

POLINARES is a project designed to help identify the main global challenges relating to competition for access to resources, and to propose new approaches to collaborative solutions

POLINARES working paper n. 19
March 2012

Artisanal and Small-Scale Mining (ASM)

By Ulrike Dorner, Gudrun Franken, Maren Liedtke and Henrike Sievers



Funded under Socio-economic Sciences & Humanities



The project is funded under Socio-economic Sciences & Humanities grant agreement no. 224516 and is led by the Centre for Energy, Petroleum and Mineral Law and Policy (CEPMLP) at the University of Dundee and includes the following partners: University of Dundee, Clingendael International Energy Programme, Bundesanstalt für Geowissenschaften und Rohstoffe, Centre National de la Recherche Scientifique, ENERDATA, Raw Materials Group, University of Westminster, Fondazione Eni Enrico Mattei, Gulf Research Centre Foundation, The Hague Centre for Strategic Studies, Fraunhofer Institute for Systems and Innovation Research, Osrodek Studiów Wschodnich.

7 Artisanal and Small-Scale Mining (ASM)

Ulrike Dorner, Gudrun Franken, Maren Liedtke, Henrike Sievers

High-commodity value metals such as gold, tin and tantalum, are especially linked to ASM, which significantly adds to their world supply. The artisanal and small-scale mining sector, which provides livelihood for millions of people in the world, is part of the informal and often illegal trading chain of minerals. Mining in Central Africa has been associated with violent conflict, mistreatment of artisanal miners, illegal trading and the diversion of state funds. Resource-related conflicts are especially relevant for African countries. Tantalum is an example of a mineral fuelling local conflict when functioning state institutions are absent.

7.1 Artisanal and small-scale mining (ASM)

There is no general accepted definition of artisanal and small-scale mining (ASM) yet. In the following context the term artisanal and small-scale mining is used to describe extraction that is manual and very labour-intensive, using only picks, shovels and basins or somewhat mechanized, using heavy machinery on a small scale (Figure 1) ASM refers to mining by individuals, groups, families, or cooperatives with minimal or no mechanization, often informally and/or illegally. In addition to large-scale mining, ASM production of high value raw materials such as tin, tantalum or gold contributes significantly to the supply of industrialized countries.

ASM takes place all over the world, but is mostly widespread in developing countries in Africa, Asia, Oceania, and Central and South America. Though the informal nature and on the whole unmechanized operation of ASM generally results in low productivity, the sector represents an important livelihood and income source for the poverty affected local population. It ensures the existence for millions of families in rural areas of developing countries. Worldwide about 15 million people make their living in the ASM sector. About 100 million people – workers and their families - depend existentially on ASM (figure 2) compared to about 7 million people worldwide in industrial mining. Earnings in the ASM sector – at least in gold and diamond extraction – are considerably higher than the average income of comparable agricultural regions (about 3 US \$/d in ASM, against about 0.6 US \$/d for a farmer in central Africa).



Figure 1: Artisanal coltan mining, ground sluicing at Gatumba (Rwanda)

