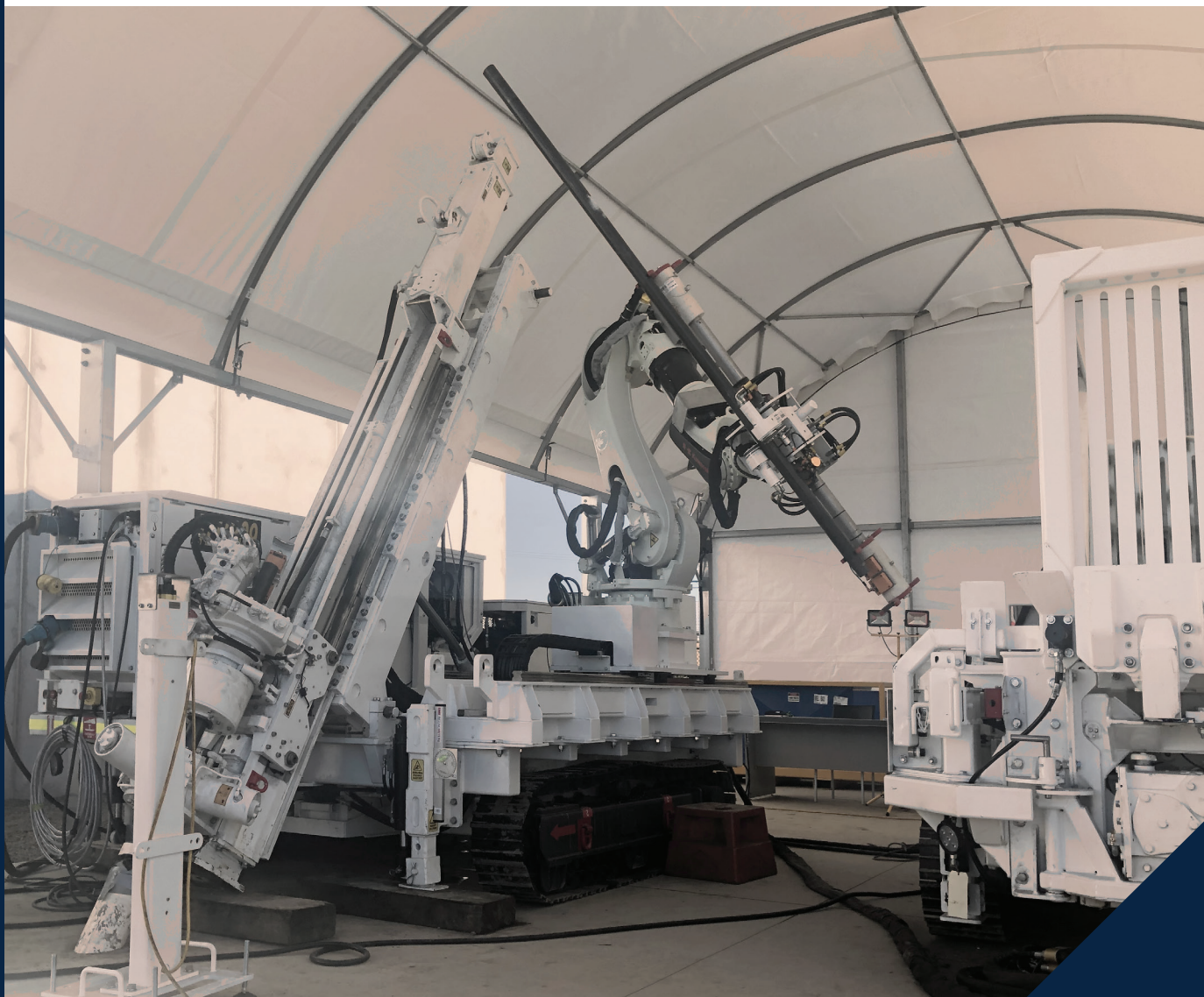


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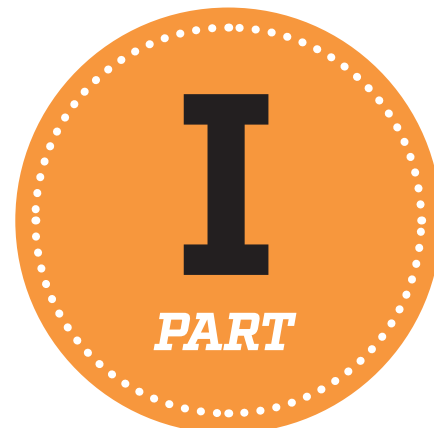
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Drill Core Storage: Orientation regarding international best practices



