

## **13.0 SAMPLE PREPARATION, ANALYSIS AND SECURITY**

### **13.1 *Sample Preparation***

Geovic maintains a sample-preparation facility at the Kongo Camp, where samples from Mada were prepared for assay. PAH reviewed the procedures in detail.

Upon arrival from the field in polyethylene woven bags, the samples were stored in a sheltered locality until processed. As each bag was opened, the sample was placed in a steel tray for drying, and an aluminum tag bearing the information on the sample bag placed on the tray. After drying, the sample was quartered and placed in a clearly labeled plastic bag, with the location and interval. Another aluminum tag was prepared which accompanied the sample, all the way to arrival and re-coding of samples in the U.S. The aluminum tag placed in the steel tray before oven drying remains with the back-up sample on the shelves in the warehouse.

Drying of samples was accomplished in a wood-fired oven. The temperature was not recorded, but appears to be in the vicinity of 100 degrees C, plus or minus 20 degrees. Samples were examined manually from time to time to determine the degree of dryness, and normally after six or seven hours were judged to be sufficiently dry for further processing.

Upon removal from the oven and cooling, each sample was inspected visually for oversize material (coarser than approximately 2 centimeters). Oversize material was manually crushed in a mortar and pestle and returned to the sample tray. At this point, the dried sample was reviewed again by a geologist to ensure that the on-site logging did not miss important features due to poor light, etc.

The sample was then split in a Jones-type riffle splitter with openings measuring 10 mm. Normally a 200-gram dried sample was weighed and bagged for shipment to the assay lab. All remaining reject was bagged and stored at Kongo Camp.

The shipment of samples follows JORC (Australian) procedures regarding chain of custody. Samples were shipped by vehicle to Geovic's office in Yaounde, the capital of Cameroon, whence they were delivered to a common carrier for air-freighting to North America.

From 1995 until early 1999, Geovic contracted the Ministry of Mines' geologists and engineers to oversee the Quality Assurance/Quality Control for Cameroon samples. In late 1999-2001, Geovic contracted R.K. Duncan & Associates, a laterite Q.P. out of Perth, Western Australia to oversee the QA/QC for the latest Mada sampling program. All but the later 64-samples were sent to Bondar-Clegg (Intertec Testing Services, No. Vancouver, British Columbia) for assaying cobalt, nickel and some chromium and manganese. Bondar-Clegg pulverized the samples to minus-150 mesh, then inserted duplicates and standards into the sample stream before analysis. The last 64-samples were handled by Mintec who provided blind sample numbering, and insert duplicate, standards, and blanks into the sample stream prior to analysis by Actlabs of Tucson, Arizona.

It was apparent to PAH that Geovic personnel, R.K. Duncan & Associates, and Mintec, Inc. paid close attention to sampling and sample-processing techniques, and have varied the techniques from time to time, based on careful analysis of results, including comparisons between different methods. PAH believe that the collection and handling of Mada samples meet or exceed industry standards for laterite projects, and that any limitations on precision and accuracy of samples are those limitations inherent in the laterite deposits themselves and in assaying technology.

## **13.2 Assaying**

During 1995-2003, Geovic shipped 3,201 Mada pit samples to Bondar-Clegg in No. Vancouver, British Columbia and Actlabs in Tucson, Arizona for processing and assay for cobalt, nickel, chromium and manganese.

On average, Bondar-Clegg who analyzed most of the Mada samples (1995-2001), used 530 standards (17%), and 250 duplicate pulp analyses.

Actlabs, under the direction of Mintec, Inc. analyzed 64 Mada in-fill samples for cobalt, nickel, and manganese. Their results were consistent with the earlier Mada geology and analyses.

Bondar-Clegg initially used 3-acid digestion of samples (HF, HCl, & HNO<sub>3</sub>) and "low-level" AAS in 1995. Later, Bondar-Clegg used 4-acid digestion (HF, HCl, HNO<sub>3</sub>, and HClO<sub>4</sub>) with ICP analyses (1999-2001). Actlabs used 3-acid digestion and ICP analyses. Geovic switched to Actlabs in 2002 in order to pay for one-half of the analyses with a U.S. Trade and Development Agency (USTDA) loan, requiring a certified, U.S. based laboratory.

