

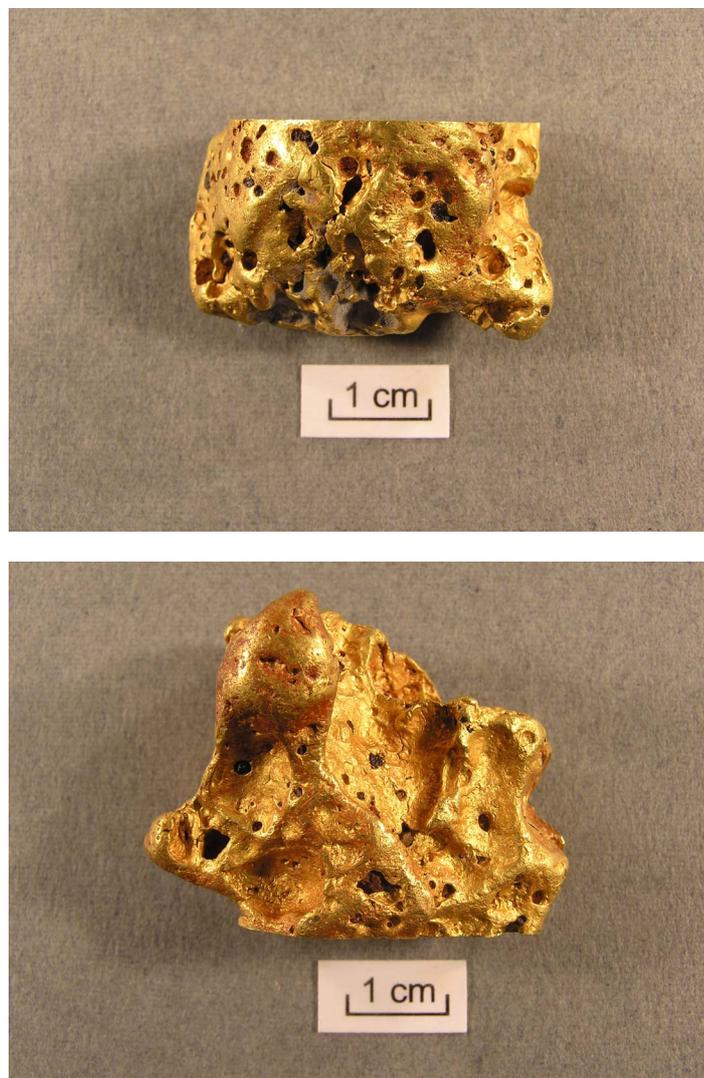
## GOLD NUGGETS: FORM AND COMPOSITION

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### INTRODUCTION

Gold nuggets (Figures 1 & 2) have long captured the imagination of exploration geologists, prospectors and the general public and have an important role in public perception not only of the gold sector, but of the mining industry in general. Western Australia, and particularly the Eastern Goldfields, is one of the principal locations in the world where nuggets have been, and are, relatively abundant. However, as time passes, they are becoming more difficult to find and their commercial significance has increased accordingly. Nevertheless, despite this widespread interest, the origin of gold nuggets is controversial and their geological significance is uncertain. In particular, it is uncertain whether some or all nuggets are partially or wholly "primary", that is, formed during the emplacement or metamorphic alteration of the ore, or whether a proportion are "secondary", formed at the earth surface during weathering.



**Figure 1 (above) & 2 (below):** Optical images of gold nuggets from the WA Museum collection.

The term "nugget" is poorly defined as "*a large lump of placer gold*" (AGI Glossary 1987). In Western Australia, the term is applied to masses of gold from a few millimetres to tens of centimetres in size. Few, if any, are found in placer deposits and, as such, have a rather different origin from that implied by this definition.

In Western Australia, most gold nuggets have been found at or near the soil surface. Others have been found deeper within the regolith and at the weathering front. Smaller nuggets, in particular, may be intimately associated with, and even enclose, soil materials and weathered rock. Even large nuggets are reported to have surface features and/or gross morphologies that suggest chemical reworking in the regolith. In addition, large masses of gold have occasionally been found at considerable depth, in completely unweathered, primary environments.

Gold is a noble metal, implying that it is inert under most ambient, earth-surface conditions and commonly considered chemically immobile in the weathering environment. Consequently, gold nuggets, especially those found in placers, have generally been regarded as primary in origin. Those in placers are considered to have physically eroded from the original ore and subsequently transported and deposited under fluvial conditions, and those in deep regolith accumulated by residual concentration during weathering. These views have been held especially by geologists working in temperate regions in the Northern Hemisphere. However, for over 100 years, Australian geologists and chemists have recognized that gold can be chemically mobile under some weathering conditions (Liversidge 1893a, b), and could therefore form "secondary" nuggets in zones of supergene enrichment.

We will present our new data on the form and composition of a selection of gold nuggets from Western Australia. These results provide a valuable contribution to the debate on the origin and weathering of gold nuggets.

#### **REFERENCES**

- AGI GLOSSARY 1987. *AGI Glossary of Geology, Third Edition*. BATES R. & JACKSON J. eds. American Geologic Institute.
- LIVERSIDGE A. 1893a. On the origin of gold nuggets. *Journal and Proceedings of the Royal Society of New South Wales* **27**, 303-343.
- LIVERSIDGE A. 1893b. On the crystallization of gold in hexagonal forms. *Journal and Proceedings of the Royal Society of New South Wales* **27**, 343-347.