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UNITED NATIONS INTERNATIONAL FRAMEWORK CLASSIFICATION FOR RESERVES/RESOURCES – Solid Fuels and Mineral Commodities – Final Version (Finalized and submitted by the United Nations Task Force)*

1. Introduction and Historical Background

This document introduces and describes the United Nations International Framework Classification for Reserves/Resources - Solid Fuels and Mineral Commodities - (abbreviated: UN Framework Classification). It is the Final Version of the UN Framework Classification.

The principal function of the UN Framework Classification is to allow national terms to be maintained and at the same time make them comparable. The framework function of the new reserve/resource classification will enhance communication on a national and international level, provide for a better understanding and firmer knowledge of reserves/resources available and make investment in solid fuels and mineral commodities safer and more attractive. Furthermore, the new classification will assist economies in transition in reassessing their solid fuels and mineral deposits according to market economy criteria.

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* In accordance with the recommendations of the Task Force meeting in Geneva, 2-4 November, 1996 and the decision of the Working Party on Coal meeting held in Geneva, 4-6 November 1996 (ENERGY/WP.1/12,para.33)

The UN Framework Classification has been developed by the United Nations Economic Commission for Europe (UN/ECE) Working Party on Coal on the basis of a proposal by the German Government [13], which was in turn based on a classification originally developed by the Federal Institute for Geosciences and Natural Resources in 1991 [31]. The work was supported by two workshops (1994 and 1995), one ad hoc meeting (1995) and three Task Force meetings (one in 1995 and two in 1996) representing all interested countries from the ECE, other countries participating in the meetings pursuant to Article 11 of the Commission's Terms of Reference, the Council for Mining and Metallurgical Institutions (CMMI) and the United Kingdom Institution of Mining and Metallurgy (IMM). In addition to these meetings, more than 40 countries contributed in writing by replying to two questionnaires and to the UN/ECE document Energy/WP.1/R.57 of 19 July 1996 which were distributed worldwide.

The Task Force set up by the Working Party on Coal in 1995 to finalize the UN Framework Classification comprised the following members:

- Mr. Dietmar KELTER (Germany), Coordinator
- Mr. Günter FETTWEIS (Austria)
- Mr. HU Kui (China)
- Mr. Vitaly TVERDOHLEBOV (Russian Federation)
- Mr. Andrej SUBELJ (Slovenia)
- Mr. Gordon RIDDLER (United Kingdom)
- Mr. Hal GLUSKOTER (United States of America)

In addition, the following experts took part in the Task Force meetings:

- Mr. Slav SLAVOV (United Nations)
- Mr. Richard NÖTSTALLER (Austria)
- Mr. SHI Jexin (China)
- Mr. Jochen PARCHMANN (Germany)

All opinions were considered and taken into account, and the results and the main decisions of the meetings are recorded in the respective reports and publications (see [1] to [30], [32] to [37], [39] to [40], [42], [45] to [48], [50] to [52]) and [54] to [55]).

The UN Framework Classification is the latest effort to develop a universally and internationally applicable scheme for assessing solid fuel and mineral deposits under market economy conditions. The initiative was undertaken by the UN/ECE Working Party on Coal recognizing that the importance of and need for an internationally acceptable reserve/resource classification has attained a new dimension with the current transition of central and eastern European countries to market economy conditions.

It was furthermore recognized that the numerous classification systems in use, which are based on differing principles and have differing terms and definitions, can only be harmonized by means of a supranational framework system. The alternative to a framework system, i.e. a set of new terms to replace the existing national terms, has been tried in the past, notably by the United Nations in 1979 [23], [44] and [53]. However, the nationally used terms are so strongly rooted in tradition that it proved impossible to replace them.

2. Objective

The main objective of the UN Framework Classification is to create an instrument that will permit reserves/resources of solid fuels and mineral commodities to be classified on an internationally uniform system based on market economy criteria. This new classification system is designed to allow incorporation of existing terms into it in order to make them comparable and compatible, thus enhancing international communication. The market economy principles should facilitate international trade and cooperation, especially between "market economies" and "economies in transition".

A further objective is to create a generally understandable and simple system, easy to use by all interested parties. It should directly reflect the procedures used in practice to investigate and evaluate mineral reserves/resources and should accommodate the results of these investigations and evaluations, i.e. the reserve/resources figures quoted in the respective reports and documents. An additional objective is to create a flexible system that will meet all requirements for applications on a national, company or institutional level, and for international communication and global surveys.

