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Bill McKay, Ian Lambert and Norman Miskelly

Submitted for publication in The AusIMM Bulletin

Contact:

Dr Bill McKay, FAusIMM CPGeo
Mineral Resources & Advice
Tel.: +61-2-6249 9003
Fax: +61-2-6249 9983
E-mail: bill.mckay@agso.gov.au
Postal: GPO Box 378, Canberra, ACT 2601
AGSO – Geoscience Australia
ABN: 80 091 799 039

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Bill McKay and Ian Lambert[1]

Norman Miskelly[2]

[1] AGSO – Geoscience Australia, GPO Box 378, Canberra ACT 2601, Australia

[2] Australasian Joint Ore Reserves Committee (*JORC)* and Chair, Council of Mining and Metallurgical Institutions (CMMI), Mineral Reserves International Reporting Committee, 2 Pembroke Avenue, Turramurra NSW 2074, Australia

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Bill McKay and Ian Lambert, AGSO – Geoscience Australia

Norman Miskelly, JORC and CMMI Mineral Reserves International Reporting Committee

Many different resource and reserve classification and reporting schemes have been in use around the world for mineral (including fuel) commodities. Interest in harmonisation of classification has grown with the "emergence" of former Eastern Bloc countries. Furthermore, the need for rigorous reporting of resources for commercial purposes became generally accepted in the aftermath of the BreX scam in Indonesia in 1997.

As a major mining nation, Australia has played a leadership role in achieving significant advances in the establishment of national and international standards for commercial reporting of mineral resources and reserves. Australia's industry reporting scheme has evolved from the McKelvey system (USBM/USGS, 1980). Resource estimation for the national inventory takes a broader and longer-term strategic perspective, but it is also based on the McKelvey system and it draws heavily on company reporting of reserves and resources.

Independently, a Task Force of the United Nations Economic Commission for Europe (UN-ECE) has been promoting international use of the UN Framework Classification (UNFC) scheme, which it designed with a view to bringing closer together all existing classification systems.

The UN-ECE convened a meeting on Harmonisation of Terminology for Fuel Resources in Geneva, 13th and 14th June 2001. The objective was to advance the harmonising of definitions for coal, uranium, oil and gas resources with other mineral commodities.

This paper outlines industry reporting of resources in Australia and western mining nations, national-scale reporting by government, the UNFC, and agreement on definitions of common terms. It then summarises the outcomes of the Geneva meeting and their implications for Australia.

Industry reporting in Australia and western mining nations

The Australasian Code for Reporting Mineral Resources and Ore Reserves is used for industry reporting of individual deposits in Australia. Known as the JORC Code, it was developed by a joint committee of the Australasian Institute for Mining and Metallurgy, the Australian Institute of Geoscientists and the Minerals Council of Australia (JORC, 1999). The JORC Code is incorporated in the listing rules of the Australian Stock Exchange. There is no equivalent to the JORC Code for reporting resources from individual petroleum fields in Australia.

The JORC Code is well accepted internationally and is used as an internal and external reporting standard by major international mining companies. Indeed, the JORC Code was the basis for agreement by Australia, Canada, South Africa, United Kingdom and United States, through the Council of Mining and Metallurgical Institutions (CMMI), to implement international standard definitions for mineral resources and mineral (ore) reserves in 1999. These countries have published revised standards, with the United Kingdom linking with the European Federation of Geologists and the Institute of Geologists of Ireland to produce a reporting code for Europe. These more recent codes have some valuable additions, which will be taken into account in the next revision of the JORC Code.

Australia's national inventory

As Australia's national geoscientific agency, AGSO – Geoscience Australia (Geoscience Australia formerly the Australian Geological Survey Organisation) is responsible for compiling data on the nation's mineral and petroleum resources. Geoscience Australia reports estimates of Australia's identified resources of all major and several minor mineral commodities on an annual basis (eg. AGSO, 2000a). It also reports national petroleum resources on an annual basis (eg. AGSO, 2000b).

