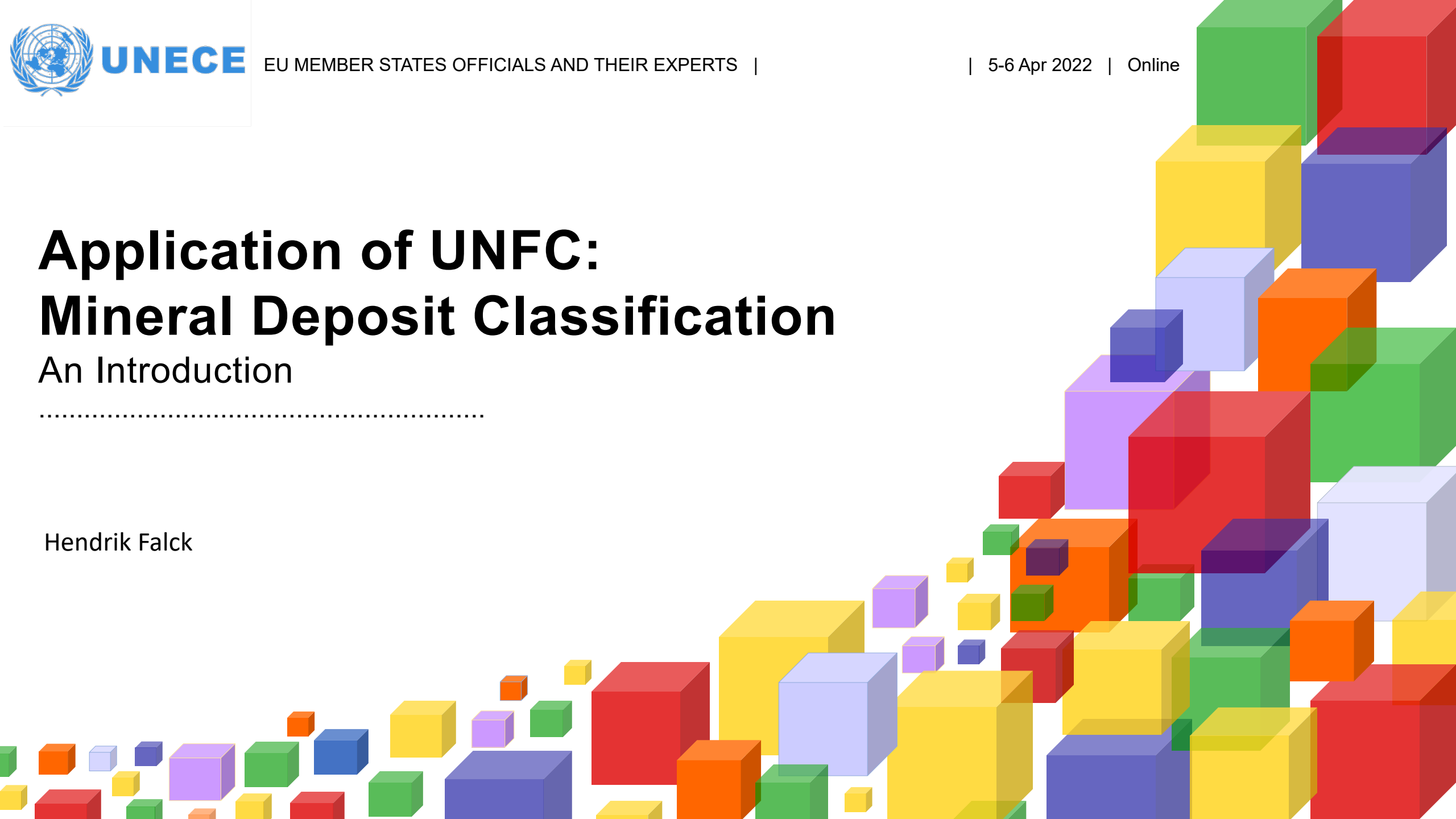


Application of UNFC: Mineral Deposit Classification

An Introduction

.....