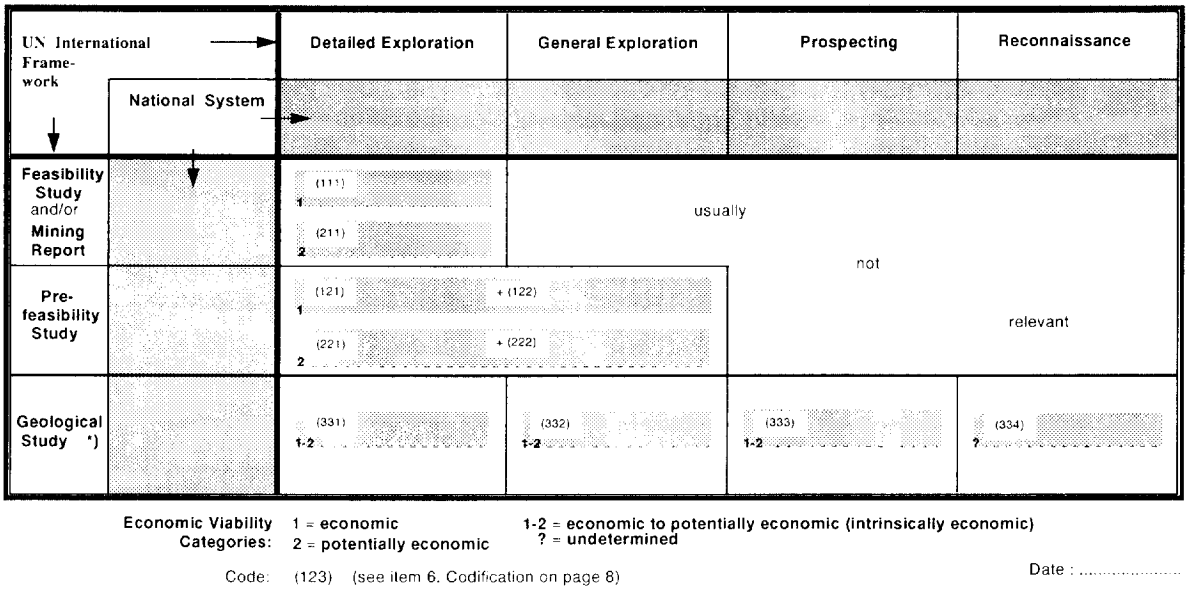
3. Classification

The UN Framework Classification provides information about (1) the stage of **Geological Assessment**; (2) the stage of **Feasibility Assessment**; and (3) the degree of **Economic Viability**. The principle behind the UN Framework Classification and methodology of classifying reserves and resources is revealed in its matrix form (Fig. 1).

Fig. 1: Matrix

United Nations International Framework Classification for Reserves/Resources

- Solid Fuels and Mineral Commodities -



* A Geological Study contains a preliminary evaluation of Economic Viability and is thus the initial stage on the Feasibility Assessment axis.

The main consecutive stages of Geological Assessment are shown on the horizontal axis. They define reserve/resource categories according to degree of geological assurance. Along the vertical axis, the main Feasibility Assessment stages are introduced as a yardstick to rank reserves/resources according to the amount of detail with which the Feasibility Assessment has been carried out. These reflect the degree of assurance of the reserve/resource figures with respect to Economic Viability. The actual result of the Feasibility Assessment, i.e. the Economic Viability of the deposit, is depicted using the third dimension. The three-dimensional presentation of the matrix is shown in Figure 5b.

The categorization of reserves/resources according to stage of assessment, which reflects the successive stages of investigation generally undertaken in standard professional practice in all mining countries, makes the UN Framework Classification applicable to all solid fuels and mineral commodities. The terms used for these stages are considered to be familiar to all users, not only to geologists and mining engineers but also to investors, bankers, shareholders, and planners engaged with solid fuels and mineral commodities. The terms and definitions currently used in the existing classification systems can easily be related to and assigned to the corresponding stages of assessment of the UN Framework Classification, allowing the national terms to be maintained and making them comparable at the same time. In this way, the UN Framework Classification truly provides a framework integrating the diverse national classifications, enhancing national and international communication and reducing the risk of misinterpretation of reserve/resource figures derived from different classification systems.

Figure 2 represents the UN Framework Classification in the form of a table, which can be conveniently used for reporting and summing several individual deposits.

Fig. 2: Table

United Nations International Framework Classification for Reserves/Resources

- Solid Fuels and Mineral Commodities -

Deposit / Mine	Feasibility Study and/or Mining Report		Prefeasibility Study		Geological Study			
	Economic	Potentially economic	Economic	Potentially economic	Detailed Exploration	General Exploration	Prospecting	Reconnais-sance
	(111)	(211)	(121) (122)	(221) (222)	(331)	(332)	(333)	(334)
Total								

= National System

Date : .....

Code: (123)

If necessary, the main categories of the UN Framework Classification can be subdivided on a national level to allow for specific needs, thus giving the classification system the necessary flexibility.

For the level of global surveys such as those of the International Energy Agency and World Energy Council, the UN Framework Classification can be condensed as shown in Figure 3, which distinguishes four main classes.

Fig. 3: Table for Worldwide Survey

United Nations International Framework Classification for Reserves/Resources

- Solid Fuels and Mineral Commodities -

Countries	Prefeasibility Study, Feasibility Study and / or Mining Report		Geological Study	
	Economic	Potentially Economic	Detailed & General Exploration	Prospecting & Reconnaissance
	(111) (121) (122)	(211) (221) (222)	(331) (332)	(333) (334)
Total World				

= International System

Code: (123)

Date :.....

4. Terms and Definitions

Geological Study is subdivided into four consecutive stages of geological assessment which are, in order of increasing detail: **Reconnaissance**, **Prospecting**, **General Exploration** and **Detailed Exploration**. These conveniently provide four categories reflecting increasing degree of geological assurance.

Feasibility Assessment is subdivided into three consecutive stages which are, in order of increasing detail: **Geological Study**, **Prefeasibility Study**, and **Feasibility Study/ Mining Report**. These conveniently provide three categories reflecting degree of assurance of Economic Viability. The Mining Report and Feasibility Study have the highest degree of assurance and constitute one category; a Prefeasibility Study, which is usually carried out prior to a Feasibility Study, provides an Economic Viability statement with a lower degree of assurance; in contrast, a Geological Study is not intended to provide a reliable statement on Economic Viability.

The **Economic Viability**, corresponding to the reserve/resource figures as obtained from the Feasibility Assessment, is reported as the third dimension, using the individual boxes in the matrix or the individual column in the table of the UN Framework Classification.

