, 2009). Success at Cononish will generate further interest in the Scottish Dalradian, especially near intrusive complexes that may provide the heat sources to drive mineralising hydrothermal systems. The British Geological Survey has published several reports on exploration models for gold in the Dalradian, such as Plant (1998), and also on the use of Geographic Information Systems (GIS) to assist in the selection of prospective areas (Leake et al, 1996).

There is the possibility of additional discoveries similar to those in the Longford-Down area in the Lower Palaeozoic rocks of Southern Uplands and Northern Ireland. These will be found adjacent to major structures, such as the Southern Uplands Fault and also in association with the abundant minor intrusions. Some small bonanza-type deposits probably remain to be found in the Dolgellau area, but these are less likely to be attractive to companies due to the amount of financial risk involved.

Small-scale panning may locate additional small nuggets of gold in the 1–10 g range, especially around Leadhills, Helmsdale and Dolgellau (Fig. 14). More than 4 tonnes of gold is reported to have been won from the tin streams of Cornwall and Devon (Camm, 1995) but no official records exist of this. The 'tin streamers' who worked the alluvial tin used to carry quills into which they put any grains of gold that they found in their pans. The largest nugget recorded from Cornwall is 59 grammess (almost 2 ounces) from the Carnon Valley, and is in the Royal Institution of Cornwall Museum at Truro (Camm, 1995).

Figure 14*. Placer gold won from the stream sediments of Helmsdale, panned by an amateur mineralogist on holiday visits in recent years.*

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