



# Global Mercury Project

Project EG/GLO/01/G34: Removal of Barriers to Introduction of Cleaner Artisanal Gold Mining and Extraction Technologies



## From the Editor

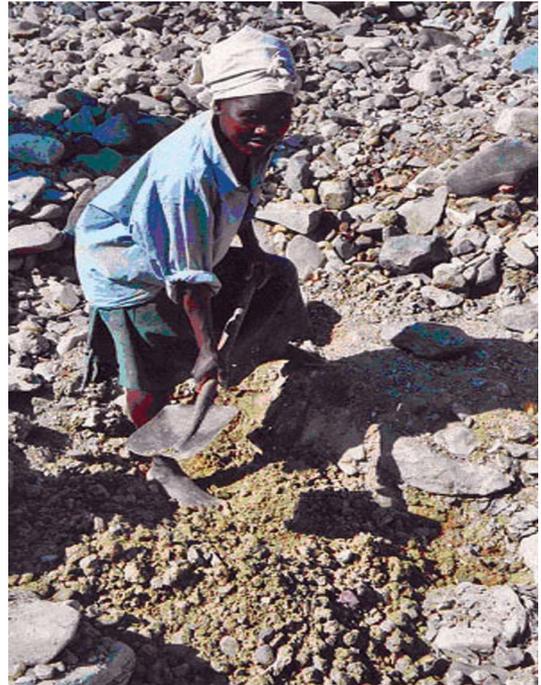
In this issue we highlight the news that CETEM has completed the field work for the Environmental and Health Assessment (E&HA) of mercury impacts in Brazil and Indonesia. In Tanzania, BGS also finished its fieldwork in the Rwamagasa area (drainage to the Tanganyika Lake) where biological, geological and human samples were collected to be analyzed. In Zimbabwe, the French Institute, BRGM has been conducting the Environmental Assessment in the Kadoma-Chakari region.

## Zimbabwe: Miners, Millers, Panners

In Zimbabwe, it is estimated that there are between 300,000 and 400,000 artisanal gold miners sustaining the livelihood of at least 2 million people. About 20,000 to 30,000 people are directly involved in gold extraction in the GMP site, Kadoma-Chakari region. There are 3 categories of workers in the area: **miners** (about 3,000 to 5,000 people) who excavate the ore and take this to be processed in custom milling centers; **millers** (1,000 to 2,000 people in 70 milling sites) who process the ore to extract gold in the milling centers and **panners** (15,000 to 25,000 people) who extract gold by panning the gravels in creeks and rivers. The custom milling centers are a desirable solution as this organizes the activity and avoids the use of mercury in different places. However, the millers allow miners (customers) to use their own mercury at any step of the process. It is common to see miners adding three teaspoons (150 g) of mercury in the centrifuges used for gravity concentration of gold. This “flours” part of the mercury that is lost with the tailings. The use of copper-amalgam plates is very popular in the region and must be forbidden to amalgamate the whole ore. Mercury (and gold) accumulates on a point of the plate surface, and with the attrition of the ore, it is lost. A miner stated: “If I sleep and I do not spread the mercury on the plate, I lose mercury and my gold, and the miller will have it later on when he uses cyanide”.

A businessman stated that he is importing annually 20 tonnes of mercury from Netherlands to Zimbabwe. Based on field observations it is estimated that Hg losses in the region must be between 3 to 5 tonnes/a.

*An impaired woman panning for gold in the Kadoma-Chakari region, Zimbabwe*



Millers extract the gold left in the primary and amalgamation tailings by vat-cyanidation. Miners receive no compensation for this. Most Centers have 5 to 10 cyanidation tanks. When the Hg-contaminated tailings are leached with cyanide, part of the mercury goes into solution and part of it stays with the final tailings. The fate of Hg-cyanide in the tailings is unknown but cyanidation process can also exacerbate the Hg methylation potential in tailings.

Panners in Kadoma-Chakari are isolated individuals usually from remote areas, some of them from neighboring countries. They are frequently harassed by local police while working in illegal areas. In the dry season, they divert the river and excavate the gravels to concentrate gold in improvised sluice boxes (known as James Table). They process from 1.5 to 2 tonnes of material per day recovering 0.2 to 0.4 g Au and losing equal quantity of mercury.