There are two categories of Economic Viability: **economic** and **potentially economic**[1] , which are only quoted in the stages of Mining Report/Feasibility Study and Prefeasibility Study. If necessary, each of these can be subdivided on a national level into two subcategories, namely *normal* and *exceptional* in the case of the economic category, and *marginal* and *submarginal* in the case of the potentially economic category.

In a Geological Study, in contrast to Mining Report/Feasibility Study and Prefeasibility Study, the Economic Viability is not assessed but roughly estimated by adopting cut-off values and/or by comparison with mining activities carried out in similar deposits. Thus, the resource figures are quoted as being in the range of "**economic to potentially economic**" and therefore of intrinsic economic interest. For the same reason, generally only "in situ" resource figures are reported at the Geological Study stage, while at the Mining Report/Feasibility Study and Prefeasibility Study stages both quantities "extractable" and "in situ" may be quoted. In all cases it should be clearly stated whether the reported reserve/resource figures refer to "in situ" or "extractable" quantities[2] .

The definitions of the above terms as used in the UN Framework Classification are provided in Appendix I. These definitions were formulated in the light of all comments made during the meetings and the replies to the two questionnaires.

5. Reserve and Resource Terminology

The terms Reserve and Resource have a variety of meanings in the various national classification systems throughout the world, most of which have a long history.

To use these terms for international communication within the UN Framework Classification would therefore mean partially redefining them. This could only be done if the exercise is fully supported by those countries that are affected.

Both terms, as well as their current definitions provided by many countries in their replies to the questionnaires, were discussed in detail during the Workshop in Hanover. The replies received revealed that some countries use only one term or neither term; in other countries Reserve is part of the Resource, being either the economic part or the geologically more assured part; in other countries Reserve is not a subset of Resource but is additional to Resource. The Workshop agreed to incorporate the CMMI definitions of Reserve and Resource into the English language version of the UN Framework Classification as a basis for further discussion about the use of these definitions in different national languages.

The reason for giving preference to the definitions of CMMI is that considerable progress has been made by CMMI during the few last years in establishing precise definitions for Reserve and Resource to be used by its members and consequently by investors, shareholders and bankers in a number of English-speaking mining countries. In the case of Australia these definitions constitute part of the Stock Exchange listing rules [38] and [43].

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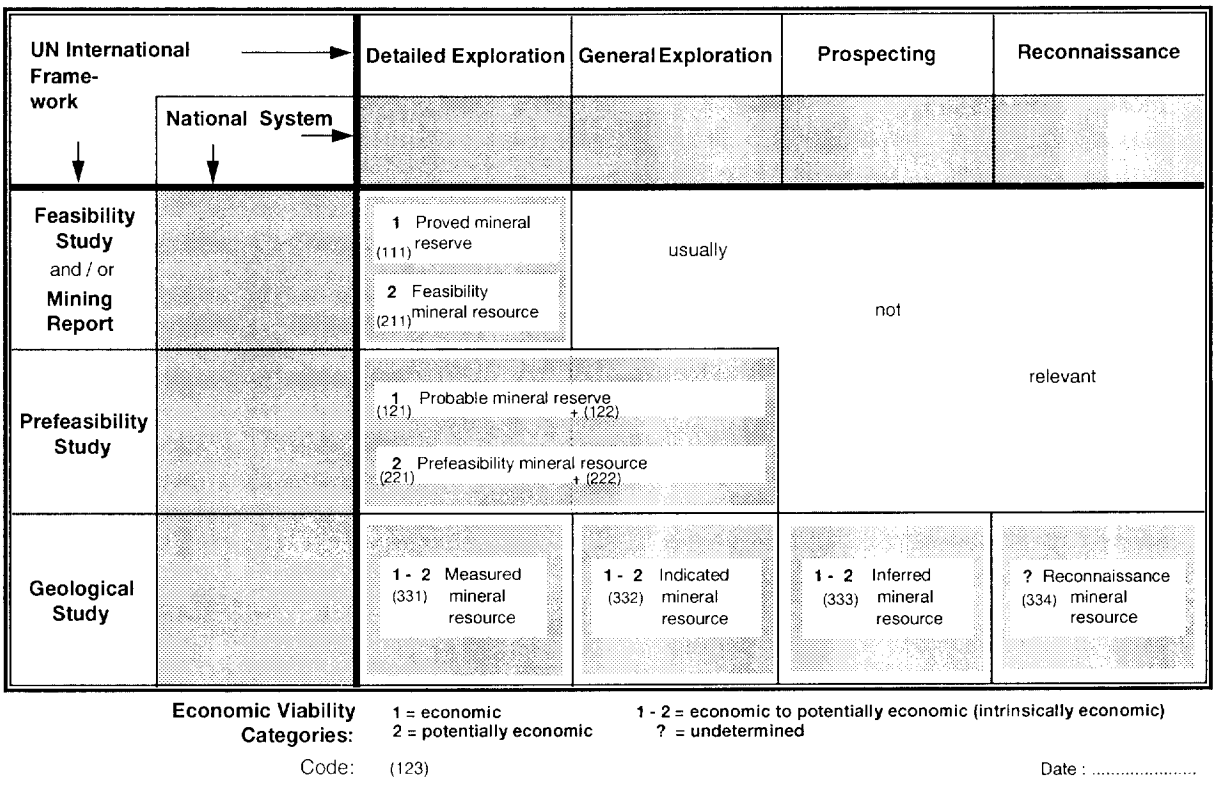
[1] The term "potentially economic" is recommended as a substitute for the term "subeconomic" as it avoids confusion with a number of other terms.

