The CTC (Certified Trading Chains) Mineral Certification System: A Contribution to Supply Chain Due Diligence and Good Governance in the Mining Sector of Rwanda and the Great Lakes Region in Central Africa

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ABSTRACT

The CTC (Certified Trading Chains) mineral certification system has been piloted in Rwanda since late 2008. CTC project implementation is jointly driven by the Federal Institute for Geosciences and Natural Resources (BGR) and the Rwanda Geology and Mines Authority (OGMR), in cooperation with other national stakeholders. Five Rwandan mineral producers participate in the CTC project with their flagship mining concessions. Based on independent third-party audits, CTC certifies supply chain due diligence measures of these companies engaged in the artisanal mining sector through on-the-ground assessments of mining conditions, transparency, as well as mineral origin and traceability. The CTC system thus allows responsible mineral producers and their clients to verifiably demonstrate supply chain due diligence and good governance in conflict-affected and high-risk areas.

INTRODUCTION

Artisanal and small-scale mining (ASM) activities have long since formed the base for the livelihood of a substantial portion (currently about 50 million people; Hayes [1]) of the African population. However, representing a labor-intensive, low-productivity form of mining in a mostly informal to illegal environment, ASM activities are often associated with significant adverse social and environmental impacts and generate a relatively low contribution to national revenues, if at all.

In addition, multiple reports of a United Nations (UN) Panel of Experts (e.g., [2]) noted that the artisanal exploitation of natural resources in the eastern provinces of the Democratic Republic of the Congo (DRC) was intimately associated with regional-scale conflict dynamics in central Africa, coining the term “conflict minerals” for artisanal mining production of tin ore (cassiterite), tantalum ore (tantalite; “coltan” when in association with niobium ore), and tungsten ore (wolframite and other minerals), as well as gold originating from parts of the Great Lakes Region (Fig. 1). As such, adverse social impacts of ASM, for which little livelihood alternatives exist in eastern DRC, are further aggravated through conflict impacts, although the militarization of mineral production and trade might generally be regarded as a symptom (rather than the source) of the prevailing security crisis and weak state control in eastern DRC [3]. In this context, mineral supply/trading chain stakeholders producing in and/or sourcing from a conflict-affected or high-risk area such as the Great Lakes Region might consider disengaging completely from that area as a means of supply risk management. At the same time, however, this step would deprive the local population of a significant portion of their livelihood base thus further aggravating prevailing social problems. Therefore, disengagement is not a sustainable solution for the conflict mineral scenario.