**The Global Mercury Project (GMP)** began in August 2002. The GMP will demonstrate ways of overcoming barriers to the adoption of best practices and pollution prevention measures that limit the mercury (Hg) contamination of international waters from artisanal and small-scale gold mining (ASM). Six countries are participating in the GMP: Brazil, Lao PDR, Indonesia, Sudan, Tanzania and Zimbabwe. In addition, the GMP aims to introduce cleaner technologies, train miners, develop regulatory mechanisms and capacities within Government, conduct environmental and health assessments (E&HA) and build capacity in local laboratories to continue monitoring Hg pollution after the project.

## Environmental & Health Assessment in Brazil

The Project sites chosen to investigate the environmental and health effects of Hg from artisanal and small-scale mining (ASM) in Brazil are located in the Tapajós region. The main characteristics are:

- it is the main Brazilian ASM location with almost 100,000 km<sup>2</sup> impacted by mining. This is larger than Portugal area (92,000 km<sup>2</sup>);
- ASM started back in 1958 with historical official gold production of 180.6 tonnes (US\$1,915 million); the estimated actual production is around 650 tonnes of gold (US\$ 6,877 million);
- gold is extracted from secondary and primary, deposits in more than 2,200 mining sites;
- about 500 occurrences of primary gold, of which 100 of them are in being mined;
- it was the first area to organize a formal association of the mine owners "Associação dos Mineradores de Ouro do Tapajós" - AMOT.

The selected areas of Creporizinho and São Chico are located in the Tapajós River basin, situated in the SW of the State of Para, Brazil, distant 1,300 km from Belém, State Capital. Creporizinho was founded in 1962 and has three churches, a large variety of grocery stores, a police station and some 238 houses for an estimated population of 1000 inhabitants. Electricity is generated from diesel engines. About 200 children go to the local elementary school, from 1st to 6th grade. Its top gold production occurred between 1983 and 1990, when 350 to 400 kg of gold per month was produced. At that time the town received 10,000 inhabitants. Currently the gold production of 50 kg/m is basically from primary ore. São Chico has a similar history. Discovered in 1963, the town witnessed a gold rush from 1999 to 2001 when production of circa 2 tons of gold was reported and the population peaked 5000 people. Currently there are about 130 miners producing a bit more than 1 kg of gold per month.

In order to assess the environmental and health impacts caused by ASM, CETEM – Centre of Mineral Technology, Rio de Janeiro, Brazil together with the medical doctors from the Instituto Evandro Chagas of the Brazilian Ministry of Health, Belém, Pará State collected 646 environmental samples, including soil, stream sediments, and aquatic biota as well as 700 human samples (urine, hair and blood) from miners and other community members of Creporizinho and São Chico. In the process the doctors interviewed the volunteers to know more about their general health and performed a series of neurological tests to establish the level of mercury intoxication. The team also left with local health and sanitary authorities a simple colorimetric method to provide a fast way to evaluate the level of mercury contamination in edible fish. All samples are being analyzed in Rio de Janeiro and in Belém to produce a definitive picture of the level of mercury pollution at the project sites.

Beyond mercury pollution, the siltation (due to erosion of the margins) of the rivers has caused huge environmental impacts that can be noticed up to 300-500 km downstream of the Tapajós River.



*Recover of amalgam from a copper plate, Itaituba, Brazil.*



*Burning of amalgam in open air close to cooking facilities, Itaituba, Brazil.*

## The Demise of the Country Focal Point in Brazil

The PCU is sad to communicate the passing of Dr. Eng. Gildo Sá occurred on 24 September 2003. Gildo, GMP Country Focal Point and Director of CETEM died at age of 64. As a well-known professional engineer throughout Latin America, he was associated to CETEM and the Brazilian Geological Survey for more than 25 years. During his professional career he held such responsible positions such as Director of FOSFERTIL, Vice President of ABRAFOS, the Brazilian Fertilizers Association, Vice President of OLAMI, the Latin America Mining Organization, President of FAEMI, the Brazilian Federation of Mining Engineers and had worked as Consultant in several important mining projects in Brazil and Argentina. He leaves his wife, Darcy, and two daughters Ceça and Luciana to whom we extend our condolences.