By **Daniel Bortowski Carvalho**, Geologist and CEO at Core Case, **Gláucia Cuchierato**, Geologist and CEO at GeoAnsata, and Professor and Mining Engineer **Ana Carolina Chieregati**

Introduction

The quality and representativeness of data from a mineral deposit or potentially mineralized area is often the subject of much discussion among technicians and academics, especially when the commodity in question is a rare or base metal, as they are ores that have important variables to consider concerning their economic evaluation and extraction.

Exploration results

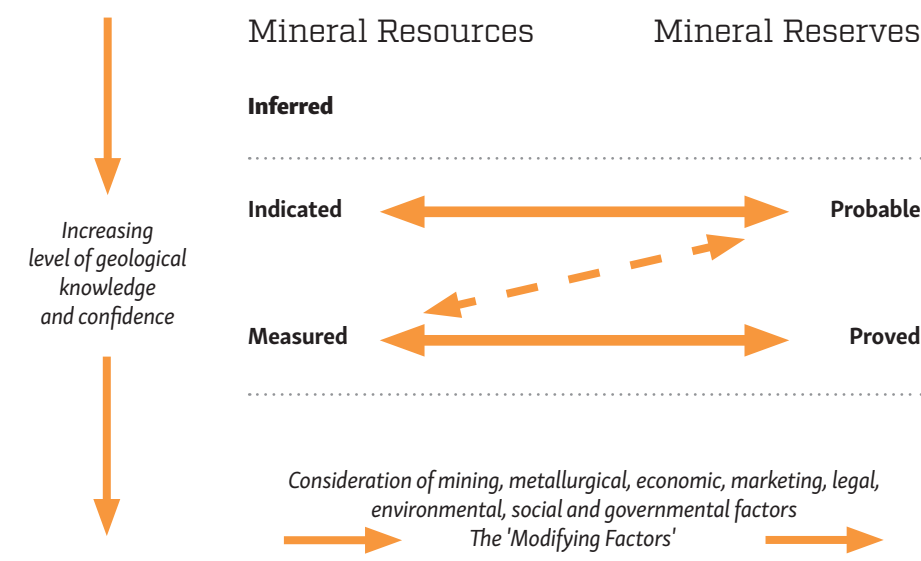


Figure 1 – Relationship between the exploration results, resources, and mineral reserves.
Source: CRIRSCO (2006).

Companies adjust each phase and purpose of their operations, such as evaluation, establishment of the geological-metallogenetic model, grade quality control, and ore reconciliation, according to the drilling options on the market. However, we still lack a consensus on the best cost-effective method. In general, qualified professionals are responsible for conducting efforts to plan activities that reflect the highest quality, clarity, and repeatability of the processes, samples, and data, so as to adjust the available information to international standards.

Diamond drilling is considered one of the best practices for achieving this quality because it allows core to be obtained and preserved with several advantages over other methods, including a more representative, continuous, and homogeneous sampling regarding the characteristics of the ore at the mineralized interval, the occurrence depth, the mineralogy, the geological structures, and the amount of collected material.

Activities performed during drilling, through the study of sampling errors, quality assurance and quality control programs (QA/QC), and additional precautions taken to avoid contamination and bias, enable the collection of a better quality of core samples. It is mandatory for the mining industry to evaluate the advantages of the drilling process to reduce the operating costs of drilling campaigns, core management, and occupational risk management.

After considering an infamous case of historical mining fraud and the consequent scientific, economic, and technical-operational issues, this article sets out some

crucial points on international reporting standards for defining the best procedures for sampling and the safe storage of information obtained at a mineral site.