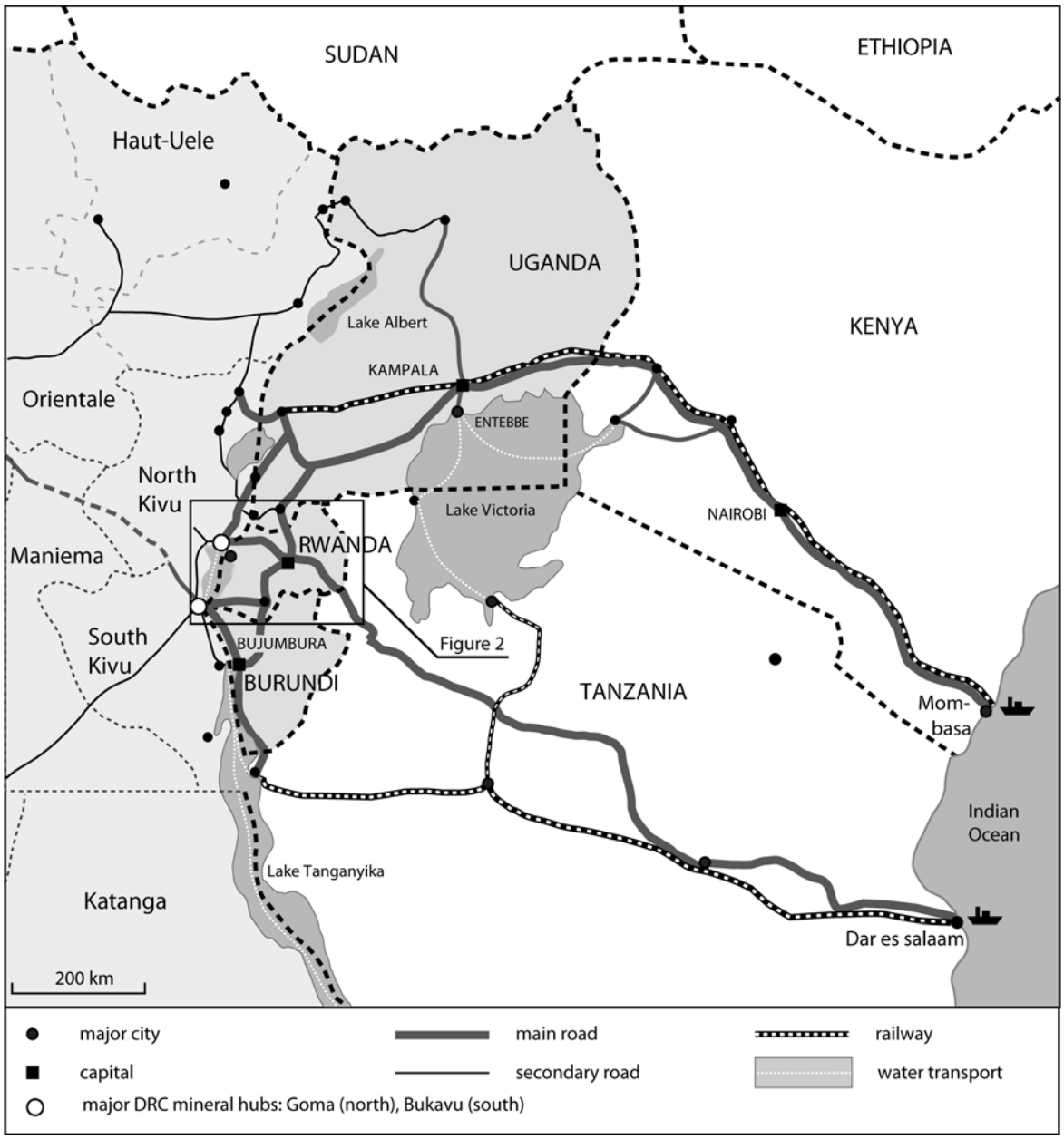

Figure 1: Map of the Great Lakes Region displaying major infrastructure units in eastern Central Africa. Minerals produced in eastern DRC are aggregated at major mineral hubs and subsequently transported to Mombasa and Dar-es-salaam. Upon their passage through the eastern DRC neighbor states, these minerals may lose their indication as "DRC origin" due to variable out-country processing and mixing with foreign mineral production. Map adapted from International Alert [16]

If managed responsibly, on the other hand, ASM may have the potential to sustain livelihoods, alleviate poverty, and increase state income while minimizing adverse social, socio-economic, and environmental impacts. Acknowledging this potential of the ASM sector, and aligned with the concepts elaborated at a G8 Summit in Heiligendamm, Germany [4], the German Federal Institute for Geosciences and Natural Resources (BGR) developed a mineral certification system termed CTC (Certified Trading Chains) specifically tailored to the ASM sector (although its applicability is not restricted to the latter) [5].

The principal objective of CTC mineral certification is to contribute to supply chain due diligence and good governance in the ASM sector by implementing and enforcing due diligence (mineral

origin and traceability, transparency, security) and ethical (social, socio-economic, environmental) standards in mineral production and trade. CTC follows a bottom-up approach starting at individual artisanal mining operations, subsequently including local- to regional-scale mineral concentrate traders and processors. Demonstrating responsible supply chain management through CTC allows mineral producers and their downstream clients along a given mineral trading chain to continue producing in and/or sourcing from conflict-affected or high-risk areas, rather than disengaging.

The CTC approach has been piloted in the Republic of Rwanda (since early 2009) and in the South Kivu Province of eastern DRC (since late 2009), with a view to wider dissemination in the Great Lakes Region of Central Africa. Geared towards long-term sustainability at the national to regional level, the CTC approach combines mineral certification with capacity building components for government sector institutions, as well as consulting for mining companies in close cooperation with company management. In this contribution, we describe the background of the Rwandan mining sector and outline design and implementation steps of the CTC pilot project Rwanda. We further discuss recent developments in supply chain due diligence concepts by local, regional, and international stakeholders and their potential impact on the on-going adaption of the CTC system.

THE RWANDAN MINING SECTOR AND CTC

Mining Sector Evolution and Governance Scheme

Rwanda's main mineral production comprises cassiterite, coltan, and wolframite (and other associated tungsten ores). Significant exploration for gold takes place and considerable gold mineralization is known from all of Rwanda's neighboring countries (DRC, Uganda, Tanzania, and Burundi); however, only minor quantities of gold are produced in Rwanda at the present day. A new mining law, established in 2008, emphasizes the importance of exploration activities to further develop the Rwandan mining sector [6].

Since the 1930s, private companies produced significant amounts of cassiterite and wolframite in Rwanda, peaking at annual production rates of 2239 t and 836 t, respectively, in 1977 [6]. Production was largely by semi-industrial means with little consideration of environmental management, resulting in significant historic liabilities (e.g., waste dumps). Stepwise nationalization of the mining sector since 1973 was partly associated with mismanagement and, ultimately, resulted in the collapse of most of the Rwandan mining sector during the 1980s to early 1990s. A partial recovery of the mining sector in the early 2000s and a (re-)privatization process initiated by the Rwandan government triggered significant foreign mining investments in the 2006-2009 period.

Small private mining companies, representing formal concession license holders, typically rely on a mixture of ASM and semi-industrial mining methods; semi-industrial methods (supported by artisanal miners) are applied where feasible, and sub-economic ore bodies are additionally targeted by manual artisanal methods. A total of ca. 35,000 artisanal miners (for all commodities) are employed in the Rwandan mining sector; the number of artisanal miners involved in cassiterite, coltan, and wolframite mining is somewhat lower. Artisanal mining is tolerated and supported by most mining companies provided (1) the miners sell the mineral concentrates they produce on their concessions to the mining company, rather than to external traders who may offer better prices (as they do not have any production overhead costs); and (2) ASM activities at a given mine represent long-standing occupations of local communities without significant short-term, mining-related migration and social conflicts. In case of the absence of mining companies, ASM may be organized in cooperative units that may act in a similar fashion as the companies.

The well-balanced Rwandan ASM governance scheme significantly differs from the situation in eastern DRC where formal mining concession license holders (companies) rarely have direct access

to their concessions, and ASM activities on these concessions are considered as illegal. Supporting artisanal miners through progressive semi-formalization, mine infrastructure development, production services, and logistic means allows mining companies to significantly boost ASM productivity in Rwanda, generating increased income for both artisanal miners and the state. Mining companies represent ideal partners for CTC mineral certification, since (1) CTC standards (see below), providing due diligence and good governance frameworks tailored to the realities of the ASM sector, may be considered by company management to guide their CSR and due diligence efforts; and (2) company management is highly efficient in enforcing these standards through company policies and procedures. As such, the governance scheme of the Rwandan ASM sector may have a region-wide model character for ASM formalization, mineral certification, and beyond.