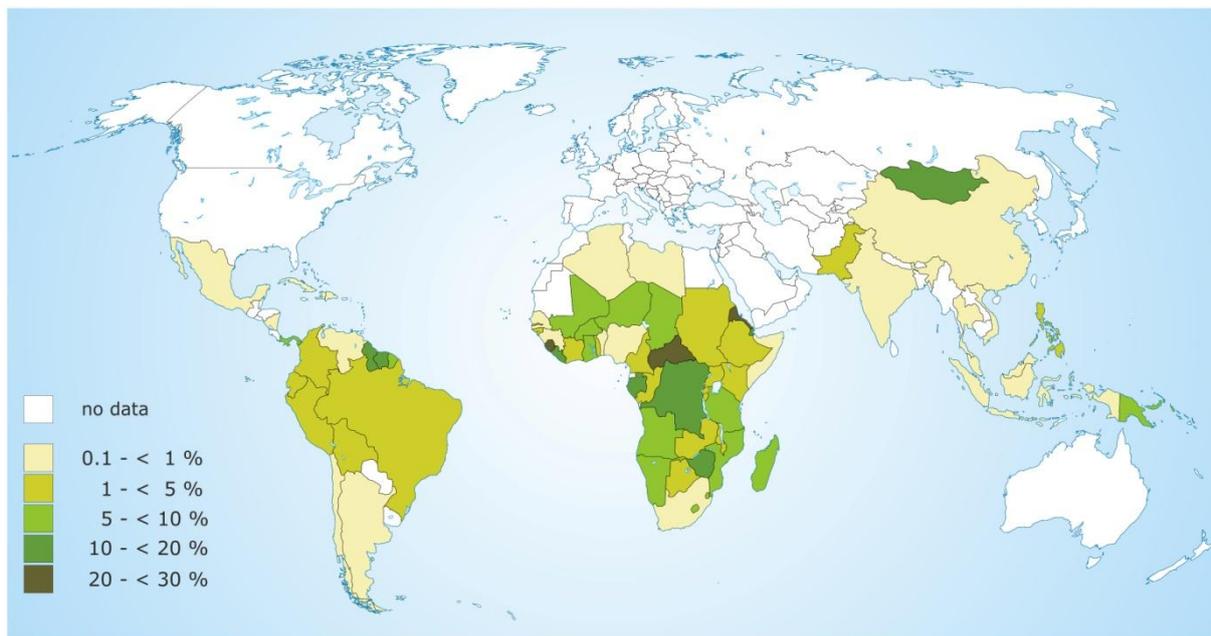


Figure 2: Percentage of the population depending on ASM (CASM 2009)

Most suitable raw materials in ASM are extractable by simple means, high-value and easily transportable. A broad variety of raw materials (e.g. metals such as gold, tungsten and tin as well as coal, gemstones up to construction raw materials) are extracted and processed by individuals, families or small cooperatives. Metals like tin, tantalum (coltan), tungsten and

gold are mined this way worldwide in significant quantities (figure 3). Although extraction often takes place all year round, it is sometimes dependent on seasonal agriculture.

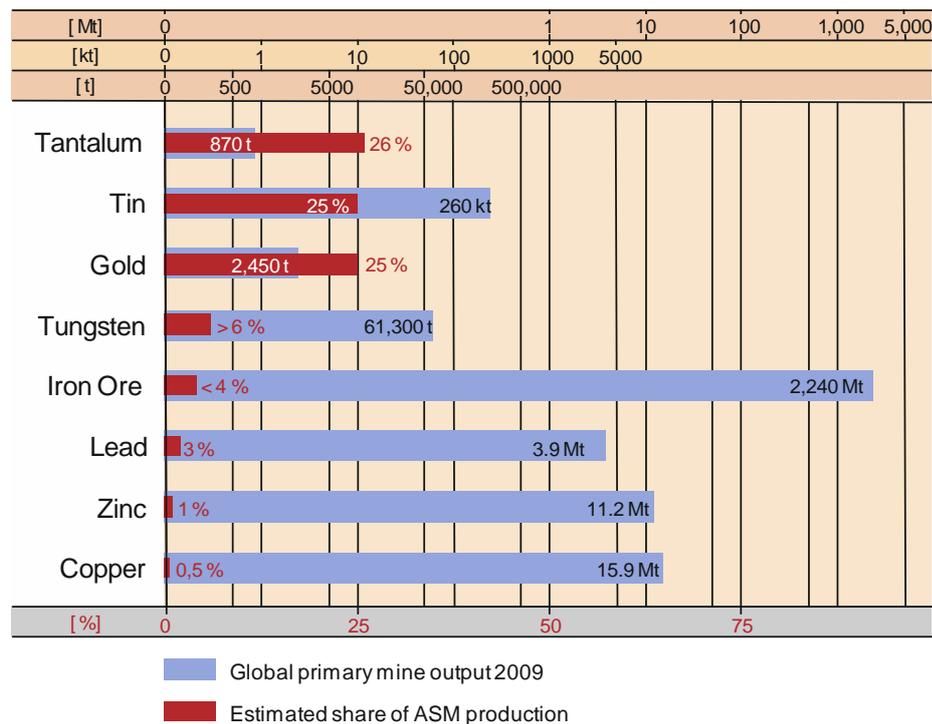


Figure 3: Primary global mine production of selected metals (metal content of ore mined) and the proportion of the sources from artisanal mining. A significant proportion of global production of minerals connected with conflict - tin, tantalum (coltan), gold and tungsten - is of artisanal origin.