The JORC/CMMI classification systems provide the basis for Australia's national resources reporting. Geoscience Australia collates and analyses information from reports by companies to the Australian Stock Exchange. It seeks clarification or additional information from companies as required, including through site visits.

The national mineral resource classification and reporting system reflects both the geological certainty of existence of the resource and the economic feasibility of its extraction (Figure 1). The classification category, 'economic demonstrated resources' (EDR), is used instead of 'reserves' for the national inventory because the term 'ore (mineral) reserve' has specific meanings for individual mineral deposits under the criteria of the JORC Code. EDR includes what is considered to be currently commercial (from companies' reported ore reserves) plus proportions of reported mineral resources that are considered by Geoscience Australia's commodity experts to be economic in the longer term. EDR provide a basis for meaningful international comparisons with the economic resources of other nations, in particular those reported by the United States Geological Survey in their annual "Mineral Commodity Summaries" publication.

Increasingly, environmental, social and political considerations are limiting where mining will be conducted and what types of deposits will be mined (eg. Lambert, 2001). These factors have to be considered alongside economic factors in evaluating whether mining of a particular deposit is feasible. In the JORC Code this is taken into account in the requirements for ore reserves, which include consideration of modifying factors, including those of "an environmental, social or governmental nature". In the national accounting scheme, mineral resources which are not available for development at the time of classification because of "modifying factors" have been classified without regard to such factors. However, the amount or proportion of resources thus affected is, wherever possible, stated for each classification category. For example, in 2000, the position in regard to mineral sands was reported by AGSO (2000a) as follows:

> *Some 17%, 23% and 28% of Australia's EDR of ilmenite, rutile and zircon respectively, are unavailable for mining. Areas quarantined from mining and now largely incorporated into national parks include: Moreton, Bribie and Fraser Islands; Cooloola sand mass north of Noosa; Byfield sand mass and Shoalwater Bay area in Queensland; and Yuraygir, Bundjalung, Hat Head and Myall Lakes National Parks in New South Wales (AGSO, 2000a, p26).*

UN Framework Classification

The UN-Economic Commission for Europe developed the United Nations Framework Classification for Resources/Reserves (Solid Fuels and Mineral Commodities) to provide a basis for comparison of the various schemes in use around the world. The UNFC was developed because of a perceived need for an internationally acceptable reserve/resource classification system, particularly in view of the transition in former Eastern Bloc countries from centrally planned to market economy conditions. The UNFC was released in 1997 (ECE, 1997), and refined in 1998 and 1999.

Elements of the UNFC are illustrated in Figure 2. It is a three-dimensional system in which a feasibility axis reflects the degree of assurance of resource/reserve estimates with respect to economic viability (Fig. 2a). It also has the economic and geological assurance axes used by western mining nations, where technical factors are taken into account in economic feasibility studies. The UNFC was designed to encompass all existing schemes and it incorporates numerical codes for resource and reserve categories to overcome the problems of different terms and languages.

Following its approval and endorsement by the UN Economic and Social Council (ECOSOC) in 1997, there have been some uncertainties about the acceptance of the UNFC scheme internationally. The possibility that the established systems for classification and reporting of reserves and resources for industry purposes and national inventories may have to be replaced in western mining nations by the much more complex UNFC system raised some concerns. This was reflected in the decision by the Australian Geological Survey Organisation not to act on a request from UN-ECE in 1997 to trial the UNFC.

Concerns centred on implementation of the UNFC and the relevance of all its three-dimensional array of reserve and resource categories (Fig. 2b). A number of categories were of little or no added benefit for government agencies responsible for national mineral resource inventories in western mining nations, and were generally not estimated. Governments and companies of major mining countries need to have a resource reporting system(s) that provides the information required in as simple and

lucid a manner as possible. They are not interested in estimating resources that are not relevant to national inventory or investment considerations.