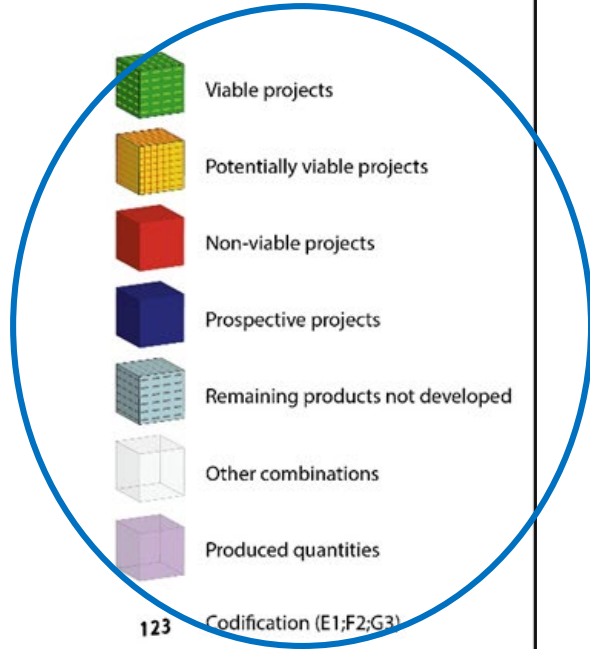
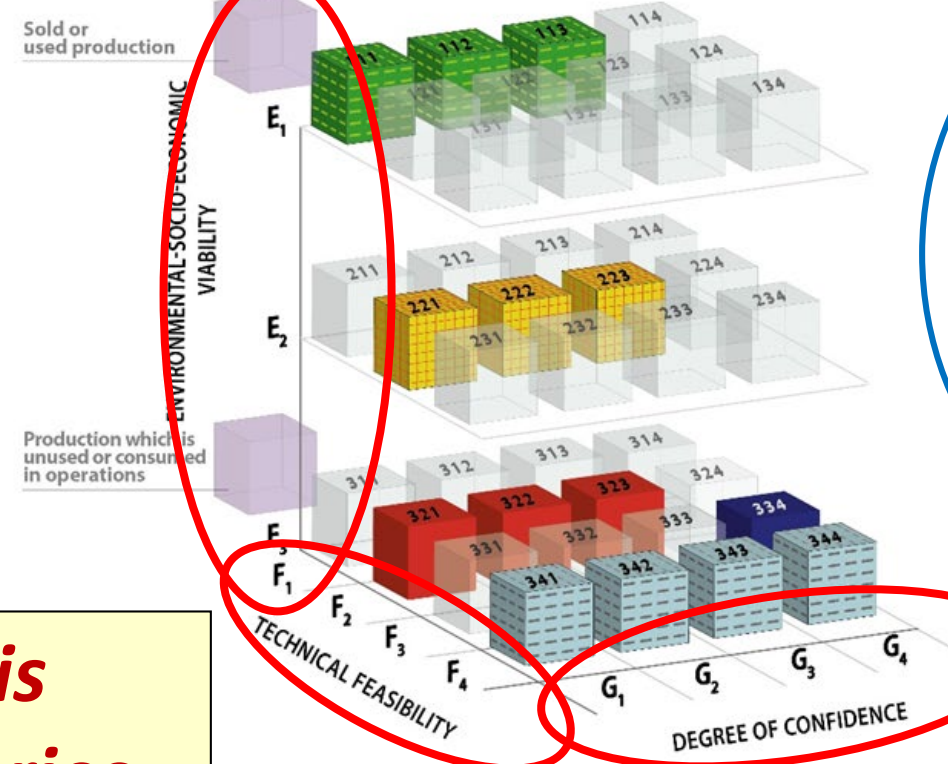
Hendrik Falck



Categories and Classes

Codification

E axis categories



Classes

F axis categories

G axis categories

Category definitions

E axis

- Degree of favourability of environmental social and economic conditions in establishing the viability of the project
- Includes consideration of market prices and relevant legal, regulatory, social, environmental and contractual conditions
- E1, E2 and E3 categories
- E1 is “best”
- Definitions should always be read in conjunction with supporting explanation

| Category | Definition |
|----------|--|
| E1 | Development and operation are confirmed to be environmentally-socially-economically viable. |
| E2 | Development and operation are expected to become environmentally-socially-economically viable in the foreseeable future. |
| E3 | Development and operation are not expected to become environmentally-socially-economically viable in the foreseeable future or evaluation is at too early a stage to determine environmental-socio-economic viability. |