## Environmental & Health Assessment in Indonesia

The E&HA has been undertaken in August/ September 2003 by a team composed of scientists from Centre of Mineral Technology, CETEM, Rio de Janeiro, Brazil, and Institute of Forensic Medicine of the Ludwig-Maximilians University Munich, Germany. The areas under survey were close to Manado, North Sulawesi, and Palankaraya - Kereng Panggi, Central Kalimantan Island. Both teams were assisted by the local UNIDO representatives, the Indonesian Focal Point, Mr. Thamrin Sihite, and the Assistant to the Country Focal Point, Ms. Selinawati Darmutji, who was present throughout all phases of the field campaign. Meetings took place with the Chief Technical Advisor for deliberating on next steps in disseminating results, awareness raising and training.

The mining site in Kalimantan is reached via Palankaraya airport. From there, it takes almost 1 hour to the mining town of Kereng Panggi, where in the nearby mining area of Galagan both the health and environmental teams performed their surveys. The mining area drains to the Katingan River flowing from North to South into the Java Sea. In Galagan, about 12,000 miners extract alluvial material in an area of 200 km<sup>2</sup>. The material is concentrated on sluice boxes and amalgamation is conducted in pools excavated nearby their houses. Amalgam is burned in open crucibles inside family houses (kitchens) or in commercial stores (e.g. restaurants, warehouses). Gold, with residual 2 to 5% Hg, is sold in Kereng Panggi. In the rainy season 15 kg of gold/day is sold to 20 gold shops and melted in the village in rudimentary fume-hoods with no condensers or filters for Hg abatement.

The investigations in Sulawesi were conducted close to Manado, a prosperous city of 600,000 inhabitants located at the Manado Bay of the Sulawesi Sea. The mining area Tatelu is some 30 km away from Manado. Mineral processing activities are pursued along a small road crossing the village. Miners take 0.5 to 1 tonnes of ore per day to the milling centers. The material is crushed by stamp mills and then ground in a series of 12 home-made tumbling mills. Each steel mill, with diameter of 48 cm and length of 60 cm, has capacity of milling 40 kg of ore per batch (usually 5 hours). The mill grinds the ore for 4 hours using 40 river cobbles/mill. Then the grinding step is interrupted and about 1 kg of mercury per mill is added and the mill rotates for an additional hour. After separation of the amalgam and the pulp, tailings are undergoing a second amalgamation and/or cyanidation process. Three small rivers drain into the Manado Bay, all originating from the Talawaan watershed. Both teams took samples in this area and alongside the watersheds.

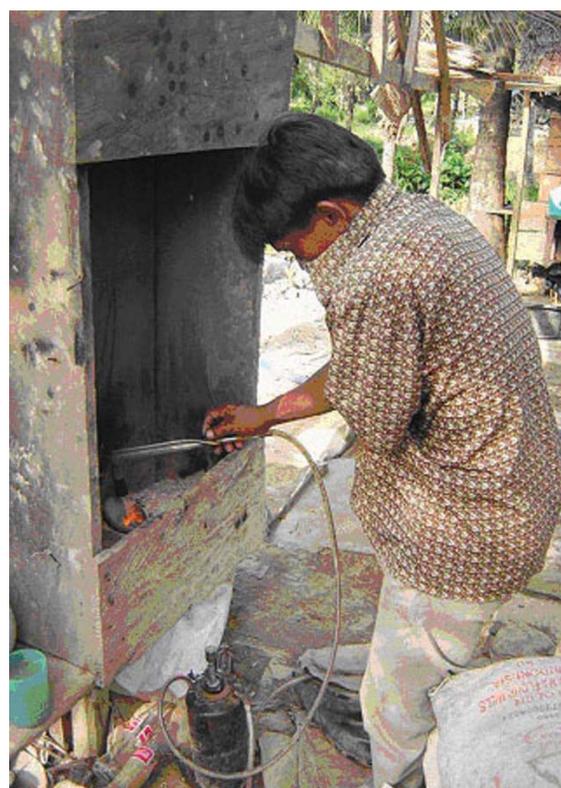
In each of the surveys in Sulawesi and Kalimantan, 200 members of the small-scale mining communities participated voluntarily in the health assessment. Another 100 participants living in non-mercury exposed areas were checked as a reference group. Basic data on the communities were recovered through a questionnaire in Bahasa language. All participants were physically examined through