Mining at CTC Concessions in Rwanda

Five Rwandan mineral producers volunteered to participate in the CTC project at seven mining concessions (Table 1; Fig. 2). At these concessions, the companies produced 493 t cassiterite (Rutongo: 225 t; Gatumba: 50 t; Rutsiro & Nemba: 218 t), 39 t coltan (Gatumba: 28 t; Rutsiro: 11 t), and 349 t wolframite (Gifurwe: 144 t; Nyakabingo: 172 t; Rutsiro: 33 t) concentrate in 2009. Total Rwandan exports are 4269 t cassiterite (+ 1346 t re-exports), 950 t coltan (+ 24 t re-exports), and 874 t wolframite (+ 189 t re-exports) concentrate for the same period (Rwanda Ministry of Trade and Industry, pers. comm., 2010).

Concession	Company	Monthly production (2009-2010)	Type of operation	Artisanal Miners	CTC audit
Rutongo	Rutongo Mines Ltd.	Up to 80 t cassiterite	Underground	~2,100	10/2010
Nyakabingo	Eurotrade International Ltd.	Up to 40 t wolframite	Underground	Several 100	08/2009 (baseline)
Gifurwe	Wolfram Mining & Processing Ltd.	~10 t wolframite	Open pit	~500 (+casual workers)	03/2010 (baseline); 11/2010
Gatumba	Gatumba Mining Concession Ltd.	~10 t cassiterite, 1-3 t coltan	Open pit (mostly), few shafts	>600	08/2009 (baseline); 11/2010
Nemba	Natural Resources Development Ltd.	~8-14 t cassiterite	Open pit	700-1500	08/2009 (baseline); 12/2010
Rutsiro	Natural Resources Development Ltd.	~3-5 t cassiterite, 1-3 t wolframite, <1 t coltan	Open pit (mostly), few shafts	~900	08/2009 (baseline); 12/2010
Cyubi	Pyramides S.a.r.l.	Capacity up to 8 t coltan; no production yet	Open pit	None	11/2010 (baseline)

Table 1: Rwandan mining sites participating in CTC

If Rwandan export figures were taken as a proxy for Rwandan mineral production, the relative share of Rwandan minerals produced at CTC concessions in 2009 would amount to ca. 12% (cassiterite), 4% (coltan), and 40% (wolframite). However, as noted, for example, by Global Witness [7],

mineral concentrates processed in and subsequently exported by Rwandan-based mineral traders may be declared as "Rwandan origin" in case an additional value of at least 30% has been created by in-country upgrading of the original mineral concentrate, even though the minerals might have been mined outside the country. Therefore, Rwandan mineral export figures do not necessarily correspond to original Rwandan mine production figures. Based on our field observations and discussions with various project partners and stakeholders in Rwanda, we suggest that the amount of mineral concentrate produced at the above-noted mining concessions participating in CTC represents a more significant share of original Rwandan mine production than inferred by simple comparison to Rwandan export figures (although there is still significant original Rwandan mine production outside of CTC concessions).