Enhancing comparability and compatibility of terms

In meetings in 1998 and 1999, agreement was reached between the UN-ECE and CMMI on the integration of the CMMI standard reporting definitions with the UNFC (with minor modifications) for those categories that are common to both systems:

Mineral Reserve	
Proved Mineral Reserve	(UNFC Code 111)
Probable Mineral Reserve.	(UNFC Code 121 and 122)
Mineral Resource	
Measured Mineral Resource	(UNFC Code 331)
Indicated Mineral Resource	(UNFC Code 332)
Inferred Mineral Resource	(UNFC Code 333)

To meet the needs of countries with economies in transition, the UNFC retains definitions of Feasibility Mineral Resource (UNFC Code 211), Prefeasibility-Mineral Resource (UNFC Codes 221 and 222), and Reconnaissance Mineral Resource (UNFC Code 334). These are not used by the CMMI Group countries for investment and financing purposes, but could be used for government planning purposes, including decisions on future land use and strategic minerals inventories, if data were available.

With key terms and their definitions being accepted virtually world-wide, the CMMI Group, in accord with the trend towards globalisation in many sectors of the mining industry, is now aiming to develop international standards as a basis for an International Code for commercial reporting of mineral reserves and resources. A key requirement is for a “competent person(s)” to estimate and sign off on reserves and resources for a public report. Such a person must have appropriate professional qualifications, affiliation and considerable relevant experience. It is not feasible nor necessary to meet this requirement in all instances for national inventory estimation.

The principle of redefining/improving the proposed terms and definitions to make them acceptable and applicable to world energy (and other mineral commodity) surveys is admirable. The CMMI/UN-ECE agreement on common definitions provides an important fundamental basis for comparison of resource/reserve data prepared by industry in different countries. However, it has to be accepted that harmonisation is not likely to be a straightforward process because of the different requirements between resource reporting for commercial purposes and national inventories, and issues specific to established market economies and economies in transition.

Geneva meeting, 14-15 June, 2001

Almost a hundred delegates attended, mostly from Europe and Russia. Australia was represented by Norman Miskelly (CMMI/JORC), Ian Lambert (Geoscience Australia, mineral resources), and Andrew Barrett (Geoscience Australia, petroleum resources). Niall Weatherstone (Rio Tinto, UK) also represented CMMI, and was involved particularly in discussions centred on the CMMI's "European Code" as it was then designated.

Australian representatives reported that:

– Geoscience Australia's national inventory compilation depended on systematic reporting by companies under the JORC Code, which is consistent with the UNFC (although it does not encompass all elements of the UNFC).
– Geoscience Australia would be looking to align as closely as possible its national reporting definitions with those agreed by the CMMI/UN-ECE.

Australian representatives also noted a number of issues that would need to be considered to establish whether it is feasible to use the UNFC more comprehensively in western mining nations.

Unfortunately, the Geneva meeting was dominated at times by 'misunderstandings' about the purpose of the JORC-related Codes. In particular, there was concern about the Draft European Code for Reporting of Mineral Exploration Results, Mineral Resources and Mineral Reserves (based largely on JORC), and its status in relation to

the UN-ECE Framework Classification (which to date has been used for governmental purposes). The UN-ECE Task Force opposed the use of the term "European" and was clearly not happy that it did not have any control over its development. With negotiation and diplomacy, some of these 'misunderstandings' were removed.

The European Federation of Geologists (an umbrella professional body for some 25 countries) formally adopted the European Code at its meeting in Kracow, Poland, 16-17 June, 2001, and is to engage in further dialogue with UN-ECE and European governments.

