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Geological fakes and frauds

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ABSTRACT

Some geological fakes and frauds are carried out solely for financial gain (mining fraud), whereas others maybe have increasing aesthetic appeal (faked fossils) or academic advancement (fabricated data) as their motive. All types of geological fake or fraud can be ingenious and sophisticated, as demonstrated in this article. Fake gems, faked fossils and mining fraud are common examples where monetary profit is to blame: nonetheless these may impact both scientific theory and the reputation of geologists and Earth scientists. The substitution or fabrication of both physical and intellectual data also occurs for no direct financial gain, such as career advancement or establishment of belief (e.g. evolution *vs*. creationism). Knowledge of such fakes and frauds may assist in spotting undetected geological crimes: application of geoforensic techniques helps the scientific community to detect such activity, which ultimately undermines scientific integrity.

Contents

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1. Introduction

The faking of objects for financial gain and the fraudulent substitution of low value objects for the valuable is common in the art world, antiques trade and mining industry, amongst others. Many fakes and frauds use geological materials, or are detected using methods common in the Earth Sciences. Fakes and frauds that have no connection to the Earth sciences are not included in this review. The faking of objects using geological materials is likely to have occurred before written documentation, as Mesopotamian (c. 4000 BC) creation of fake stones by heating silt to a partial melt and cooling is recorded by Wilford (1998): this is essentially a substitution case – replacing a high-value item with one of significantly less or no value. Egyptian fakery using geological materials was well established by 300 BC (Gashe and Finch, 2008). In this case the fake was actually the earliest (1295 to 664 BC) recorded fake body part, a big toe made of linen, glue and importantly for this review, the use of calcium sulphate hemihydrate plaster, created by heating gypsum: again, essentially substitution. More contentious is the theory advanced by Joseph Davidovits (Barsoum et al., 2006; Halford, 2006) that the bulk of the stones in the Pyramids are reconstituted from sediment, clay and an early form of geopolymer, and not of natural rock at all. The different value (relative or financial) of gems, crystals and stones was known in prehistory as flint, obsidian and porcellanite were selectively mined and traded. The first recorded instance of using mineralogical tests to detect fraud was by Pliny the Elder (Healy, 1999). Pliny used a scratch test to detect fake gems, knowing that diamond, the most valued gem at the time, scratched all other minerals. All three of the above (historical) examples include elements of what can still be seen in more recent fakes and frauds: substitution and fakery. Financial gain is not proven in the above, unlike many of the cases outlined below: the Mesopotamian stones may well have been faked for financial gain; the Egyptian toe was undoubtedly for aesthetic purposes; the Pyramids (if correct) would have been made of constructed stone for labour-saving (cf. financial) reasons. Thus, even 2000 to 4000 years ago there were geological fakes being perpetrated for financial and aesthetic reasons. Recently, a third reason for carrying out geological fakes and frauds has emerged: those crimes that combine the financial with the aesthetic (e.g. faked fossils that are scientifically important but also carry a high price). This review examines the types of geological fake and fraud that have occurred, giving some examples that serve to inform Earth scientists of the possibility that data, fossils, gems, ores and even oil, may all be fabricated for financial gain, personal self-promotion, or a mix of the two. The published facts and personal communications for the cases are described, followed in each section by some conjecture on the probable or possible motives for the fake or fraud. Methods for detecting fakes and frauds are briefly mentioned. For a comprehensive guide on the detection of fakes and frauds, the reader is directed to Craddock (2009). A healthy cynicism concerning what appears to be geologically fantastic may help prevent future criminal activity that in the past has brought many of the geosciences into disrepute.

2. Economic fakes and fraud

2.1. Substitution

The famous zoologist and correspondent of Humboldt and Darwin, Professor Christian Gottfried Ehrenberg carried out a classic investigation of substituted materials. This was described in Scientific American (1856, p.240) ' … on one of the Prussian railroads, a barrel which should have contained silver coin, was found, on arrival at its destination, to have been emptied of its precious contents, and refilled with sand. On .... being consulted on the subject, he (Ehrenberg) sent for samples of sand from all the stations along the different lines of railway …. and by means of his microscope, identified the station from which the interpolated sand must have been taken. The station once fixed upon, it was not difficult to hit upon the culprit in the small number of employees on duty there.' Substitution continues to this day as a common criminal practice, often using geological materials (due to their weight, size and zero cost) as replacement materials. Murray (2004) provides examples that include whisky bottles in boxes being exported by ship from Scotland, and on arrival at their final destination, the bottles had been replaced by granite cobbles. The ship had docked at a number of ports in different countries *en route*: the granite was a distinctive type that was only found in one of the countries. A visit to the port established a pile of similar cobbles in a yard close to where the ship had been moored. The dock workers who had access to both the dock and ship were questioned and the guilty parties admitted their crime: however, the whisky was not recovered. In a modern twist to such substitution, Ruffell and McKinley (2008) record the delivery of high-value experimental computer drives from the Far East to northern Europe, with the cargo plane stopping once in the Middle East and once in the Mediterranean. On arrival, the packages were found to contain brick, rocks and some bags of soil. The combined approach of a geological and palynological assessment, showed the pollen and soil types to be typically Mediterranean, excluding the Far Eastern source, northern European destination, and Middle Eastern stop-over. An enquiry at the Mediterranean location led to the identification of a suspect, who lost his job but criminal proceedings were dropped.

2.2. Gems, precious and semi-precious stones

The basics of gem fraud are straightforward, with the Mesopotamian example given at the start of this review as an example of what still occurs today – the creation of fake valuable gems and stones using cheap or valueless materials. Murray (2004) gives examples of modern methods of gem fraud and these are summarised by Matlins and Bonanno (2009). These include treating diamonds with high-pressure, high temperature methods that remove coloured impurities, leaving the more valuable colourless variety. The opposite is true, with colours being added to otherwise dull stones, or flaws being concealed in an otherwise real gemstone. Diamond, ruby, emerald and sapphire are now all synthesised by sophisticated means: Matlins and Bonanno (2009) explain how these synthetic gems can only be recognised by highly skilled gemmologists. However, as Boles (2008) explains, the scientific aspects to gem or precious stone fakery are sometimes the result of the work of a large network of criminal or terrorist activity. Such individuals control both the creation and sale of such items as fake diamonds and emeralds, or the substitution of illegally-mined real gems (such as 'blood diamonds' in Africa) for those claimed to be from licensed mines. Intense scrutiny from NGOs (non-governmental organisations) and the media, coupled with growing consumer anxiety has, in recent years, encouraged the development of traceability systems to track and certify the origins of precious and semi-precious stones through initiatives such as the Kimberley Process (Bieri 2010). This serves to illustrate that interweaved among the aesthetic and pecuniary aspects of gem fraud are also moral anxieties associated with corruption, conflict