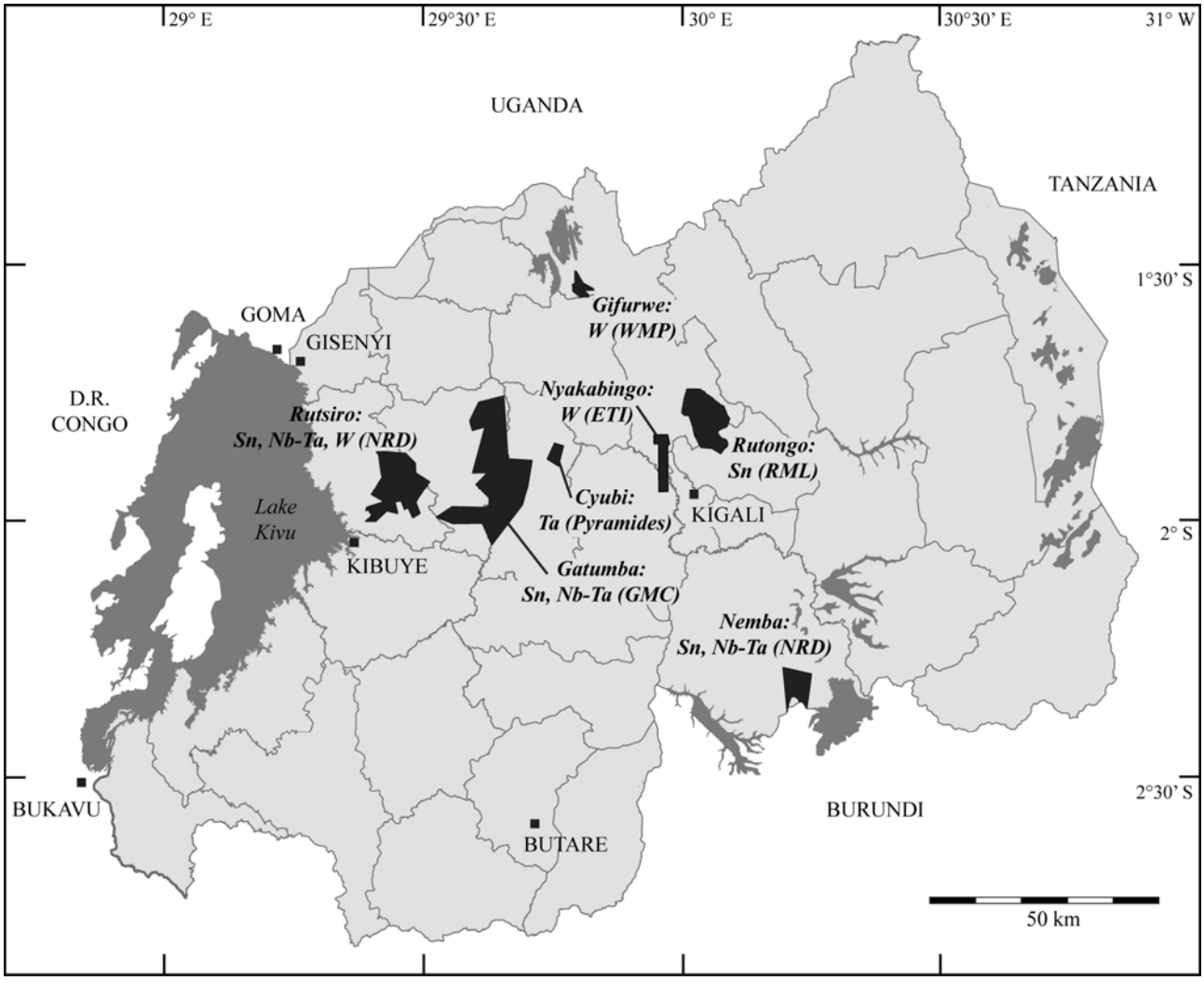

Figure 2: Map of Rwanda; CTC mining concessions are marked in black

Mining operations at concessions participating in CTC typically comprise a mixture of artisanal and semi-industrial methods. Some exemplary features of artisanal and semi-industrial ore extraction and processing techniques at these concessions are illustrated in Figure 3. Artisanal mining activities are typically spread over large concession areas, with individual mineralized zones mined by dedicated groups of artisanal miners with group sizes ranging from <10 to 200 members, organized by a "sub-contractor". Tin, tungsten, and tantalum mineralization may either be in-situ (hard rock) or of alluvial/eluvial nature (poorly consolidated material). Alluvial and eluvial deposits are mostly mined by ground sluicing methods. In-situ mineralization is mined by a combination of manual techniques (artisanal miners using hammers, chisels, and pick axes), with technical support

equipment (jack hammers), and through drilling and blasting operations. The latter procedure is usually carried out by qualified mining company staff where artisanal miners may subsequently clear and extract blasted rock material. Crushing of hard rock material is done manually (by artisanal miners and casual workers) or via jaw crushers (as part of a processing plant). In case of semi-industrial open pit operations, ore extraction may also be by means of (crawler) dozers and excavators.

Figure 3: Artisanal mining practice in Rwanda. A – Semi-industrial open pit; B – ground sluicing; C – manual mining of high-grade zone (followed by ground sluicing); D – clearing of blasted material from underground operation; E – mineral concentrate drying; F – mineral concentrate upgrading

Multi-stage mineral concentrate processing comprises ground sluicing, hand cobbing/picking, and panning to obtain mineral pre-concentrates. Higher-grade mineral concentrates of export quality are subsequently obtained at variably equipped mechanized processing and beneficiation plants, located either in close proximity to the mine site or at more distant processing and aggregation locations. Processing plants typically include gravity jigs, shaking tables, and, occasionally, magnetic

separators. Small on-site laboratories exist at some locations to allow basic grade control of mineral concentrates; hand-held XRF scanners are also partly in use. In 2009 and 2010, in-country smelting of cassiterite concentrate produced at CTC concessions did not take place, although this is a likely near-future option for some larger operations. Chemical processing of wolframite and coltan concentrates does not take place in Rwanda.

Mineral trading chains associated with CTC concessions in Rwanda

A typical Rwandan mineral trading chain is illustrated in Figure 4. Small amounts of mineral pre-concentrates produced by artisanal miners at CTC concessions are regularly (e.g., daily) or sporadically collected at locked and/or guarded, site-specific or central storage locations. Regular (monthly to daily, depending on the size of the operation) pre-concentrate upgrading takes place, usually performed by or under the supervision of a mining company. Artisanal miners are paid according to produced concentrate quantities and quality on a regular base. Upgraded concentrate material is aggregated by the company and typically transported in 50 kg sacks; transport lots weigh up to ~10 t (corresponding to a truck load). Since September 2010, OGMR has started to organize sack tagging (i.e., sealing combined with a sack-specific serial number as identifier) at several mining concessions as part of ITRI's tin supply chain initiative ("iTSCi" [8]); OGMR plans to cover the majority of Rwandan mineral production with the tagging scheme until April 2011.

