LECTURE

Gold in Britain and Ireland

Summary of lecture presented to the Society on Saturday 8th December 2001 by Dr Bob Leake, of B.G.S.

Finding gold by panning alluvial sediment has often been the first step in exploration that eventually led to the discovery of gold-bearing mineralisation. Systematic study of alluvial gold grains began at BGS in the mid-80s after the acquisition of an automated electron microprobe machine capable of mapping the distribution of elements within individual grains. Initial work on alluvial gold from South Devon showed a great deal of internal compositional heterogeneity to be present, particularly in palladium and silver contents, which often revealed how the grain had grown over time. In addition, microscopic inclusions of different varieties of selenide mineral were observed to be associated with some of the types of gold.

The interpretation of the chemical characteristics of the South Devon alluvial gold provided the crucial clues that show that oxidising solutions circulating within Permian red beds were responsible for transporting gold, palladium, platinum and other elements. Deposition then occurred when these fluids penetrated into more reducing rocks below the Permian unconformity, or where they became mixed with more reduced fluids. On the basis of this model, exploration was switched from South Devon, where the Permian cover had largely been removed by erosion, further north to the Crediton Trough, filled with a thick sequence of Permian red beds. Alluvial gold similar to that in South Devon was found at many localities, and gold mineralisation was found subsequently in situ in association with alkali basalt within the Permian red bed sequence. Further application of the model also led to similar gold being found in association with the Mauchline and other Permian red bed basins in Southern Scotland.

Following the success in studying alluvial gold from Devon, BGS began a similar study of material from other parts of Britain and Ireland in collaboration with Rob Chapman of Leeds University. Internal chemical heterogeneity was found in gold from other localities, but not to the extent of that present in Devon gold. However, a whole range of other opaque inclusions comprising various sulphides, sulpharsenides, arsenides, sulphosalts, tellurides and other minerals were found to differ from area to area. The nature of these inclusions together with the general chemistry of the gold grains reflected different styles of host mineralisation and different geological environments. Gold from one particular site or area usually has a definite signature with a distinct range of composition and a constant inclusion assemblage.

There are three main types of alluvial gold in the Southern Uplands of Scotland, the silver contents of which are plotted in the graph below, together with some minor types. The Shortcleugh type is characterised by its common arsenopyrite inclusions; it is dominant in the Leadhills district and also in Galloway, where it has some connection with centres of minor igneous activity. Similar gold also occurs within a comparable geological environment in the Mourne Mountains of Northern Ireland. The Megget type occurs over a wider area of the Southern Uplands, and is characterised by inclusions of base metal sulphides and minor tetrahedrite. but little arsenopyrite. Similar gold occurs in South Mayo, Ireland, associated with shear zones in rocks similar in age to those of the Southern Uplands. The third type is characterised by inclusions of selenides but not sulphides, and is associated with red bed basins and their immediate contact rocks.

Establishing the nature of the different types of alluvial gold to be found in Britain and Ireland is also vital in solving the old archaeological problem of the likely sources of gold used to make the many early Bronze Age artefacts that have been found, particularly in Ireland. Similarly, comparison of artefact and natural gold may reveal the nature of processes used in the Bronze Age to extract and refine gold prior to working.

Literature

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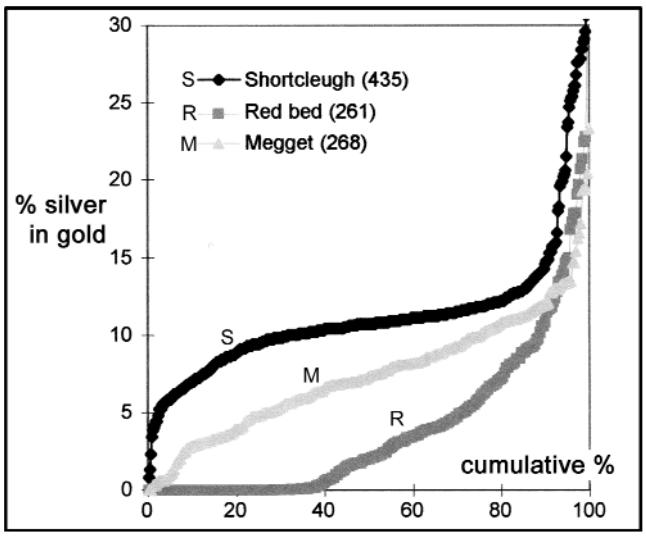

Silver content of the three major types of gold in southern Scotland (numbers of grains in brackets)