High value raw materials not dependent on extensive infrastructure for production and transport are particularly suitable for ASM in developing countries. This group includes mainly metals, such as nonferrous metals (lead, copper, zinc, tin), steel additives and refractory metals (chromium, nickel, tungsten, niobium, tantalum and molybdenum), and the precious metals (gold, silver and platinum). Non-metallic commodities that are traded internationally and extracted in artisanal mining are, for example, gemstones, diamonds and industrial minerals (e.g. beryl, fluorite, mica, graphite, quartz or barite) as well as abrasive and refractory minerals (Al_2SiO_5 - group) (Wagner et al. 2007).

Most high-value commodities, especially gemstones and precious metals, which are extracted in ASM, are sold to processors worldwide or directly to buyers in developed countries. However, although many raw materials that may be accessible to ASM, customer demands for quantity, quality and homogeneity causes substantial market hurdles. This is especially true for bulk commodities, which include the nonferrous metals.

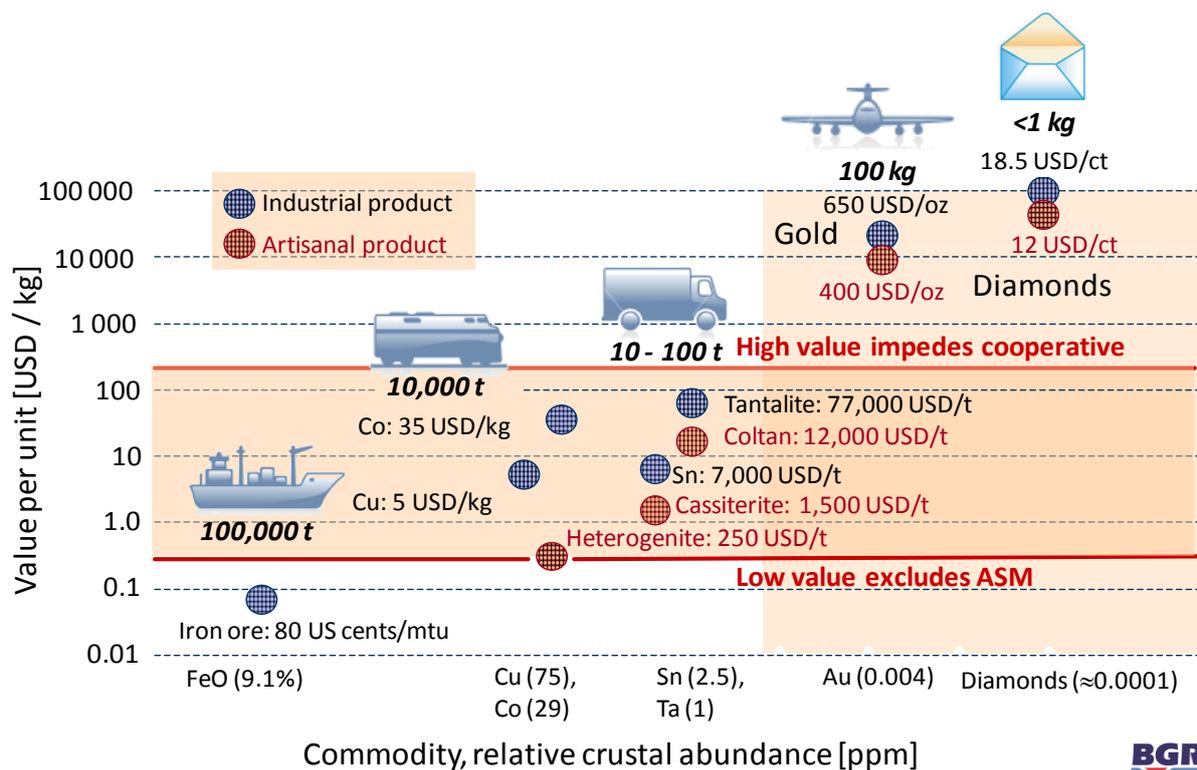


Figure 4: Low value bulk commodities such as iron ore tend not to attract ASM; artisanal miners equipped with only picks and shovels can't mine the ore fast enough to make it worth their while. At the other end, the price of diamonds and gold draws vast numbers of artisanal producers.