Category definitions

F axis

- Maturity of technology, studies and commitments necessary to implement the project
- These projects range from early conceptual studies through to a fully developed project that is producing
- F1, F2 and F3 and F4 categories
- F1 is “best”
- Definitions should always be read in conjunction with supporting explanation

| Category | Definition |
|----------|---|
| F1 | Technical feasibility of a development project has been confirmed. |
| F2 | Technical feasibility of a development project is subject to further evaluation. |
| F3 | Technical feasibility of a development project cannot be evaluated due to limited technical data. |
| F4 | No development project has been identified. |



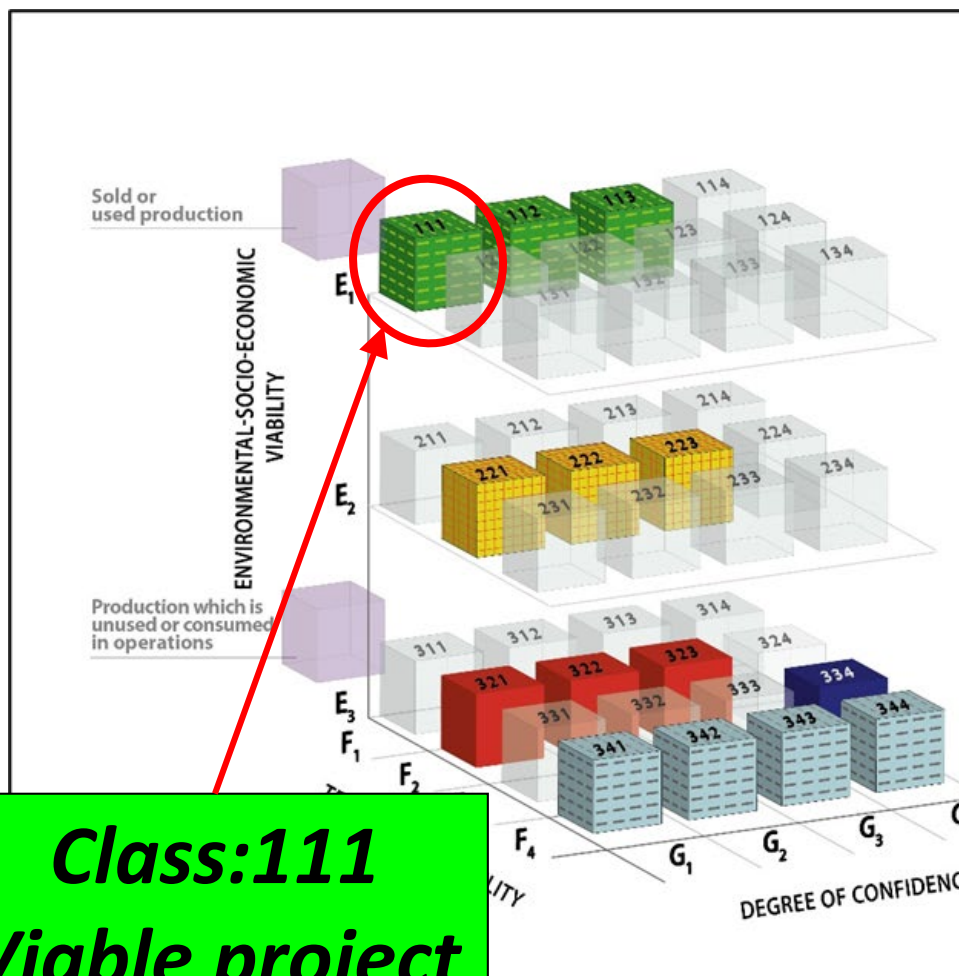
Category definitions

G axis

- Degree of confidence in the estimate of the quantities of products from the project
- Generally defined as discrete increments for solids (G1, G2, G3), but often defined as scenarios for fluids (G1, G1+G2, G1+G2+G3)
- G1, G2, G3 and G4 categories
- G1 is “highest confidence”
- Definitions should always be read in conjunction with supporting explanation