neurological testing and specimens of blood, urine and hair. The samples were shipped to Germany for analysis. According to first results, there is a very high rate of mercury intoxication in male miners of the Galagan and Tatelu area. Although the final results are not yet ready, it is estimated that 50 percent of the miners must be regarded as intoxicated. All these rankings are based on UNIDO health assessment protocols, where intoxication is determined by a medical score plus a given level of mercury in bio-monitors. The protocol is available at GMP website. In total, 764 samples were taken by the environmental team. The sample material consists of 416 biological samples from fishes, plants and shells, and 348 inorganic samples from sediments, soils and water. It is expected that the final report will be available at the end of the year 2003.

*R. Villas Boas, from CETEM showing the GMP News to Miners in Kalimantan*



*A miner from Sulawesi believes that his "mask" is protecting him from Hg vapor*





## Activities July – December 2003

- ✓ Recruitment of new Assistant to the Focal Point in Zimbabwe.
- ✓ Meeting with stakeholders in Zimbabwe and Tanzania. Presentation of lectures on environmental and health effects caused by mercury.
- ✓ Technical assessment of the miners' need in Zimbabwe and Tanzania.
- ✓ Elaboration of a strategy to implement technological solutions at project sites in Zimbabwe and Tanzania.
- ✓ Completion of sociological studies in the hot spots of the 6 countries and transmission of conclusions to selected subcontractors for the health and environmental surveys.
- ✓ Fieldwork for the E&HA completed in Brazil, Indonesia and Tanzania.
- ✓ Fieldwork for Environmental Assessment in Zimbabwe.
- ✓ Assessment of analytical laboratories in Zimbabwe and Tanzania.
- ✓ International bidding on portable Hg-analyzers for all 6 project participating countries.
- ✓ Participation in the Annual Meeting of CASM (Community and Artisanal and Small-scale Mining), World Bank, in Elmina, Ghana.
- ✓ Training of National Experts in undertaking epidemiological surveys in mercury-affected areas (Brazil, Indonesia, Tanzania).
- ✓ Training of Health Experts in semi-quantitative Hg analysis of fish (Indonesia).
- ✓ Legal survey of US EPA on mining-related legislation in the six participating countries.
- ✓ Peer Review of US EPA on Environmental and Health Protocols developed by PCU.
- ✓ Start of preparation of adaptable training courses (TRAIN-X) for field training.
- ✓ Creation of a website [www.globalmercury.org](http://www.globalmercury.org) and inclusion of project-related reports.
- ✓ Review of sociological and technical information obtained in the six countries for website.
- ✓ Global Task Force Meeting Luang Prabang/Lao PDR, 17-19 December.



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## Plans for January - June 2004

- Purchase of portable Hg analyzers for all 6 participating countries.
- Legal study on small-scale gold mining in the State of Amazonas/Brazil.
- Continuation of preparation of training modules.
- Preparation of Country Task Force Meeting in Brazil with presentation of the results of the Environmental and Health Survey.
- Preparation of Country Task Force Meeting in Indonesia with presentation of the results of the Environmental and Health Survey.
- Start of a public awareness campaign in Brazil and Indonesia.
- Health survey in Zimbabwe.
- Environmental and Health Survey in Sudan.
- Environmental and Health Survey in Lao PDR.
- Training of laboratory technicians in Hg analysis and Hg monitoring.
- Upgrading laboratories for Hg monitoring in Brazil, Lao PDR, Indonesia, Sudan, Tanzania, Zimbabwe
- Assessment of technical needs in Sudan.
- Identification of potential equipment suppliers in Latin America, Africa and Asia.
- Development of technical specifications for equipment at demonstration sites.
- Initiating of bidding on mineral processing equipment.

*Woman carrying 50-kg bag of ore to be processed in a custom milling center in Rwamagasa, Tanzania*