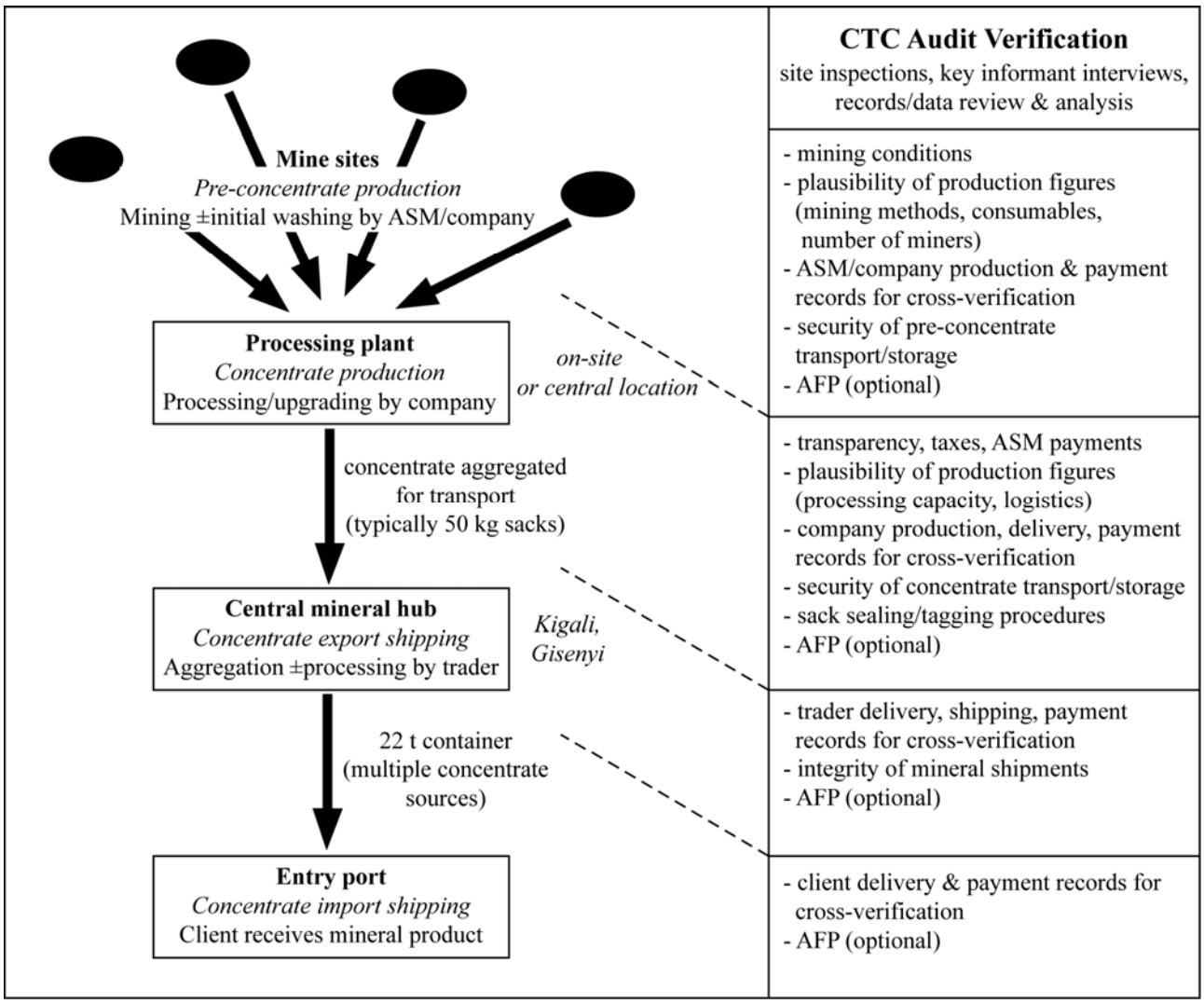

Figure 4: Typical mineral trading chain in Rwanda, and associated CTC audit activities

Mineral traders, located in Rwandan mineral hubs such as Kigali and Gisenyi, receive the concentrate material and handle subsequent export logistics and documentation. These mineral traders do not always act as buyers of mineral concentrates, but may instead assume a role as logistic partners of the original mineral producers and third party buyers. Mineral traders may either conduct grade analysis of mineral concentrates themselves, or outsource analyses to third party chemical laboratories; the latter may also be used by mineral producers for grade cross-verification. Mineral concentrate export is by means of standard 22 t containers trucked to the sea ports of Mombasa, Kenya, and Dar-es-Salaam, Tanzania (Fig. 1). Container loads may integrate concentrate material from multiple sources.

Overall, mineral trading chains in Rwanda are substantially less complex than in eastern DRC, where typical basic transport units are 25 kg sacks which may pass through the hands of multiple traders until they reach trading center ("comptoir") level (e.g., [8]). All of the above steps of mineral production, processing, and trade define the upstream section of a complete trading chain. Subsequently, a downstream section comprises extractive metallurgical processing of minerals to produce metals, which may then be used in the manufacturing of, for example, electronic components and, eventually, end user products (e.g., cell phones). It is important to differentiate these trading chain sections when evaluating end user demands on supply chain due diligence (see below). CTC mineral certification exclusively applies to the upstream section of a given trading chain and, thus, needs to be supplemented by further downstream due diligence mechanisms to cover the whole trading chain from the mine site to the final end user product.

CTC IMPLEMENTATION IN RWANDA

CTC Standards

Key element of the CTC system is a set of certification standards organized in five CTC principles (Table 2). While CTC principles are considered as universal, individual CTC standards are adjustable to the national context. The standards were developed based on a number of international "integrity instruments" as well as on-the-ground assessments of their practical applicability in Rwanda's ASM sector. The standard set focuses on supply chain due diligence elements including mineral origin, mineral traceability, and transparency, as well as the conditions of mining with respect to human rights in general, workers' rights, and minimum corporate social responsibility norms acceptable in the ASM sector.

In detail, each CTC standard derives from specific provisions of the Organization for Economic Cooperation and Development, OECD [9, 10, 11] as well as some of the International Finance Corporation's Performance Standards and the Voluntary Principles on Security and Human Rights; individual standards may be subject to further revision to reflect on-going political and economical developments. Following consultation of the draft standards at the 8th annual conference of the World Bank's Communities and Small-Scale Mining (CASM) initiative in Brasilia, Brazil, October 2008, five basic, universal principles were established, each referring to a thematic cluster of standards. Further consultation with civil society on the CTC standard set included a workshop held at the "Digging for Peace - Private Companies and Emerging Economies in Zones of Conflict" conference, Bonn, Germany, November 2008, and further discussion at the 9th annual CASM conference in Maputo, Mozambique, September 2009 (Table 3).

Twenty certification standards and associated level descriptors (five descriptors per standard) have been drafted for CTC implementation in Rwanda, based on the above consultations and additional consideration of (1) national law; (2) the outcomes of a consultation workshop with national stakeholders in Kigali, March 2009; and (3) CTC baseline audit findings in the period August 2009 to March 2010. CTC standards are envisaged to be formally transferred into certification standards

according to Rwandan regulations by consultations of the Rwandan Bureau of Standards (RBS) in the frame of a national certification workgroup (see below).

