

Australian Standard[®]

**Copper, lead, zinc, gold and silver
ores—Guide to sample preparation
for the determination of gold**

This Australian Standard was prepared by Committee MN/5, Copper, Lead, Zinc, Gold and Silver Ores and Concentrates. It was approved on behalf of the Council of Standards Australia on 6 September 1991 and published on 9 December 1991.

The following interests are represented on Committee MN/5:

Australian Institute of Mining and Metallurgy

Australian Lead Development Association

Australian Mining Industry Council

CSIRO, Division of Mineral and Process Engineering

Royal Australian Chemical Institute

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RECONFIRMATION

OF

AS 3988—1991

**Copper, lead, zinc, gold and silver ores—Guide to sample preparation for the
determination of gold**

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PREFACE

This Standard was prepared by the Standards Australia Committee on Copper, Lead, Zinc, Gold and Silver Ores and Concentrates, under the direction of the Multitechnics Standards Board, as part of its program of standardizing methods for the determination of elements of commercial interest in such materials.

Like any other material, the precision of a given sample preparation method for the determination of gold depends on a number of basic parameters such as concentration, particle size and sample mass. However, an optimum preparation scheme requires further information on the size and spatial distribution of individual gold particles in the gangue, and on whether the gold is alluvial, associated with another mineral, or disseminated in the gangue. Some of these parameters are difficult to measure, but their possible adverse effect can be evaluated by testing the ore in question so that a suitable sample preparation sequence can be specified. It is not possible to define an optimum sample preparation procedure which would be applicable to all ores.

This Standard describes a basic sample preparation procedure, methods for the determination of the precision of sample preparation and testing as a whole and for individual stages, and optional procedures to improve the precision. The achievable precision varies depending on ore type. The test procedure described permits a realistic precision level to be defined for the material in question.

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STANDARDS AUSTRALIA

Australian Standard

Copper, lead, zinc, gold and silver ores—Guide to sample preparation for the determination of gold

1 SCOPE This Standard provides guidance on methods for the preparation of samples of gold-bearing ore for the determination of gold content. It also describes procedures for checking and adjusting the precision of sample preparation and testing.

The procedures described are applicable to the preparation of laboratory samples and test portions for chemical analysis from the material delivered to the laboratory. Some aspects of primary sampling such as drill hole sampling and frequency of taking increments from a conveyor belt are not considered.

2 REFERENCES The following documents are referred to in this Standard:

AS

1152 Test sieves

2850 Chemical analysis—Interlaboratory test programs—For determining precision of analytical method(s)—Guide to the planning and conduct

3 DEFINITIONS For the purpose of this Standard, the following definitions apply:

3.1 LOT A quantity of ore consisting of all of the increments or all of the subsamples taken from a lot; also a composite of all of the increments or all of the subsamples after having been reduced in particle size.

3.2 SAMPLE A sample which is so conditioned that—

- (a) it can be sent to a laboratory; or
- (b) it can be used as a source for one or more test portions for chemical analysis.

3.3 SIEVE The size of aperture of the finest sieve (complying with AS 1152) through which a minimum of 95 percent of the mass of the material passes.

3.4 SUBSAMPLE A quantity of ore, consisting of a number of increments representing all or part of a lot.

3.5 TEST PORTION A quantity of material taken from a laboratory sample or a test sample which is submitted to analysis or testing in its entirety.

3.6 TEST PORTION PREPARATION A quantity of material obtained from a laboratory sample when additional preparation (drying, hygroscopic moisture determination) is needed prior to the selection of one or more test portions.

4 GENERAL PRINCIPLES

4.1 INTRODUCTION Owing to the particulate nature and low concentration of gold in ores, the effects of size and spatial distribution of gold particles can have a large influence on the precision of sample preparation. The problems have been described in numerous technical reports. A good summary of these has been presented by R.G. Burn*.