Historical context

Recently used as a Hollywood script in the film *Gold* (2016) directed by Stephen Gaghan, the most famous mining fraud of all time was in fact the foundation for establishing the first international instruments for the public reporting of mineral resources and reserves by companies seeking funding on the financial market.

Bre-X Minerals Ltd, the centerpiece of this worldwide scandal, was a Canadian mining company founded by David Walsh. It was listed on the Alberta Stock Exchange (ASE) in 1989, with shares worth only a few cents, holding a few small prospects in northern Canada. In March of 1993, David Walsh partnered with geologists John Felderhof (who assumed the position of General Manager) and Michael de Guzman (Chief Geologist) for the assessment of a gold deposit in a hydrothermal venular system in northeast Borneo, Indonesia, in a place known as 'Busang' (Nicholls, 1999).

The drilling began in September 1993 with the analysis carried out in laboratories from the Kalimantan province on the island of Borneo. Early studies did not indicate significant positive results at these sites, and from 1994 to 1996 targets were expanded to other locations, where new exploration agreements and labor contracts were reached with the Indonesian government,



Figure 2 – Countries belonging to the CRIRSCO family. Source: CRIRSCO (2019)

with periodic reporting of results that were increasingly promising. In April 1996, the company had its IPO – Initial Public Offering at the Toronto Stock Exchange (TSX), with Bre-X shares traded at prices in above USD 200 per share. In July of that year, reserve estimates were released at 47 million ounces – compared to the world's largest gold reserve (Grasberg) which was estimated at 64.2 million ounces, the Bre-X deposit was considered the second largest in the world at the time.

After some attempts by large gold mining companies to operate in the region (Barrick Gold Corporation and Placer Dome Inc.), and

interventions by the Indonesian government throughout 1996, there were suspicions of irregularities, with the annulment of labor contracts in December of that year and threats to the company's credibility, culminating in the recommendation by the Indonesian Minister of Mines and Energy, Ida Bagus Sudjana ('the Minister') to expropriate Bre-X in February of 1997. The previous month (January 1997), a serious fire at the Busang site in the core warehouse and offices destroyed the samples and all material proof.

Under these circumstances, in February 1997 Bre-X announced a joint venture agreement with the participation of the