Characteristics of the deposits are essential for determining the suitability of ASM. In general all factors that support mechanization and economy of scale (uniformity of deposit, width of ore bodies, depth, overburden) tend to counter ASM. However, unfavorable conditions for medium- or large-scale mining (irregular ore bodies, steep dipping seams) create a niche for economically viable small-scale mining. ASM makes it possible to mine small deposits which large companies would not be in a position to extract. Poor quality can be a limiting factor for artisanal miners, as their processing technology is usually not capable of processing low-grade ores (Hentschel et al. 2003).

The share of mineral production by ASM differs considerably between different raw materials as well as at certain times as miners are often the so called “swing-producers”: in times of low market prices the sector tends to lower production, sometimes with the miners turning to other sources of income such as agriculture if available. Gold as well as the high-tech and electronic metals tin, tantalum, tungsten and cobalt are produced to a high degree in ASM operations. Nevertheless, the redistribution of income from ASM shows that only the smallest part of the extracted wealth eventually reaches the miner, because of inefficiency of transport, illegal taxation as well as long trading chains. This is also due to the fact that ASM is often part of the informal and illegal trading chain of minerals. Although artisanal and small-scale mining is dealt with in most mining regulations, the actual effectiveness of the monitoring and regulation of this sector by the national mining authorities is low. The process of extraction in ASM is usually carried out unchecked, ignoring fundamental labour standards (e.g. the elimination of forced and child labour, workplace safety, equal treatment). Social and ecological aspects are paid scant regard. Working conditions are generally poor, and child and

forced labour are particularly abundant in weak governance regions. Missing or neglected mine safety procedures are the cause of frequent work accidents, environmental impacts can be devastating.

In addition, the lack of free market access for artisanal mineral production, caused by insufficient infrastructure or by legal restraints, is another obstacle for the thriving of this sector. Because the local and intermediary trade of minerals needs a secure business environment especially in conflict-affected areas, the traders have to buy security support from local political and military rulers or private companies. Part of the revenue from mineral trade is lost by illegal taxation and corruption or can contribute to finance conflicts (Franken et al. in press).

7.2 The Case of Tantalum and the Democratic Republic of Congo

From 1995 to 2008 the African production of columbite-tantalum concentrate accounted for between 12 - 34% of world production. Since the period of increasing prices in 2000, tantalum mining has developed very quickly. In 2007 and 2008 the global proportion was around 34%. In 2009, when production in Australia and Canada was shut down, African mines were responsible for over 50% of the world tantalum share. With the exception of Mozambique (Marropino mine), and Ethiopia (Kenticha), current tantalum mining in Africa is mainly artisanal in nature, reflected in the large fluctuation in production.