Agreement to pursue greater harmonisation

There was increased recognition during the Geneva meeting that there are different but related needs for deposit-scale commercial reporting by companies, and national reporting by governments. It was acknowledged that the national inventories for major mining nations would continue to rely heavily on company reports of reserves/resources (which relate to the geological assurance and economic feasibility axes), and that UNFC's lesser categories of resources (which are generally of no interest to companies) would not be required to be estimated. In some other countries with limited mining activity and adequate numbers of resource experts, there would be greater emphasis on estimating lesser categories of resources. It was accepted that, although no serious attempt has been made yet to apply the UNFC's numerical codification, industry and national resources reporting in western mining nations were broadly consistent with the UNFC.

There was agreement that the harmonisation process will now advance further, focussing on coal, uranium and petroleum. In effect, the UN-ECE Framework Classification Task Force has completed its work and will be disbanded. To take the work further, a UN Ad Hoc Classification Committee of experts with broad representation from governments, industry/finance/investment/ banking representatives and sector representation (eg. International Atomic Energy Agency, and professional geological organisations) is to be established. There will be three sub-divisions — oil and gas, uranium, and coal/minerals. Norman Miskelly will represent CMMI (and JORC effectively) on the third-mentioned committee, and the

US Geological Survey is likely to represent government interests for the major western mining nations.

Implications and evaluation

The main implications arising for Geoscience Australia were the need to:

– investigate in more detail whether the UNFC numerical codes for different classes of reserves and resources can be applied to our national reporting categories; and
– liaise with government agencies responsible for national mineral inventory reporting in other western mining nations to agree on common positions to be fed into the ongoing harmonisation process.

Geoscience Australia subsequently assessed the extent that the UNFC system was relevant to its reporting of Australia's national minerals inventory. This evaluation confirmed that the UNFC scheme was relevant only to the extent that agreement has been reached between CMMI and UN-ECE on key definitions. Geoscience Australia will update Australia's national system for reporting identified mineral resources to take account of these harmonised definitions. This will not result in any significant change to current national reporting arrangements. It was not found possible to implement the UNFC beyond that for national reporting largely because of the complexity arising from the inter-dependence of the UNFC's feasibility and economic axes which confounds use of the three digit code; the confusing terminology of the additional UNFC categories (reconnaissance mineral resource, prefeasibility mineral resource and feasibility mineral resource); and the unavailability of industry data for many of these lesser categories of resources, which do not relate to common industry practices in western mining nations. These findings reflect the paucity of government resource geoscientists in relation to Australia's vast mineral endowment, and the consequent reliance on data from systematic industry reporting.

There is no foreseeable impact on industry reporting, which is adequately accommodated by the reserve and resource categories agreed between the CMMI and UN-ECE. When the JORC code is next reviewed, there will be consideration of its definitions in the light of the more recent CMMI codes and the CMMI/UN-ECE

agreed definitions, but Geoscience Australia will not seek to have additional UNFC categories included in the new version.

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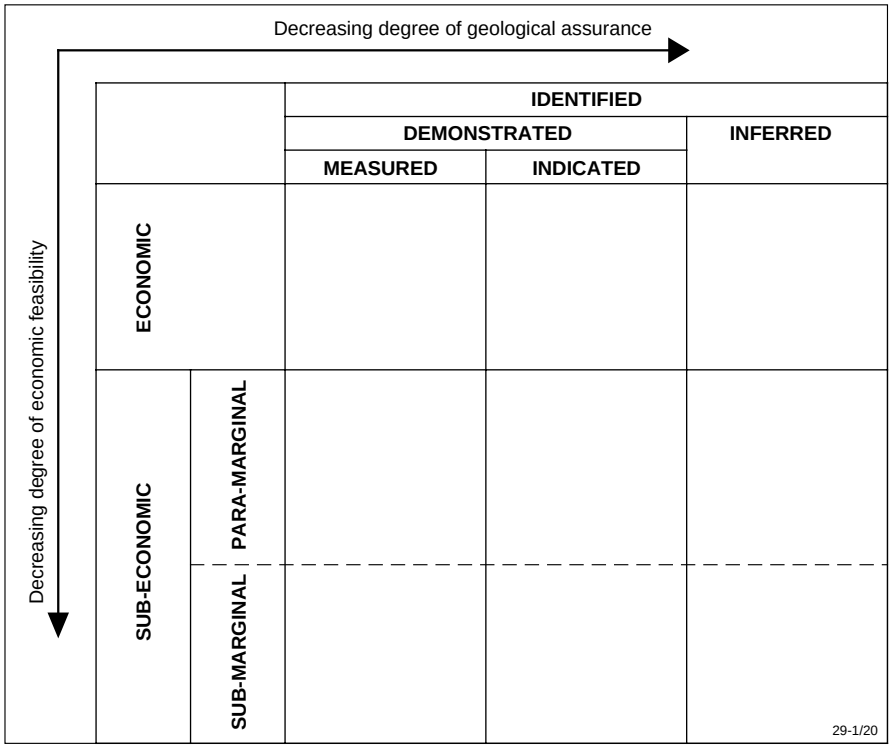