| Category | Definition |
|----------|---|
| G1 | Product quantity associated with a project that can be estimated with a high level of confidence. |
| G2 | Product quantity associated with a project that can be estimated with a moderate level of confidence. |
| G3 | Product quantity associated with a project that can be estimated with a low level of confidence. |
| G4 | Product quantity associated with a Prospective Project, estimated primarily on indirect evidence. |





Class:111
Viable project

| Category | Definition |
|----------|---|
| E1 | Development and operation are confirmed to be environmentally-socially-economically viable. |

| Category | Definition |
|----------|--|
| F1 | Technical feasibility of a development project has been confirmed. |

| Category | Definition |
|----------|---|
| G1 | Product quantity associated with a project that can be estimated with a high level of confidence. |



Supplementary Specifications

for the Application of

**the United Nations Framework Classification for
Resources to Minerals**

Done at Geneva, 24 September 2021

These minerals specifications are intended to support the attainment of the Sustainable Development Goals as relevant to the minerals industry.

Through their application, the collective industry will be directed towards the shared global goals.

This document incorporates the changes introduced by the recent update of UNFC (2019).



UNFC Classes and Sub-classes defined by Sub-categories

| <i>UNFC Classes Defined by Categories and Sub-categories</i> | | | | | | |
|--|---|--|---------------------------|----------------|---------|------------------------|
| | Produced | Sold or used production | | | | |
| | | Production which is unused or consumed in operations | | | | |
| | Class | Sub-Class | Categories | | | |
| | | | E | F | G | |
| Total Products | Known Sources | Viable Projects | On Production | 1 | 1.1 | 1, 2, (3) ^c |
| | | | Approved for Development | 1 | 1.2 | 1, 2, (3) ^c |
| | | | Justified for Development | 1 | 1.3 | 1, 2, (3) ^c |
| | | Potentially Viable Projects | Development Pending | 2 ^b | 2.1 | 1, 2, 3 |
| | | | Development on Hold | 2 | 2.2 | 1, 2, 3 |
| | | Non-Viable Projects | Development Unclassified | 3.2 | 2.2 | 1, 2, 3 |
| | Development not Viable | | 3.3 | 2.3 | 1, 2, 3 | |
| | Remaining products not developed from identified projects | | 3.3 | 4 | 1, 2, 3 | |
| | Potential Sources | Prospective Projects | [No Sub-classes defined] | 3.2 | 3 | 4 |
| | | Remaining products not developed from prospective projects | | 3.3 | 4 | 4 |

A Class is uniquely defined by selecting from each of the three criteria a particular combination of a Category or a Sub-category (or groups of Categories/Sub-categories). Since the codes are always quoted in the same sequence (i.e. E; F; G), the letters may be dropped and just the numbers retained.

While there are no explicit restrictions on the possible combinations of E, F and G Categories or Sub-categories, some may be more useful than others. For the more important combinations (Classes and Sub-classes), specific labels are provided as a support to the numerical code



Supplementary Specifications

for the Application of

**the United Nations Framework Classification for
Resources to Minerals**

Done at Geneva, 24 September 2021

- A. Overview
- A. Minerals project plan and definition
 - Prospecting/Exploration
 - Mining
 - Beneficiation
 - Processing
 - Decommissioning
 - Remediation.



Supplementary Specifications

for the Application of

**the United Nations Framework Classification for
Resources to Minerals**

Done at Geneva, 24 September 2021

- B. Minerals project lifetime
- C. Minerals project evaluation
- D. Project Classification
- E. Project reporting
 - Basis for the estimate
 - Effective date
 - Minerals product
 - Reference point
 - Aggregation of quantities
 - Use of Numerical Codes
 - Units and Conversion Factors
 - Documentation
 - Avoidance of double counting
 - National reporting

Supplemental Specifications for Mineral Projects

Mineral project plan and definition

- **Prospecting/Exploration**
- **Mining**
- **Beneficiation / Processing**
- **Decommissioning**
- **Remediation**

Mineral Project Lifetime

Project Lifetime is the remaining period of time that a project is expected to operate, constrained by technical, economic, regulatory or other permit/license cut-offs.