### **13.2.1 Sample Preparation for Assaying**

The samples received at Bondar-Clegg and Actlabs were dried for 24 hours at 150°C before analyses. According to the mineralogical literature on asbolane, there should be no loss of chemically combined water or hydroxyl ions below 150°C. Thus the subsequent assays reflect intact dry asbolane, which was lacking only any loosely-bound water that is not included in the calculated dry tonnes of mineral resource.

### **13.2.2 Laboratory Qualifications**

Both Bondar-Clegg and Actlabs' facilities are accredited to ISO/IEC-17025 and CAN-P-1579 (Canadian) standards, and are thus fully accredited as a commercial mining assay laboratory.

### **13.2.3 Laboratory Methods**

Following the drying at Bondar-Clegg and Actlabs facilities, as discussed above, pulps of Geovic samples were digested in a 3-acid solution and 4-acid solutions and analyzed primarily by the ICP-OES

(Inductively Coupled Plasma Optical Emission Spectrometry) method for Co, Ni and Mn. The 3-acid digestion is normally sufficient to dissolve all minerals typically present in the Mada samples.

Various other appropriate methods were used for occasional analyses of 34 other elements (Pb, Zn, Cu, Cr, V, Mg, Al, Sc, Zr, etc.) for bulk samples and other specialty samples. The multi-element analyses by ICP methods were not included in the Mada resource estimate since most samples were reanalyzed later using a 4-acid digestion and ICP.

### **13.3            *Bulk Samples***

A bulk sample was taken from 25 Mada pits (53, 1-meter samples) that were metallurgically tested by Metcon (Tucson, Arizona) and compared to the Nkamouna metallurgical tests. The Mada and Rapodjombo metallurgical samples were found to be consistent with the Nkamouna column (heap leach) tests.

### **13.4            *Inter-Laboratory Comparisons***

Various inter-laboratory checks have been undertaken by Geovic throughout the life of the Cameroon project. Although the focus was on the Nkamouna deposit, the results are generally applicable to Mada, since the mineralization is similar and the sampling and assaying procedures were identical.

In 1999, K D Engineering Co Inc. of Tucson, Arizona, visited Nkamouna and undertook to re-sample eight exploration pits. Samples were taken separately from one-meter intervals in channels in the east and west wall of each pit. Splits of each crushed sample were sent for pulverizing and assay to three different laboratories: International Plasma Laboratories (Vancouver); Bondar Clegg Intertek Testing Services (Vancouver); and Genalysis Laboratories (Perth, Australia). The laboratories did not include Actlabs, which subsequently assayed the greater bulk of Nkamouna samples. Their report (K D Engineering Co. Inc., 2000), indicates that Genalysis and Bondar Clegg agreed closely on Co assays (difference of less than 2 percent relative, and a Coefficient of Correlation,  $R^2$ , of 0.987), whereas the International Plasma results averaged more than 10 percent low, with  $R^2$ , of less than 0.95 when compared to either of the other two labs. No further samples were analyzed by International Plasma.

### **13.5            *Quality Control***

The samples assayed by Actlabs were submitted to both Actlabs' and Geovic's independent QA/QC checks. The use of second splits and sample standards are universally recognized methods to provide confidence in the assaying reliability.

#### **13.5.1            *Actlabs Quality Control***

The Actlabs laboratory runs assay batches of 24 prepared pulp samples, comprising 20 samples plus repeats on the 1<sup>st</sup> and 20<sup>th</sup> samples of each batch, in addition to two in-house standards. One sample per client's submitted batch of 20 was reweighed along with both an in-house and a certified reference

standard of known Co-Ni-Mn content. Actlabs internal checks allow for a maximum acceptable variance of 2 percent for duplicates and standards. Given its ISO and CAN-P-1579 certifications, Actlabs is required to have a suitable program in place for periodic round-robin inter-laboratory comparisons.

### **13.5.2 Geovic Sample Splits**

Geovic undertook a comprehensive program of comparing second sample splits from Nkamouna. The pairs of samples extracted from the same sample intervals show a high degree of correlation for Co, Ni, and Mn, providing confidence in the ability of Actlabs to generate reproducible assay results from similar sample material. Although the sample-split campaign did not include Mada, there is every expectation that similar results would accrue, given the similarities in geology, sampling methods, and analytical methods.

### **13.6 *Excluded Samples and Reasons***

The exclusion of samples from the resource calculations is discussed in Section 17.0, Resources. Nearly all the exclusions were due to ignoring certain pits sunk on metamorphic bedrock at the margins of the deposit, and yielding very low metal values.