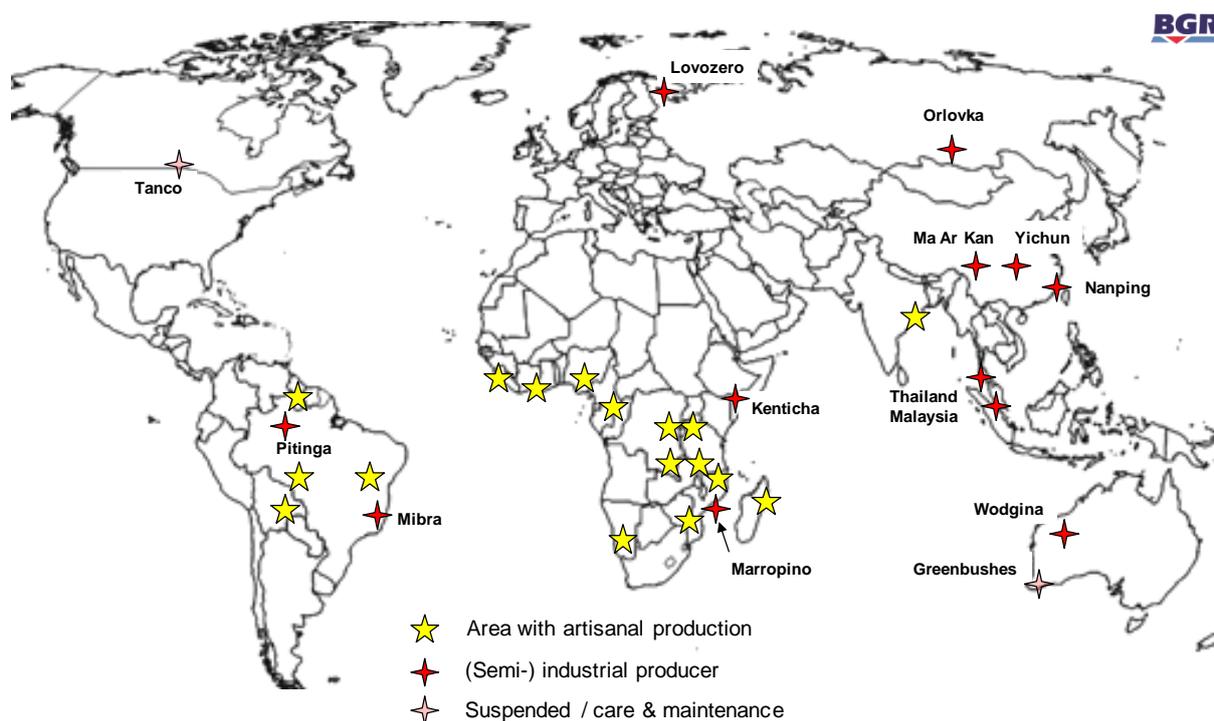


Figure 5: Global distribution of tantalum producers.

The centre for African tantalum mining is the Great Lakes region in Central Africa, particularly the area around Lake Kivu, with the Congolese provinces of Kivu, Maniema, Katanga and Ituri as well as in Rwanda, Burundi and Uganda. The share of the total

Democratic Republic of Congo (DRC) production by independent small-scale artisanal miners is not known but it is assumed, that a significant amount of primary tantalum originated from the eastern DRC. Most of the columbite-tantalite produced in the DRC is exported via other countries, typically Rwanda, and is shipped from the export ports of Mombasa and Dar es Salaam. The DRC likely constitutes the major source of coltan exported through Rwanda, where cross-border smuggling causes a substantial income loss for the Congolese state.

Mineral production in the DRC depends to a large amount on the artisanal and small-scale mining (ASM) sector. Current estimates indicate that about 2 million people are working in this sector and about 10 million people are depending on the earnings generated here – this is 20% of the total Congolese population. In the early years of this decade, the artisanal mining sector in the DRC produced between 80–100% of the total Congolese mineral production (Garrett & Mitchell, 2009), due to a difficult operating environment and lack of infrastructure. The Congolese population not only suffers from the reprisals of the warring groups but also from wanting working conditions in artisanal mining. Beyond that, in the initial phase of operation, artisanal miners commonly receive a trader's credit. During the pay down of the credit, they are obliged to sell their production under unfavourable conditions to the lender. This results in a long-term dependency of the miner.

The two main warring parties, the Forces armées de la République du Congo (FARDC, Congolese national army) and the Forces Démocratiques de Libération du Rwanda (FDLR), the predominantly Rwandan Hutu armed group, control highly mineralised areas (North and South Kivu) where they benefit from mineral production and trade. They impose illegal "taxes" on miners and traders. The FDLR obtains a significant proportion (up to 75%) of its income from gold mining and trading. Informed estimates suggest that the Congrès National pour la Défense du Peuple (CNDP), another warring party, earns up to 15% of its revenue from the mineral trade, and the FARDC up to 95% (Garrett & Mitchell, 2009).

The analysis of export data from the Kivu provinces suggests that under-declaration and smuggling are the major problems. The trade starts at remote sites, from where the minerals are transported by foot, car, truck, and by plane to the main export centres. From there, the exported material passes through Burundi, Kenya, Rwanda, Uganda, and/or Tanzania. Differences between Congolese and Rwandan statistics suggest that traded minerals are either declared as transit goods or un-taxed at the DRC border and then declared in Rwanda. Independent research (Garrett & Mitchell, 2009) indicate that for example 28,700 tons of cassiterite have been exported from the DRC and Rwanda in 2008, with 87% originating from the DRC.