CTC Principle	CTC Standard Rwanda
1. Origin and volumes of produced goods as well as company payments to host government are transparent	1.1 Origin and production volume of minerals from the mine site throughout the trading chain are traceable
	1.2 Meet fiscal obligations required by host government law
	1.3 Publish all payments made to government according to internationally accepted standards
	1.4 Actively oppose bribery and fraudulent payments
2. The company does not use child labor and ensures fair remuneration and work conditions as well as continual improvement of health and safety measures for all employees	2.1 Pricing and distribution systems for artisanal miners and sub-contractors, as well as salary levels for employees are fair, legal, and regulated
	2.2 Ensure that no child laborers (age under 16) work on company sites
	2.3 Support workers' organizations and collective bargaining
	2.4 Provide essential protective safety equipment to workers and production services to support the work of artisanal miners
	2.5 Ensure occupational health in all company operations as well as insurance for workers
	2.6 Provide training for workers on safety, health and effective use of on-site facilities
3. The company ensures security on company sites whilst respecting human rights	3.1 Provide sufficient and adequately trained security forces
	3.2 Undertake security risk assessments
4. The company consults communities in which it operates and contributes to their social, economic and institutional development taking into account genders	4.1 Interact regularly with communities and local governments to address grievances and other common concerns
	4.2 Support local enterprises to supply company operations
	4.3 Support integrated development programs in nearby communities for livelihood security, social and physical infrastructure, and capacity building
	4.4 Obtain free, prior and informed consent before acquiring land or property
	4.5 Understand the situation and perspectives of women in the company's area of influence, and design and implement company operations in a gender-sensitive way
5. The company seeks continual improvement of its environmental performance	5.1 Carry out an environment impact assessment as the basis for developing an environmental management and protection plan and strategy
	5.2 Properly treat or dispose of hazardous material and waste from its site(s)
	5.3 Provide a plan for mine closure and make provision for the full costs of rehabilitation upon closure

Table 2: CTC Rwanda principles and standards (August 2010 revision)

CTC standards refer to the areas of mineral origin and traceability, supply chain structure and transparency (including mineral flow and associated financial movements as well as taxes), artisanal working conditions (e.g., child labor, occupational health and safety), security forces (their presence and respect of human rights; risk assessments), community development (e.g., gender

sensitivity), and environment (e.g., impact assessments; Table 2). While doing so, the CTC scheme aims for a balanced approach of assessing essential supply chain due diligence elements relevant for the central African ASM sector, while avoiding unwarranted and potentially cumbersome complexity.

Governance Scheme and Project Progress

Based on a number of general concept studies, the CTC pilot project in Rwanda has been jointly implemented by the Rwanda Geology and Mines Authority (OGMR) and BGR since late 2008. The project is co-funded by the German Federal Ministries of Economic Cooperation and Development (BMZ) and Economics and Development (BMWi), respectively. A number of milestones define CTC project progress in the 2007-2011 period (Table 3).

The envisaged principal CTC governance scheme is illustrated in Figure 5. A national certification unit is responsible to accept certification requests on behalf of responsible mineral producers or their clients. The certification unit may then accredit and commission an independent auditor to perform a CTC audit of a specific mineral producer and the associated mineral trading chain according to the CTC standard set. Audit costs are envisaged to be covered by the audit client; during the pilot phase, audit costs are covered through project funding. In case warranted by the audit results, the certification unit may subsequently issue a certificate for the mineral producer and trading chain in question. The certification unit should also be responsible to establish a regular CTC standard review procedure. Transparency and integrity control of the certification system is provided through oversight by a multi-stakeholder certification workgroup which acts as a national discussion forum for CTC mineral certification in Rwanda (Fig. 5).