[2] This was introduced in the 1979 UN Classification System, where the upper case letter "R" was used for in-situ reserves / resources and the lower case letter "r" was used for recoverable reserves. This is mentioned in this document because it is still in use in some countries.

The proposal given below was prepared by the Task Force during its meeting in Leoben in May 1996 [18]. The **Total Mineral Resource** is defined as naturally occurring concentrations of mineral raw material of economic interest and with specified geological certainty. A **Mineral Reserve** is the economically mineable part of Total Mineral Resource as demonstrated by Feasibility Assessment. The **Remaining Mineral Resource** is the balance of the Total Mineral Resource that has not been identified as a Mineral Reserve (see Fig.5b). According to the different stages of assessment, Mineral Reserve and Remaining Mineral Resource are subdivided into a total of eight different classes as shown in Figure 4 and defined in Appendix II on pages 15 to 17.

Fig. 4: Proposed UN Mineral Reserve/Resource Terminology

United Nations International Framework Classification for Reserves/Resources
- Solid Fuels and Mineral Commodities -



(Note: the terms **Feasibility Mineral Resource** und **Prefeasibility Mineral Resource** are proposed as preliminary working terms).

Outside the reserve/resource classification and not part of Reserves/Resources are the so-called occurrences, constituting either indication of mineralization without specified geological certainty termed a **Mineral Occurrence,** or a mineral concentration of no economic interest, termed **Uneconomic Occurrence**. Detailed definitions are provided in Appendix II on page 17. Both terms have been defined to demonstrate the boundaries of the UN Framework Classification and at the same time to clarify the different meanings with which the term occurrence has so far been used.

6. Codification

The incorporation of existing classification systems into the UN Framework Classification and their comparison will be further simplified by means of codification acting as interface. Codification has the further advantage of providing a short, unambiguous identification of the reserve/resource categories[1] which facilitates computer processing of data and exchange of information. During the Workshop in Hanover, the codification systems in use were discussed in detail; finally it was agreed that numerical codification of the UN Framework Classification would be most advantageous [50].

Figure 5a shows the principle behind the proposed codification of the UN Framework Classification, the three dimensions of categorization represented by the edges of a cube, the E (Economic) axis for Economic Viability, the F (Feasibility) axis for Feasibility Assessment, and the G (Geology) axis for Geological Study. The digits are quoted in the order EFG firstly because alphabetical order is easy to memorise, and secondly because the first digit refers to the Economic Viability, which is of decisive interest to both mining company and investor.

Numbers are used to designate the different classes; the lowest number, in accordance with the usual perception that the 1st is the best, referring to the highest degree of Economic Viability on the E axis, and the highest degree of assurance on the F axis and G axis. Figure 5b represents an "exploded" three dimensional layout of Figure 5a showing the codified classes which are applicable in practice.

The class coded 111, which is shaded in Figure 5a and 5b, is of prime interest to an investor: it refers to quantities that are economically mineable (number 1 as the first digit), have been proved by means of a Feasibility study or actual mining (number 1 as the second digit), and are based on Detailed Exploration (number 1 as the third digit).

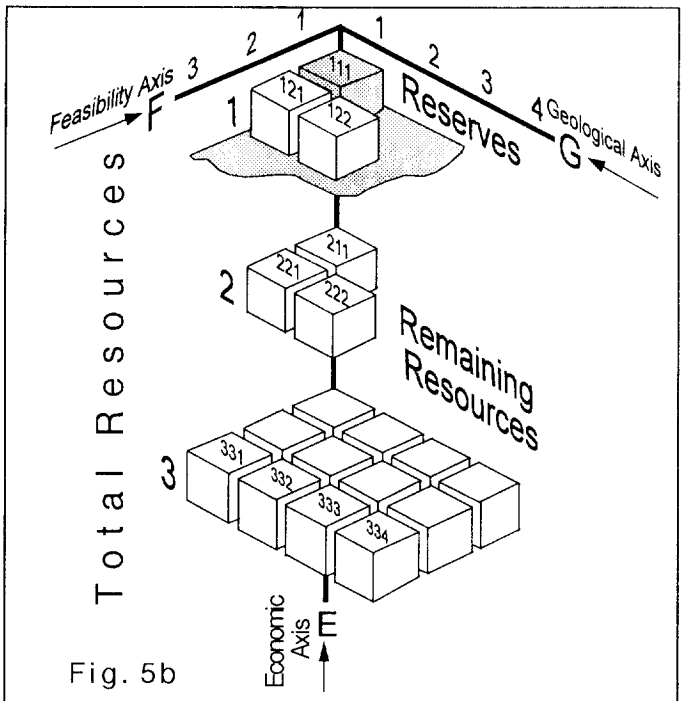


Fig. 5b

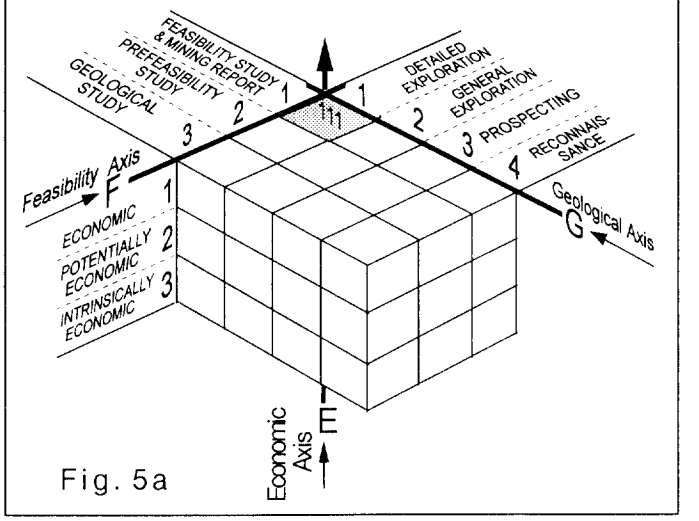


Fig. 5a

[1] Geostatistics have been proposed for this purpose. However, so far currently they are only used in the case of a Feasibility Study and occasionally in a Prefeasibility Study.

