Golden opportunities for research

Approval of Scotland's first gold mine for centuries has raised interest in scientific research that could increase the efficiency of further exploration and reduce environmental impact, Nyree Hill and Gawen Jenkin report

In October 2011, Scotgold Resources Ltd was awarded planning permission to open Scotland’s first gold mine in 500 years. Over the next decade or so, the Cononish deposit near Tyndrum in Stirlingshire will produce 20,000 ounces of gold and 80,000 ounces silver each year, with a total value estimated at £180 million at today’s prices.

Gaining planning permission to mine at Cononish has been a drawn-out process. Planning permission was originally granted in the mid-1990s by Stirling Council. However, a sustained decline in the gold price in the late 1990s made the deposit no longer economic and the project was mothballed.

Collaboration eases planning process

The steadily increasing gold price since 2001 encouraged renewed interest, with Scotgold purchasing the rights to Cononish in 2007. In the intervening period, however, the Cononish site had become part of the Loch Lomond and the Trossachs national park, created in 2002. Development in the area then fell under the control of the national park authority.

Scotgold’s first planning application was narrowly rejected by the national park planning board in August 2010. Last year, Scotgold worked closely with the planning authorities to address issues raised at the first planning meeting. A second application was lodged and planning permission was granted in late October 2011.

Throughout the planning process, Scotgold liaised closely with the local community and received much positive support for the application. However, mining activity inevitably raises concerns over potential environmental impact, especially when the mine falls within a national park. Scotgold has worked closely with the park authorities to minimise environmental impacts on Glen Cononish during mining.

Cononish is a very small mine on a global scale; around 4.5 tonnes of gold will be extracted. The largest gold mines globally contain hundreds, sometimes even thousands of tonnes of gold. The gold will be produced by mining a vein underground, which will have a much lower visual impact than open pit mining.

Scotgold has committed to returning part of the spoil underground to minimise spoil tip size and to undertake extensive restoration of the tips. These will be landscaped to mimic the surrounding glacial landscape. Spoil tips will be replanted with native flora to encourage the redevelopment of a diverse ecosystem.
Wider economic benefits expected
Cononish is expected to create 50 jobs for the local community and input some £50 million directly into the Scottish economy. The creation of year-round jobs for the local community will help support economic development in an area largely dependent on seasonal work. The economic impact doesn’t take into account potential tertiary industries expected to develop, with plans afoot for a gold mining visitor centre and trips to view gold bars being poured.

Recently the provenance of gold has been put under the spotlight by the media and consumers. This has prompted producers to seek more ethical sourcing of gold, in the same way that the diamond industry has had to prove ethical sourcing of diamonds. At Cononish, some 25 per cent of the gold produced will be processed on-site.

This will result in a completely traceable piece of gold, marked as originating at Cononish. The source of gold is impossible to trace after processing, so knowing that the gold has never left Scotland presents a unique opportunity. Judging by the success of Welsh gold jewellery, the development of a Scottish jewellery industry using local gold has potential to add significant further value to the gold mined.

Looking forward, the identification of further deposits in the area is a key part of Scotgold’s strategy to sustain the positive economic impact beyond the ten-year lifetime of Cononish and avoid the boom and bust cycle often associated with metal mining. Traces of gold are scattered throughout the Highlands. Yet despite this being one of the first areas in the world to be studied and mapped by geologists, so far gold has not been found in sufficient concentrations to form a workable deposit except at Cononish.

Our view is that this is down to the area being highly challenging for gold prospecting. There is limited exposure of the mineral, due to glacial sediment filling valley bottoms and widespread cover by forestry plantation and peat bog. The mountainous terrain presents severe access problems, with many areas only reachable by walking all day from the nearest road.

The weather can be a major hindrance too, varying from extremes of torrential rain during the summer to gales, snow and temperatures as low as -18°C during the winter – and sometimes all variations between in a single day. River outcrops that would otherwise provide a good insight into the local geology are often inaccessible as water levels are too high to work safely.

Developing mineral exploration strategies
Drilling is a crucial part of exploration to initially identify potential deposits and then establish resource size. However, drilling requires the movement of large rigs and can often be located in environmentally sensitive areas. To help make exploration more efficient, both in locating new deposits in this challenging environment and to minimise the need for drilling and its environmental impact, Scotgold and the University of Leicester are working in conjunction to understand how current exploration strategy can be supplemented and improved with scientific input.

This research is funded by the Natural Environmental Research Council (NERC) through a Collaborative Awards in Science and Engineering (CASE) studentship to Nyree Hill in conjunction with Scotgold. The CASE scheme aims to foster collaboration between the research community and end users of research. In this instance, the study aims to establish why gold is found at Cononish and build this into an exploration model that can be developed to aid further exploration across Scotland and beyond.

The gold at Cononish is more than 400 million years old. It was concentrated deep underground as granite magma heated water circulated through large faults. The hot water, at temperatures of 300°C to 400°C, carried gold, silver and other metals and deposited them, with quartz, into veins. The process, repeated time and time again, brought the gold deposit up to economic levels.

Erosion has since brought evidence of gold mineralisation to the surface. By drawing on extensive databases of geochemical data collected by Scotgold and previous exploration companies, in conjunction with detailed analysis of recent samples, we aim to understand why the gold is where it is in order to streamline exploration.

Identifying potential prospects
This work has utilised a variety of techniques with the aim of building a picture of mineralisation in the area. Detailed field mapping has established widespread veining and faulting previously not identified in the locality. The use of hi-tech methods such as isotope ratios for tracing the origin of
elements associated with mineralisation has long been used from a scientific standpoint to improve understanding of mineralisation. However, exploration companies often cannot see its relevance to their work. Collaborative work is already beginning to show the importance of combining science and industry in research. The use of sulphur isotope ratios has so far established a clear relationship between the type of mineralisation and the ratio measured. This relationship can be used to quickly and cheaply eliminate potential targets that do not fit the range of ratios obtained for sulphur at Cononish. This work will contribute not just to industry but also to science as a whole, making NERC-funded data available for public use when the project is completed.

For example, the age of mineralisation in the Tyndrum area is not well known. This collaboration aims to use radiogenic isotope dating of mineral phases to determine the age and duration of the mineralising system in the Tyndrum area, and in turn add to the understanding of the evolution of Scotland’s geology. By such means, exploration can be streamlined through the development of a model for gold mineralisation at Cononish. This offers prospects for saving money for operators and limiting the environmental impact of exploration on the Scottish Highlands.

**Metal mining: making a comeback?**

Cononish will be Scotland’s only gold mine and mainland Britain’s only producing metalliferous mine when it comes on line in 2013. Yet Scotland, and the UK as a whole, has an extensive history of mining valuable metals

In the Tyndrum area, mining can be traced back as far as the 15th century, when silver was extracted for King James I. More recently, lead and zinc were extracted from the early 1700s into the 19th century at Tyndrum. Over the last century, metalliferous mining across the UK dwindled and is now almost non-existent. Over the past decade, booming metal prices have caused projects previously considered uneconomic to become viable, resulting in the reassessment of deposits such as Cononish. Alongside the increasing global demand for metals in general, the price of gold in particular is expected to stay high, driven in part by the perceived stability of gold in times of economic crisis. Success at Cononish, along with the development of a tungsten mine at Hemerdon in Devon, will no doubt galvanise interest by other companies in metals exploration in the UK.

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