The descriptions set out in Clauses 4.2 and 4.3 are intended to highlight the difficulties that may be encountered, particularly when unknown ores are to be treated. In practice, the size and spatial distribution of gold particles are rarely determined and the validity of a given sample preparation scheme is assessed on the basis of testing.

4.2 PARTICULATE NATURE OF GOLD For any given gold concentration the range of possible individual gold particle sizes (irrespective of whether it is expressed as size distribution, average or maximum particle size) translates into an extremely high range of corresponding ratios expressed as number of gold particles/sample mass. This ratio determines the expected precision of mass division.

Take for example, the case of 1 kg of ore containing 5 g/t of gold:

- (a) If the average diameter of the gold particles is 10 µm, the ore contains about half a million gold pieces and the precision of mass division is expected to be good.
- (b) Alternatively, the material may contain just one 1 mm nugget and a straightforward mass division would be meaningless.

* BURN, R.G. Factors affecting the selection of methods of gold analysis. *Mining Magazine*, May 1984, p. 468-475.

3 The potential problem is best exemplified as follows:

A length of drill core contains a number of gold particles which are aggregated in one or more small parts of the core volume, for instance in a rich vein, instead of being homogeneously distributed throughout the core. It is then quite possible that one half of the core contains most or, conversely, only a small proportion of the gold originally present.

1 Sample preparation involves several distinct operations, which are sometimes preceded by drying. These are as follows:

- Mixing, to achieve homogeneity.
- Division, in which the sample mass is decreased by dividing the sample into two or more parts.
- Reduction to decrease particle size.

The operations referred to in Steps (a) and (b) constitute one stage of sample preparation.

Stages of sample preparation should be chosen to minimize errors during sample preparation without having to retain too large a mass.

1 General

Errors in sample division can be reduced by thorough mixing of the sample before division. The need for mixing is particularly important when samples from more than one source are combined. Any agglomerates present need first to be broken up.

Methods of mixing

- Passing the sample through a riffle or rotary sample divider three times in succession and recombining the portions after each pass.
- Using a mechanical mixer (see Figure 1).

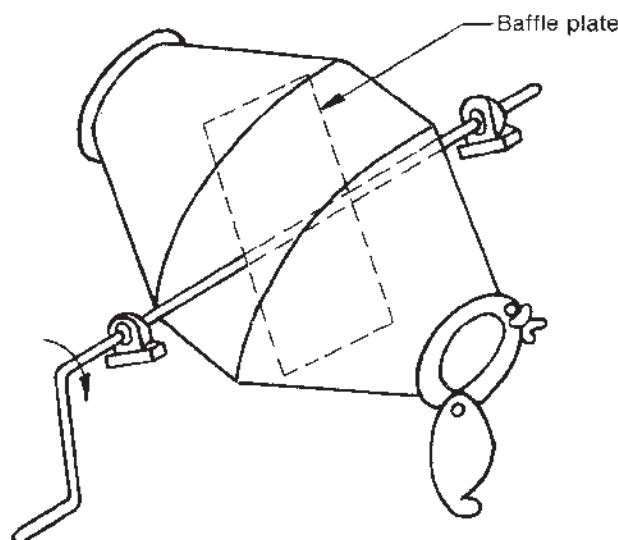


FIGURE 1 AN EXAMPLE OF A DOUBLE CONE MIXER

- Strip mixing. The material is formed into a strip by careful distribution of the ore from a shovel or scoop. The length to width ratio of the strip should be not less than 10:1. A complete cross-section of the strip is taken randomly and spread out to form a new strip. Successive cross-sections are taken randomly and spread out adjacent to the preceding cross-section, layer upon layer, until the old strip has been converted into the new strip. The above process is repeated twice.

3 General

Particle size reduction by either crushing or grinding apparatus (referred to as mills in this Standard) is used to reduce the nominal top size of the ore to a suitable level for subsequent division.

The sample should be fed uniformly into all mills to avoid choking of the mill or changes in mill speed, which may result in variation in the particle size distribution of the product.