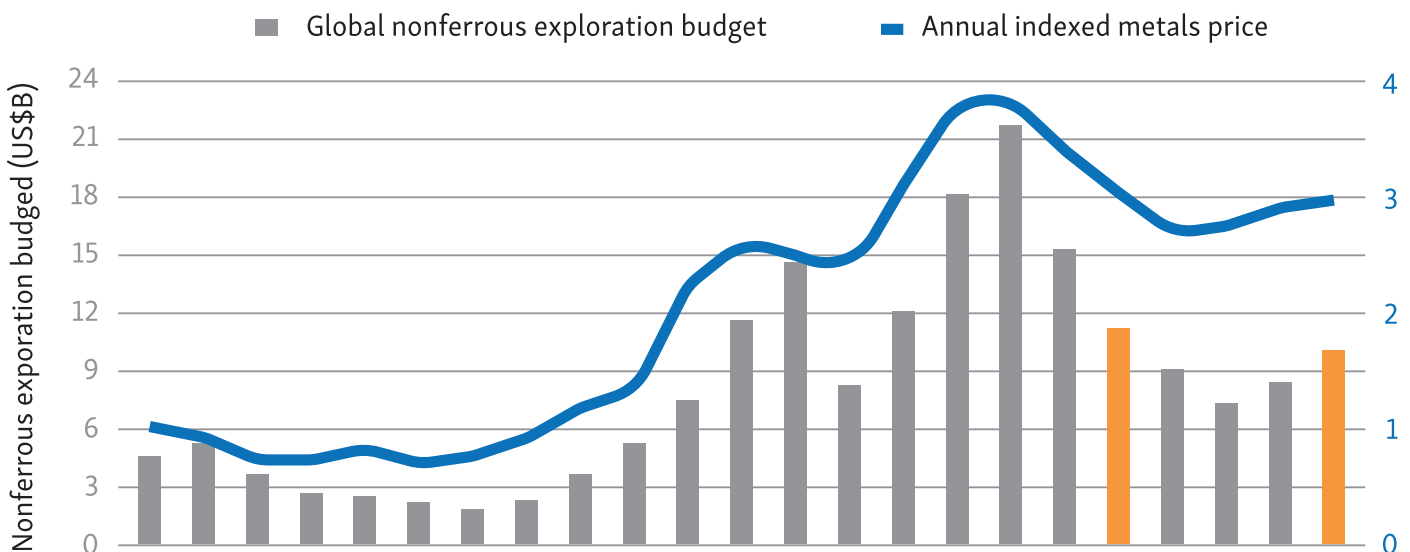


Figure 3 – Global evolution of investments in non-ferrous minerals is USD billions. Source: S&P (2019)

government (10 %), two domestic companies (30 %), and Freeport-McMoRan Copper and Gold Inc. (15 %), and Bre-X holding 45 % of the total shares. At the time of the merger, the resource valuation was updated and validated by the international consulting company Kilborn SNC Lavalin at 70.95 million ounces of gold. Freeport began their due diligence, and the initial results did not compare to amounts declared by Bre-X. Immediately, the managers and shareholders were informed and requested the presence of the responsible geologists. Before the meeting took place, geologist Michael de Guzman allegedly committed suicide during a helicopter flight on March 19, 1997.

The consulting company Strathcona Mineral Services was then commissioned to perform the official audit, and after finalizing the reanalysis of the samples, they stated in their report that there was unprecedented tampering and they held 'the firm opinion that an economic gold deposit has not been identified in the Southeast Zone of the Busang property, and is unlikely to be' (Nicholls, 1999, p. 185). Among the reported inconsistencies, the audit found a number of problems in sample preparation (such as the entire core being crushed) and in analysis techniques, but what most backed up the suspicion of tampering was the listing of the mineralogical characteristics of the gold ore as alluvial or placer, not hydrothermal, as was the case with the supposed original genetic geological model.

Although there were already some standard definitions of resource and mineral reserves reporting in several countries at that time – published by organizations such as JORC (Australasia), SME (United States), SAMREC (South Africa) and NI 43-101 (Canada), groups which were brought together by the creation of the CRIRSCO (Committee for Mineral Reserves International Reporting Standards) in 1994 – after the Bre-X fraud case the topic gained international notoriety, hastening the development of a new standard that could guarantee credibility for mineral asset statements and classification.

In response, CRIRSCO finalized the first international model for terminology and classification consolidation in 2006 with the publishing of the International Reporting Template for the Public Reporting of Exploration Results, Mineral Resources and Mineral Reserves (CRIRSCO, 2006). With the Template, the classification already adopted by JORC and NI 43-101 was made official and consolidated internationally (see Figure 1).




Figure 4 – Distribution of global mineral research investment in 2017. Source: S&P (2018)

After its publication, countries that wanted to participate in CRIRSCO produced codes adhering to the Template, as was done by Brazil, which established the Brazilian Commission of Resources and Reserves (CBRR), made up of the Brazilian Association of Mineral Research Companies (ABPM), the Brazilian Agency for Technological Development of the Mineral Industry (ADIMB) and IBRAM, with the purpose of becoming the National Committee. In November 2015, at the CRIRSCO International Annual Meeting, held in Brasília, this Committee formally accepted Brazil's membership, making it the 9th member country. The current CRIRSCO signatory countries are listed in Figure 2.

Economic context

The global budget for 2018 invested in non-ferrous mineral exploration was estimated at USD 10.1 billion, with 19 % per year growth, compared to the USD 8.5 billion investment in 2017, according to the World Exploration Trends report, presented by S&P Global Market Intelligence during the Prospectors and Developers Association of Canada (PDAC) Annual Convention in Toronto, in March of 2019 (S&P, 2019). Notably, there is optimism in the sector, where investment values are expected to increase at growth rates of 5 % to 10 % over the next few years. Figure 3 shows the amounts invested in non-ferrous metal exploration since 1996, compared to the metal price index, highlighting the major cycles and the market recovery trend. Figure 4 illustrates the top destinations for investment in mineral exploration around the world in 2017 (S&P, 2018).

In Part 2, next issue, we will discuss the present international reporting standards and what they mean for core sampling, packaging, and storage. 

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