Figure 1. The modified McKelvey system used by AGSO – Geoscience Australia for classifying identified resources

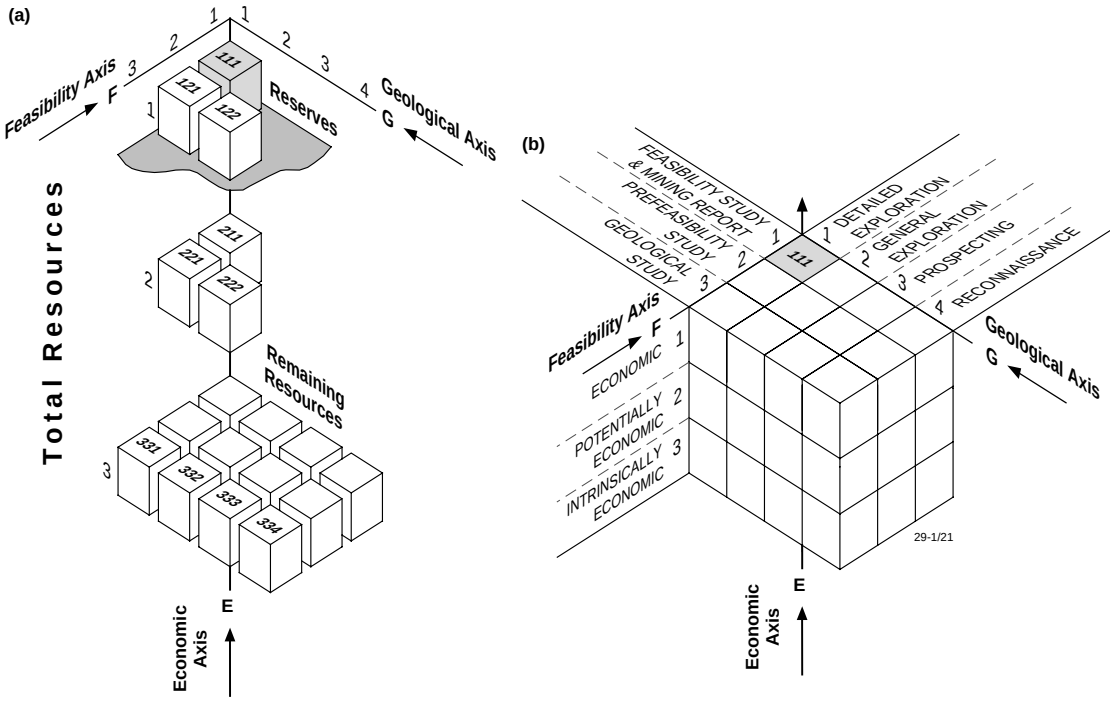

Figure 2. United Nations Framework Classification (UNFC) — Solid Fuels and Mineral Commodities
(a) UNFC's E (Economic), F (Feasibility) and G (Geological) axes
(b) Codified EFG classes (36 in total) potentially applicable using the UNFC