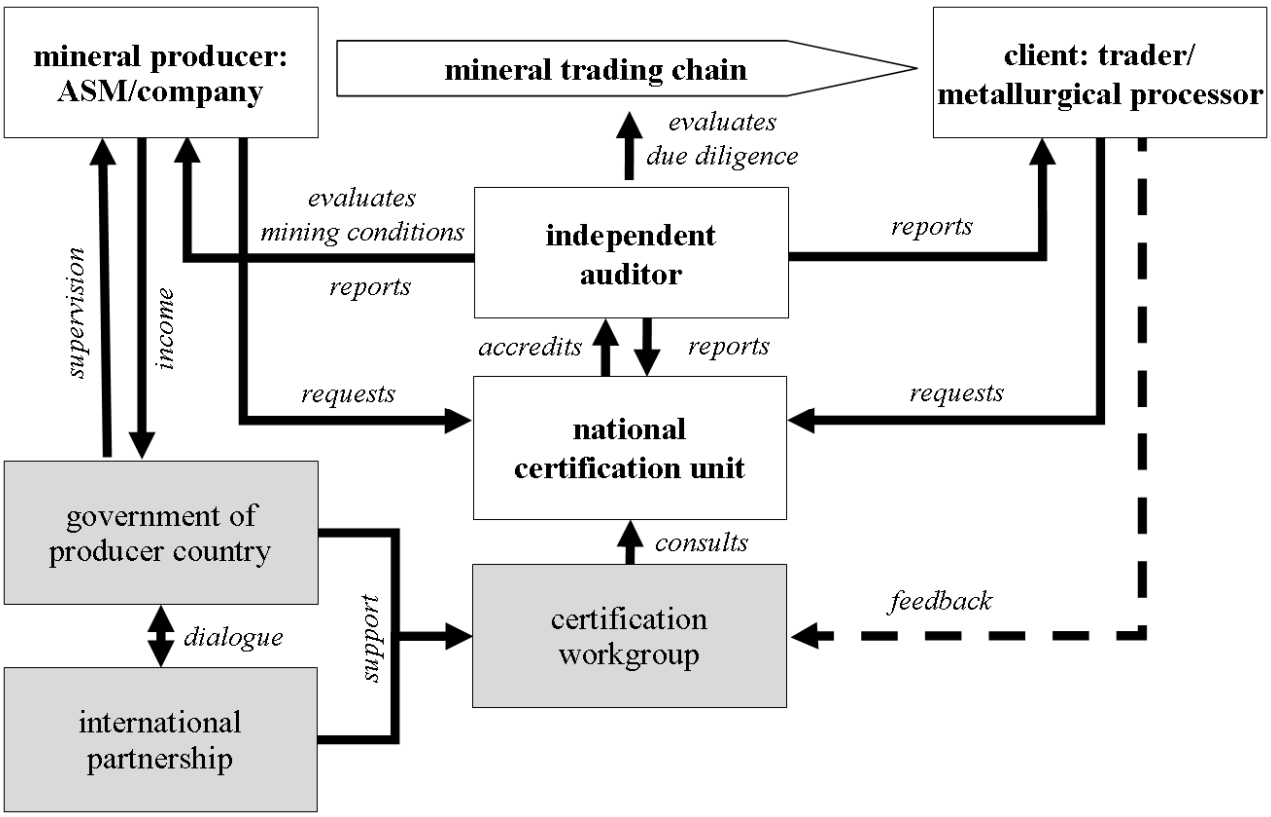

Figure 5: The CTC governance model to be established in Rwanda

Date	Milestone event
04/2007	BGR project study on the CTC concept in preparation for the upcoming G8 Summit in Heiligendamm, Germany
06/2007	At the G8 summit in Heiligendamm, the G8 endorse Germany's initiative to carry out a pilot project on mineral certification in Rwanda
01/2008	On-the-ground development of a first draft set of CTC standards for artisanal mineral producers in Rwanda
09/2008	Partnership OGMR-BGR on the "Pilot project on mineral certification in Rwanda – Certified trading chains (CTC)"
10/2008	Multi-stakeholder consultations of CTC standards at the 8th CASM conference in Brasilia, Brazil; standard consolidation into five principles
11/2008	Multi-stakeholder consultations of the CTC concept at the "Digging for Peace - Private Companies and Emerging Economies in Zones of Conflict" conference, Bonn, Germany Compilation of revised first-draft CTC standards
03/2009	Kick-off and planning workshop "Mineral certification in Rwanda" with national stakeholders in Kigali; further adaption of CTC standards to Rwandan law and mining environment
04/2009	Introduction of CTC concepts at an ICGLR conference, Bujumbura
05/2009	Three mining companies (NRD, ETI, GMC) in Rwanda join the pilot project
08-09/2009	Baseline audits of three pilot companies (NRD, ETI/RML, GMC) in Rwanda by independent auditor; two further companies (WMP, Pyramides) apply for participation
09/2009	Discussion of the CTC concept at the 9th annual CASM conference, Maputo
03/2010	Baseline audit of a fourth pilot company (WMP) in Rwanda by independent auditor
04/2010	Presentation of CTC concepts at an ICGLR conference, Bujumbura Input of experience from the CTC pilot project Rwanda to the OECD workgroup on responsible supply chain management
05-06/2010	Consulting for CTC pilot companies in Rwanda to support company management in implementing gender, anti-corruption, and occupational health and safety policies and procedures
06-07/2010	Consulting for CTC pilot companies in Rwanda to support company management in implementing record keeping systems with respect to mineral trading chain traceability
08/2010	Consulting for CTC pilot companies in Rwanda to support company management in implementing environment-related reporting (environmental impact declaration) Formalization of consultations, through a joint MoU, of OGMR, RBS, and BGR with respect to the implementation of the CTC system at the national institutional level in Rwanda. Constitution of a national mineral certification workgroup comprising the above members as well as the Rwandan ministries of Trade and Industry (MINICOM) as well as Forestry and Mines (MINIFOM) Revision of CTC standards and level descriptors based on practical baseline audit feedback
10/2010 to 01/2011	Second audit phase of four CTC pilot companies (WMP, RML, NRD, GMC); baseline audit of an additional company (Pyramides) by independent auditor
03/2011	Mineral certification conference in Kigali co-organized by OGMR, ICGLR, and BGR

Table 3: CTC Rwanda project milestones

While in pilot project stage, a number of constraints apply with respect to the certification scheme sketched above, as the dedicated certification unit has not been established yet. In the mid-term, the certification unit is envisaged to be hosted at RBS. Until then, BGR and OGMR have temporarily taken part of its responsibilities by accrediting independent third party auditors and organizing audits at Rwandan mineral producers participating in CTC. The national certification workgroup has been founded in August 2010. Workgroup members comprise OGMR, RBS, BGR, and the Rwandan Ministries of Trade and Industry (MINICOM) as well as Forestry and Mines (MINIFOM); a workgroup extension to industry and civil society representatives is currently under discussion.

The International Conference on the Great Lakes Region (ICGLR) represents a regional political platform counting among its members Rwanda and the DRC. In 2006, several ICGLR member states (including Rwanda) signed the Protocol Against the Illegal Exploitation of Natural Resources [12]. Since then, ICGLR has elaborated a scheme termed Regional Initiative Against the Illegal Exploitation of Natural Resources (RINR). Amongst others, the RINR scheme refers to mineral certification as one of the tools to counter the illegal exploitation of conflict minerals. ICGLR member state representatives recently reaffirmed their commitment to the above protocol and the RINR scheme at a heads of state summit in Lusaka, Zambia, December 2010. Implementation of a mineral certification scheme at the member state level, on the background of a framework provided by ICGLR, falls under the responsibility of individual national governments. Implementing the CTC scheme in Rwanda is regarded as the Rwandan contribution to the regional ICGLR scheme, and further adaption to align CTC Rwanda with the ICGLR initiative is envisaged.