The conflict dynamics in Eastern DRC are more complex than a simple cause and effect connection between military groups, mineral production and the trade in minerals. Weak institutions and a dysfunctional army enable military groups to pose security problems to mining and trade for their benefit.

7.3 Conclusion

High-commodity value metals such as gold, tin and tantalum, are especially linked to ASM, which significantly adds to their world supply. The artisanal and small-scale mining sector, which provides livelihood for millions of people in the world, is part of the informal and often

illegal trading chain of minerals. In many parts of the Central African Great Lakes region (e.g. DR Congo, Rwanda, Uganda and Burundi) ASM is by far the predominant method of extracting raw materials. Mining in Central Africa has been associated with violent conflict, mistreatment of artisanal miners, illegal trading and the diversion of state funds. Resource-related conflicts are especially relevant for African countries (Bannon & Collier, 2003). Three of the world's worst wars of recent years, related to natural resources took place in Sierra Leone, Liberia and the DRC. The eastern part of the DRC (North and South Kivu) has been suffering from armed conflicts for more than 12 years. In North and South Kivu, armed groups and the Congolese national army control the trade of cassiterite (tin ore), gold, columbite-tantalite (coltan), wolframite (tungsten ore) and other minerals. The warring parties have unrestricted access to these minerals and have been able to establish lucrative trading networks because of a lack of state control and the unregulated nature of the mining sector (Franken et al in press). A differentiation of the production regarding compliance to internationally accepted standards would add value to the ASM production and provide a direct access to the mineral markets in industrial countries. For industrial countries, the access to ASM production without fearing of reputational loss would help to improve the supply security, since the flexibility of the sector with regard to price changes would help to reduce the consumer's need for stock-keeping of minerals. Due to low investment costs ASM has a short lead time for development of production sites. A retreat from the region (or an embargo on central African mineral exports) would deprive the local population of an important economic basis and is therefore classified as non-sustainable (Schütte et al. 2011).

References

Bannon I, Collier P (ed.) (2003) Natural Resources and Violent Conflicts. The World Bank, Washington D. C.

CASM (2009) Community on Small-Scale Mining. Mapping ASM.

http://www.artisanalmining.org/index.cfm?page=page_disp&pid=8238. Accessed 15 December 2009.

Franken, G., Vasters, V., Dorner, U., Melcher, F., Sitnikova, M., Goldmann, S. (in press): Certified Trading Chains in Mineral Production – a Way to Improve Responsibility in Mining, in: Sinding-Larsen, R. & Wellmer, F.-W. (Eds): International Year of Planet Earth: Non-Renewable Resource Issues, Springer.

Garrett N, Mitchell H (2009) Trading Conflict for Development. Utilising the trade in minerals from eastern DR Congo for development. Resource Consulting Service.

<http://www.crisisstates.com/download/others/Trading%20Conflict%20for%20Development.pdf>. Accessed 10 December 2009.

Hentschel, T., Hruschka, F., Priester, M. (2003): Artisanal and Small-Scale Mining – Challenges and Opportunities.- p. 80, International Institute for Environment and Development and WBCSD, Russel Press, UK.

Schütte, P., Franken, G., Gebauer, H. P., Dorner, U. & Hagemann, A. (2011): Rohstoff –Zertifizierung und Sorgfaltspflichten von Unternehmen in den Lieferketten von Konfliktmineralen.- Commodity Top News 38: p. 7, Bundesanstalt für Geowissenschaften und Rohstoffe.

USGS (2010): Mineral Commodity Summaries. U. S. Geological Survey.

<http://minerals.usgs.gov/minerals/pubs/mcs/>.

Wagner M., Franken G., Martin N., Melcher, F., Vasters, J. (2007): Zertifizierte Handelsketten im Bereich mineralischer Rohstoffe: p. 101, Projektstudie. Bundesanstalt für Geowissenschaften und Rohstoffe, Hannover.