Each codified class has a specific set of assessment stages and Economic Viability degree which are arranged in a table (Fig. 6). According to this table it is possible to codify any kind of reserve and resource and to transfer any class from one system to another.

Fig. 6.: Codification of Classes

ECONOMIC AXIS	FEASIBILITY AXIS	GEOLOGICAL AXIS	CODE
Economic	Feasib.St. & Min. Rep.	Detailed Exploration	111
Economic	Prefeasibility Study	Detailed Exploration	121
Economic	Prefeasibility Study	General Exploration	122
Potentially Economic	Feasib.St. & Min. Rep.	Detailed Exploration	211
Potentially Economic	Prefeasibility Study	Detailed Exploration	221
Potentially Economic	Prefeasibility Study	General Exploration	222
Intrinsically Economic [1]	Geological Study	Detailed Exploration	331
Intrinsically Economic [1]	Geological Study	General Exploration	332
Intrinsically Economic [1]	Geological Study	Prospecting	333
Undetermined Economic	Geological Study	Reconnaissance	334

[1] Economic to potentially economic

Figure 7 shows as an example the translation from the UN proposed Reserve and Resource terms to those of CMMI by means of the numerical codes. This example also gives the 8 reserve and resource classes, in practical use.

Fig. 7: Example of translation from UN to CMMI system using codes

CODE	CMMI CATEGORY	UN PROPOSAL
111	Proved Mineral Reserve	Proved Mineral Reserve
121 and 122	Probable Mineral Reserve	Probable Mineral Reserve
211	Measured Mineral Resource	Feasibility Mineral Resource
221 and 222	Indicated Mineral Resource	Prefeasibility Mineral Resource
331	Measured Mineral Resource	Measured Mineral Resource
332	Indicated Mineral Resource	Indicated Mineral Resource
333	Inferred Mineral Resource	Inferred Mineral Resource
334	not available	Reconnaissance Mineral Resource

On a national level, letters can be used to reflect subclasses if this is required, for example **n** for normal economic, **e** for exceptional, **m** for marginal economic and **s** for submarginal.

7. Future Activities

In response to the over 50 comments received, the Task Force, during its meeting in Geneva on 2-4 November 1996, amended the final draft of the UN Framework Classification (ENERGY/WP. 1/R.57 of July 1996) and prepared its Final Version as presented in this document.

In accordance with the decision taken by the Working Party on Coal meeting in Geneva, 4-6 November 1996, the following future activities are to be undertaken:

- to request the Task Force to prepare a summary version which should be simple and might be useful for the mining industry;
- to recommend to the ECE secretariat to organize as soon as possible, separate meetings with Russian- and Spanish-speaking countries with a view to improving and harmonizing definitions and terms of the UN Framework Classification in both languages;
- to recommend a 3-year trial period of application of the UN Framework Classification; for this purpose, the secretariat, in consultation with the countries and the Task Force, should prepare an implementation programme;
- to organize an intermediate meeting in 1998 to assess the results of application of the UN Framework Classification.

Appendix I

Definitions of Terms to be used in the English Language Version of the United Nations International Framework Classification for Reserves/Resources - Solid Fuels and Mineral Commodities -

Definitions of Stages of Feasibility Assessment

Mining Report	A **Mining Report** is understood as the current documentation of the state of development and exploitation of a deposit during its economic life including current mining plans. It is generally made by the operator of the mine. The study takes into consideration the quantity and quality of the minerals extracted during the reporting time, changes in Economic Viability categories due to changes in prices and costs, development of relevant technology, newly imposed environmental or other regulations, and data on exploration conducted concurrently with mining. It presents the current status of the deposit, providing a detailed and accurate, up-to-date statement on the reserves and the remaining resources.
Feasibility Study	A **Feasibility Study** assesses in detail the technical soundness and Economic Viability of a mining project, and serves as the basis for the investment decision and as a bankable document for project financing. The study constitutes an audit of all geological, engineering, environmental, legal and economic information accumulated on the project. Generally, a separate environmental impact study is required. Cost data must be reasonably accurate (usually within ± 10 %), and no further investigations should be necessary to make the investment decision. The information basis associated with this level of accuracy comprises the reserve figures based on the results of Detailed Exploration, technological pilot tests and capital and operating cost calculations such as quotations of equipment suppliers. A detailed list of the items addressed in a Feasibility Study is given in Appendix III.

Definitions of Stages of Feasibility Assessment (Cont.)