CTC Audits

Independent third-party audits represent the core of the CTC system. Auditor accreditation and terms of reference compilation in the frame of the CTC pilot project Rwanda was handled by BGR and consulted with OGMR, as a substitute for the certification unit yet to form. CTC audits represent on-the-ground assessments of supply chain due diligence with respect to the CTC standard set, both at mine sites and along the associated trading chains (Fig. 4). To ensure transparency and credibility of the auditing process, audits are typically accompanied by a team of observers made up of representatives of the certification workgroup in Rwanda. All audit findings are compiled in a comprehensive audit report available to all members of the certification workgroup in Rwanda, as well as to the respective mining company audited and, potentially, its clients.

Based on defined CTC standard level descriptors, the auditor evaluates the mining conditions at ASM production sites with respect to the CTC standard set (Table 2). Audit methodology includes site inspections, key informant interviews, and document review and analysis, aligned with auditing guidelines as defined in ISO 19011:2002. In addition, mineral origin and traceability throughout the upstream trading chain are assessed through a combination of the following elements (Fig. 4):

(1) An analysis of the plausibility of production figures for a given mine, based on a review of mining methods, the number of (artisanal) miners, mineral processing capacity, and consumables usage – using these input data, the auditor may evaluate if a specific production volume reported by the audited mining company (such as reports submitted to national ministries) is plausible. In this context, the auditor cross-references documentary evidence, e.g., by comparing the listed numbers of miners, payments made to miners, and insurance cover records of miners; documentary evidence is further verified by site inspections. Potential production anomalies, e.g., by “laundering” conflict minerals of illegitimate origin through a CTC concession, would thus be detected.

(2) The auditor cross-verifies and balances production, processing, and shipping records, including ASM production records, company production, processing, and transport records, as well as other transport and trade records of mineral pre-concentrates and concentrates of variable grades.

(3) The auditor evaluates security measures in place to ensure the integrity of mineral (pre-) concentrate shipments. This may include the presence of company security during mineral (pre-) concentrate storage and transport, as well as sealing or tagging of individual mineral concentrate sacks or whole transport lots. Combined with the previous point, audit findings in this regard represent an indication of a company's due diligence practice with respect to mineral origin and traceability.

(4) The Analytical Fingerprint (AFP) technique, developed at BGR since 2006, represents a combination of analytical methods (e.g., [12]) to independently verify source-specific geochemical and mineralogical features of mineral (pre-) concentrates (coltan, cassiterite, and wolframite). Using the AFP technique, a mineral (pre-) concentrate sample obtained from a given mining concession (or the associated trading chain) may be compared to and matched with the composition of a number of reference samples stored in an AFP reference database (similar to a paternity test). Supported by Rwandan mineral producers and OGMR, this reference database has progressively been extended by BGR over the last four years (2006-2010), such that the majority of Rwandan mining concessions participating in CTC is now included. Given the completely independent line of evidence generated via the AFP technique, application of the latter may substantially boost the credibility of company claims with respect to the legitimate origin of the minerals a company produces at a given mining site.

In the frame of the CTC pilot project in Rwanda, two different types of audits were conducted at the mining concessions listed in Table 1. An initial baseline audit assessed the status quo of mining conditions and supply chain due diligence with a focus on identifying areas where improvement potential exists; these baseline audits are not considered as full CTC audits according to the above definitions. Baseline audits were carried out in late 2009, early 2010, and late 2010 at six Rwandan mining concessions. Key areas with potential for improvement of mining and due diligence practice identified through baseline auditing comprise occupational health and safety, anti-corruption guidelines, gender sensitivity, records keeping systems, and environmental impact declarations. As a follow-up to the baseline audits, the CTC project funded a number of consulting interventions in these key areas. The interventions took place throughout 2010 and comprised on-the-ground consulting, workshops for company staff and artisanal miners, and the submission of dedicated manuals and draft policies to support company management.

A second audit phase included four Rwandan mining concessions audited in the October to December 2010 period. In the second audit phase, full CTC audits according to the above definitions were generated. These audit reports were presented to the national certification workgroup in Rwanda in January 2011, and may be considered for the decision on issuing a certificate for certain Rwandan mineral producers. To this end, a compliance mechanism, defining the minimum acceptable mining company performance with respect to supply chain due diligence and mining conditions, will have to be established as a next step of project development.

SUPPLY CHAIN DUE DILIGENCE REQUIREMENTS FOR CONFLICT MINERALS

Multi-national organizations such as the UN (e.g., [2]) and OECD (Organization for Economic Cooperation and Development [11]) as well as multiple civil society representatives, in particular non-government organizations (e.g., Enough – Prendergast and Lezhnev [14], Global Witness [15], International Alert [16]), have repeatedly emphasized the need for supply chain due diligence in conflict-affected and high risk areas such as DRC and Rwanda. Should a company partly source conflict minerals and their derivatives from this region (and in case the latter are necessary for the functionality of a given product), the Dodd-Frank Act of the US Securities and Exchange Commission (SEC) [17], signed into law in 2010, obligates SEC-listed companies and, indirectly, their suppliers to report on their supply chain due diligence procedures and risk assessments. In case

a company demonstrates that conflict minerals associated with the supply chain of its products did not directly or indirectly finance or benefit armed groups, the product may be labeled as "DRC conflict-free"; the report has to be verified by an independent third-party auditor.

"Due diligence" in the above sense goes beyond mere mineral traceability (e.g., by means of tagging) as far as conflict-affected and high-risk areas are concerned. As specifically noted by the UN Group of Experts [2], the conditions prevailing at mineral production sites as well as processes associated with the transportation and trade of conflict minerals need to be evaluated by on-the-ground assessments in these areas. Through its independent auditing and reporting system, the CTC mineral certification scheme may represent a credible mechanism for mineral producers to demonstrate due diligence in this regard. Ideally, a bottom-up approach such as CTC may integrate diverse mineral traceability tools and additionally consider further OECD requirements to maximize stakeholder acceptance with respect to the demonstration of supply chain due diligence measures and, at the same time, streamline due diligence reporting requirements for responsible mineral producers.

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