Prefeasibility Study	A **Prefeasibility Study** provides a preliminary assessment of the Economic Viability of a deposit and forms the basis for justifying further investigations (Detailed Exploration and Feasibility Study). It usually follows a successful exploration campaign, and summarizes all geological, engineering, environmental, legal and economic information accumulated to date on the project. In projects that have reached a relatively advanced stage, the Prefeasibility Study should have error limits of ± 25 %. In less advanced projects higher errors are to be expected. Various terms are in use internationally for Prefeasibility Studies reflecting the actual accuracy level. The data required to achieve this level of accuracy are reserves/resources figures based on Detailed and General Exploration, technological tests at laboratory scale and cost estimates e.g. from catalogues or based on comparable mining operations. The Prefeasibility Study addresses the items listed under the Feasibility Study, although not in as much detail.
Geological Study	A **Geological Study** is an initial evaluation of Economic Viability. This is obtained by applying meaningful cut-off values for grade, thickness, depth, and costs estimated from comparable mining operations. Economic Viability categories, however, cannot in general be defined from the Geological Study because of the lack of detail necessary for an Economic Viability evaluation. The resource quantities estimated may indicate that the deposit is of intrinsic economic interest, i.e. in the range of economic to potentially economic. A Geological Study is generally carried out in the following four main stages: Reconnaissance, Prospecting, General Exploration and Detailed Exploration (for definition of each stage see below). The purpose of the Geological Study is to identify mineralization, to establish continuity, quantity, and quality of a mineral deposit, and thereby define an investment opportunity.

Definitions of Stages of Geological Study

(cont.)

Reconnais-sance	A **Reconnaissance** study identifies areas of enhanced mineral potential on a regional scale based primarily on results of regional geological studies, regional geological mapping, airborne and indirect methods, preliminary field inspection, as well as geological inference and extrapolation. The objective is to identify mineralized areas worthy of further investigation towards deposit identification. Estimates of quantities should only be made if sufficient data are available and when an analogy with known deposits of similar geological character is possible, and then only within an order of magnitude.
Prospecting	**Prospecting** is the systematic process of searching for a mineral deposit by narrowing down areas of promising enhanced mineral potential. The methods utilized are outcrop identification, geological mapping, and indirect methods such as geophysical and geochemical studies. Limited trenching, drilling, and sampling may be carried out. The objective is to identify a deposit which will be the target for further exploration. Estimates of quantities are inferred, based on interpretation of geological, geophysical and geochemical results.
General Exploration	**General Exploration** involves the initial delineation of an identified deposit. Methods used include surface mapping, widely spaced sampling, trenching and drilling for preliminary evaluation of mineral quantity and quality (including mineralogical tests on laboratory scale if required), and limited interpolation based on indirect methods of investigation. The objective is to establish the main geological features of a deposit, giving a reasonable indication of continuity and providing an initial estimate of size, shape, structure and grade. The degree of accuracy should be sufficient for deciding whether a Prefeasibility Study and Detailed Exploration are warranted.
Detailed Exploration	**Detailed Exploration** involves the detailed three-dimensional delineation of a known deposit achieved through sampling, such as from outcrops, trenches, boreholes, shafts and tunnels. Sampling grids are closely spaced such that size, shape, structure, grade, and other relevant characteristics of the deposit are established with a high degree of accuracy. Processing tests involving bulk sampling may be required. A decision whether to conduct a Feasibility Study can be made from the information provided by Detailed Exploration.

Definitions of Economic Viability Categories (cont.)

Economic	Quantities, reported in tonnes/volume with grade/quality, demonstrated by means of a Prefeasibility Study, Feasibility Study or Mining Report, in order of increasing accuracy, that justify extraction under the technological, economic, environmental and other relevant conditions, realistically assumed at the time of the determination. The term economic comprises both normal economic and exceptional economic as defined below. These two subcategories are for optional use on a national level.
Normal Economic	Normal economic reserves are reserves that justify extraction under competitive market conditions. Thus, the average value of the commodity mined per year must be such as to satisfy the required return on investment.
Exceptional Economic (conditional economic)	Exceptional (conditional) economic reserves are reserves which at present are not economic under competitive market conditions. Their exploitation is made possible through government subsidies and/or other supportive measures.
Potentially Economic	Quantities, reported in tonnes/volume with grade/quality, demonstrated by means of a Prefeasibility Study, Feasibility Study or Mining Report, in order of increasing accuracy, not justifying extraction under the technological, economic, environmental and other relevant conditions, realistically assumed at the time of the determination, but possibly so in the future. The term potentially economic comprises both marginal and submarginal as defined below. These two subcategories are for optional use on a national level.
Marginal Economic	Marginal economic resources are resources which at the time of determination are not economic, but border on being so. They may become economic in the near future as a result of changes in technological, economic, environmental and/or other relevant conditions.
Submarginal Economic	Submarginal economic resources are resources that would require a substantially higher commodity price or a major cost-reducing advance in technology to render them economic.
Economic to Potentially Economic (intrinsically economic)	Quantities, reported in tonnes/volume with grade/quality, estimated by means of a Geological Study to be of intrinsic economic interest. Since the Geological Study includes only a preliminary evaluation of Economic Viability, no distinction can be made between economic and potentially economic[1] . These Resources are therefore said to lie in the range of economic to potentially economic.

[1] Except in the case of low investment mineral commodities like sand, gravel and common clay, where a distinction between economic and potentially economic can be made.

Appendix II

Definitions of Mineral Reserve/Resource Terms in the UN Framework Classification and proposed by CMMI

Terms and Code	UN Framework Classification	CMMI Proposal
Proved Mineral Reserve (111)	Demonstrated to be economically mineable by a Feasibility Study or actual mining activity usually undertaken in areas of Detailed Exploration.	A Proved Mineral Reserve, stated in terms of exploitable tonnes / volume and grade / quality is that part of a Measured Mineral Resource on which detailed technical and economic studies have been carried out to demonstrate, at the time of reporting, that it can justify exploitation under specific technical and economic conditions.
Probable Mineral Reserve (121+122)	Demonstrated to be economically mineable by a Prefeasibility Study usually carried out in areas of Detailed Exploration and General Exploration.	A Probable Mineral Reserve, stated in terms of exploitable tonnes/volume and grade / quality is that part of a Measured or Indicated Resource on which sufficient technical and economic studies have been carried out to demonstrate, at the time of reporting, that it can justify exploitation under appropriate technical and economic conditions.
Feasibility Mineral Resource (211)	Demonstrated to be potentially economic by a Feasibility Study or prior mining activity usually carried out in areas of Detailed Exploration.	See definition of Measured Mineral Resource.
Prefeasibility Mineral Resource (221 + 222)	Demonstrated to be potentially economic by a Prefeasibility Study usually carried out in areas of Detailed Exploration and General Exploration.	See definition of Indicated Mineral Resource.
Measured Mineral Resource (331)	Estimated to be of intrinsic economic interest based on Detailed Exploration establishing all relevant characteristics of a deposit with a high degree of accuracy.	A Measured Mineral Resource is that part of a Mineral Resource which has been explored, sampled and tested through appropriate exploration techniques at locations such as outcrops, trenches, pits, workings and drill holes which are spaced closely enough to confirm geological continuity and from which collection of detailed reliable data allows tonnage / volume, densities, size, shape, physical characteristics, quality and mineral

(cont.)

		content to be estimated with a high level of certainty. This category requires a high level of confidence in and understanding of geology and controls of the occurrence.
Indicated Mineral Resource (332)	Estimated to be of intrinsic economic interest based on General Exploration establishing the main geological features of a deposit providing an initial estimate of size, shape, structure and grade.	An Indicated Mineral Resource is that part of a Mineral Resource which has been explored, sampled and tested through appropriate exploration techniques at locations such as outcrops, trenches, pits, workings and drill holes which are too widely spaced or inappropriately spaced to confirm geological continuity but which are spaced closely enough to assume geological continuity and from which collection of reliable data allows tonnage / volume, densities, size, shape, physical characteristics, quantity and mineral content to be estimated with a reasonable level of confidence, but not a high degree of certainty. An Indicated Mineral Resource is estimated with less certainty and lower level of confidence than for a Measured Mineral Resource, but will be more reliable than for an Inferred Mineral Resource. Confidence in the estimate is such as to allow the application of technical, economic and financial parameters and to enable an evaluation of economic viability.
Inferred Mineral Resource (333)	Estimated to be of intrinsic economic interest based on Prospecting having the objective to identify a deposit. Estimates of quantities are inferred, based on outcrop identification, geological mapping, indirect methods and limited sampling.	An Inferred Mineral Resource is that part of a Mineral Resource inferred from geological evidence and assumed but not verified continuity, where information gathered through appropriate exploration techniques from locations such as outcrops, trenches, pits, workings and drill holes is limited or of uncertain quality and reliability but on the basis of which tonnage/volume, quality and mineral content can be estimated with a low degree of certainty and low level of confidence. The level of confidence associated with an Inferred Mineral Resource is lower than that for an Indicated Mineral Resource.

(cont.)

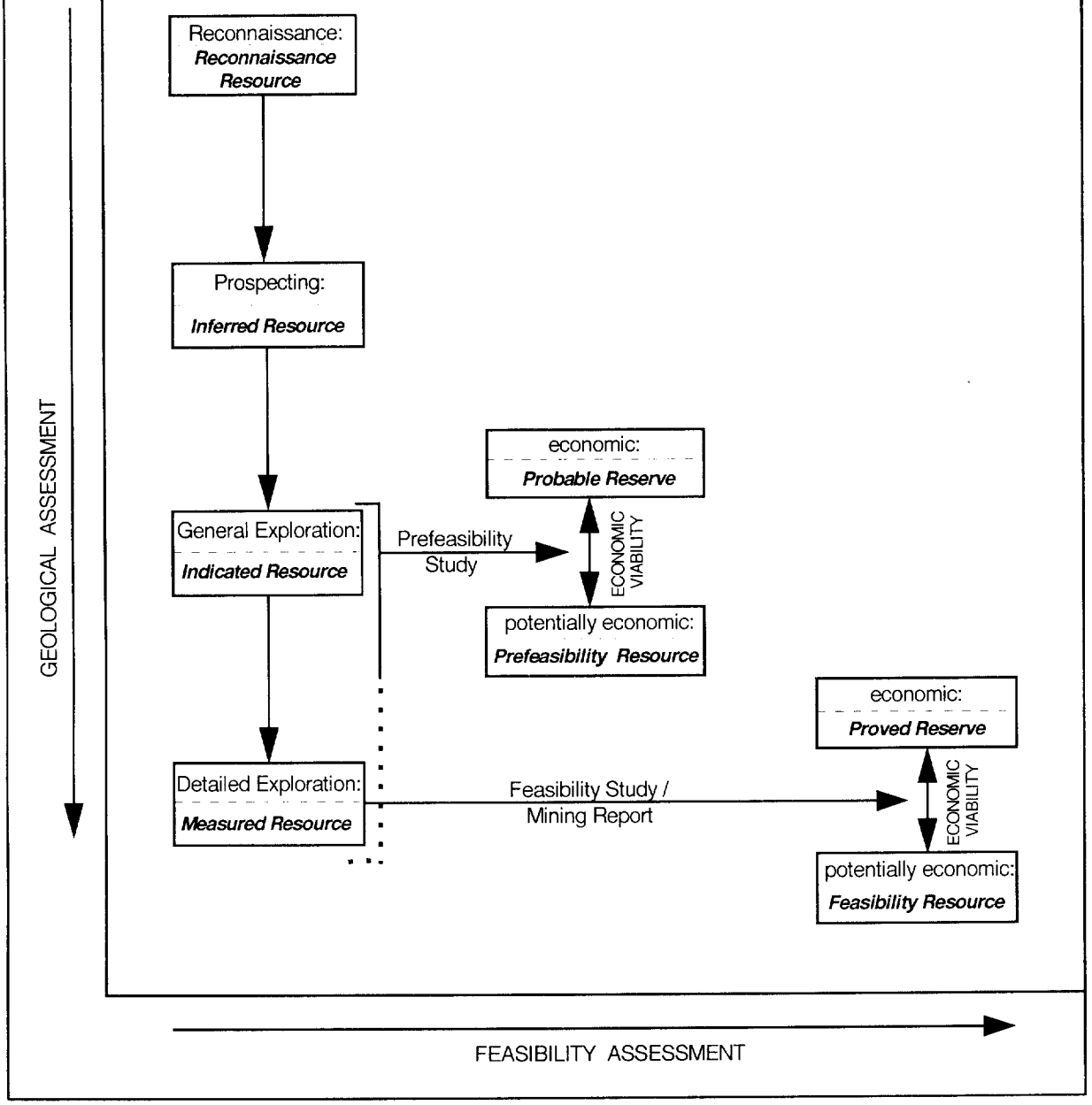
		This category is intended to cover situations where a mineral occurrence has been identified and limited measurement and sampling completed but where the data are insufficient to allow the geological framework and/or continuity of mineralisation to be confidently interpreted. It should not necessarily be assumed that all/or part of an Inferred Mineral Resource will be upgraded to an Indicated or Measured Resource by continued exploration. Caution should be exercised if this category is considered in preliminary technical and economic studies. Because of the low level of confidence and reliability of this category, Inferred Mineral Resources should not be combined with Measured Mineral Resources and Indicated Mineral Resources.
Reconnaissance Mineral Resource (334)	Based on Reconnaissance, having the objective to identify areas of enhanced mineral potential. Estimates of quantities should only be made if sufficient data are available and when an analogy with known deposits of similar geological character is possible and then only within an order of magnitude.	The term Exploration Information is broadly equivalent to the IMM term Mineral Potential, which is defined as follows: Mineral Potential describes a body of rock or mineralisation or other material or an area for which evidence exists to suggest that it is worthy of investigation but to which neither volume, tonnage nor grade shall be assigned.

Definition of Occurrences

	The term Occurrence is used with two different meanings as defined below:
Uneconomic Occurrence	**Uneconomic Occurrence** - Materials of estimated quantity, that are too low in grade or for other reasons are not considered potentially economic. Thus, **Uneconomic Occurrence** is not part of a Mineral Resource. If quantity and quality are considered worthy of reporting, it should be recognized that an **Uneconomic Occurrence** cannot be exploited without major technological and/or economic changes, which are not currently predictable.
Mineral Occurrence	A **Mineral Occurrence** is an indication of mineralization, that is worthy of further investigation. The term **Mineral Occurrence** does not imply any measure of volume/tonnage or grade/quality and is thus not part of a Mineral Resource.

(cont.)

Fig. 8 Schematic Illustration of UN Framework Classification



Definition of a Competent Person

The studies involved in the UN Framework Classification must be undertaken by a **Competent Person.** A Competent Person is defined as one who is qualified for the position by training and who has relevant experience in assessing resources and reserves of the type of deposit in question. The qualifications and experience required will vary between countries, for example in some countries licensing may be required.

Appendix III

List of the more important items to be addressed in a Feasibility Study [1] :

- Geographical Conditions

- Infrastructure
  - ⇒ public utilities
  - ⇒ roads, railways and others
  - ⇒ manpower

- Geology
  - ⇒ structure, size, shape
  - ⇒ mineral content, grade, density
  - ⇒ reserve/resource quantity and quality
  - ⇒ other relevant geological features

- Legal Matters
  - ⇒ rights and ownership
  - ⇒ socioeconomic impact studies
  - ⇒ public acceptance
  - ⇒ land requirements
  - ⇒ government factors

- Operating
  - ⇒ rock mechanics
  - ⇒ mining equipment
  - ⇒ mining method
  - ⇒ construction plan and schedule
  - ⇒ appropriate technological pilot tests
  - ⇒ mill and processing plant
  - ⇒ tailings disposal
  - ⇒ water management
  - ⇒ transportation
  - ⇒ power supply
  - ⇒ manpower / labour relations
  - ⇒ auxiliary facilities and services
  - ⇒ closure design

- Environment (if not dealt with in a separate study)

- Market Analysis

- Financial Analysis
  - ⇒ capital cost
  - ⇒ cashflow forecast
  - ⇒ investment cost
  - ⇒ inflation forecast
  - ⇒ operating cost
  - ⇒ sensitivity studies
  - ⇒ closure cost
  - ⇒ rehabilitation cost

- Risk Assessment

A sensitivity study may require independent verification in certain circumstances.

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[1] A more detailed account will be provided in the Guidelines, which should be issued during 1997.

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