Mineral project lifetime is normally constrained by the period for which prospecting, exploration or mining license may apply for the project.

Mining license may include beneficiation, processing, decommissioning and remediation stages of the mineral lifecycle.

Mineral project evaluation

Mineral projects may adopt various methodologies in the various stages of the mineral lifecycle including in the estimation of quantities as appropriate to the project. The basis for any estimations shall be appropriately referenced in the evaluation. This includes not only third-party data but also methodologies or procedures that have been used by the evaluating entity to generate in-house data.

Mineral project evaluation

Mineral projects may adopt various methodologies in the various stages of the mineral lifecycle including in the estimation of quantities as appropriate to the project. The basis for any estimations shall be appropriately referenced in the evaluation. This includes not only third-party data but also methodologies or procedures that have been used by the evaluating entity to generate in-house data.

G-Axis Considerations

- Product quantity estimates may be categorised discretely as G1, G2 and/or G3 (along with the appropriate E and F Categories), based on the degree of confidence in the estimates (high, moderate and low confidence, respectively) based on direct evidence.

Additional Comments

- The G axis in minerals and mining conditions primarily reflect geologic uncertainty impacting the estimate forecast for the project. Uncertainties include availability and resolution of direct data such as drill hole density in relation to the mineralisation and or deposit type. In addition, indirect data such as geophysical data might be included, which should be measured against redundancy of methods (e.g. geophysical measurements calibrated against drill core evaluation, drill hole logs. Calibrated methods provide higher certainty than uncalibrated methods.) The accuracy of measurements controls the level of the category (lab assay, rock mechanics, mineralogical phase assessment).

See Page 16 of the Mineral Specifications

Project Classification

Classification of projects based on the level of maturity

Where it is considered appropriate or helpful to sub-classify mineral projects to reflect different levels of project maturity, based on the current status of the project, optional sub-classes may be adopted.

Distinction between Environmental-Socio-Economic assumptions

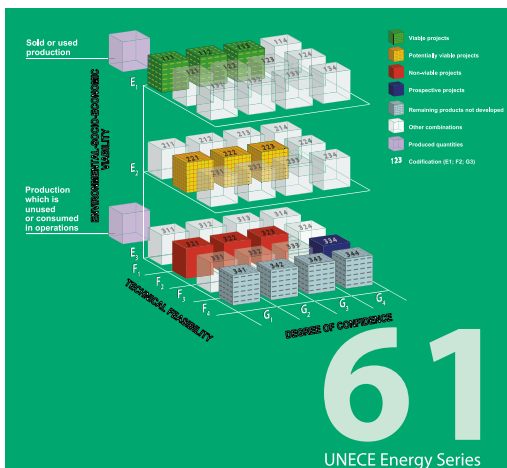
The environmental-socio-economic axis categories encompass the non-technical issues that directly impact the viability of a project, including product prices, costs, legal/fiscal framework, environmental regulations and known environmental or social impediments, barriers or benefits

Distinction between potentially produced quantities and undeveloped quantities

Quantities of products associated with projects are categorized as F1 to F3 as potentially developable using existing technology or technology currently under development or operation. There may be remaining quantities with no development project. The product quantity associated with these are categorized as F4. These are quantities which, if produced, could be bought, sold or used.



**United Nations Framework
Classification for Resources**
Update 2019



Category definitions for Minerals

International Reporting Standards

Use of UNFC

UNFC provides a method for governments and NGOs to incorporate published data into databases, mineral inventories, etc.

Use of PERC (CRIRSCO)

PERC is recognised by ESMA for use on European Union stock exchanges (ESMA = European Securities and Markets Authority)

Accepted on a number of other stock exchanges around the world (Canada, Singapore, ...)



INTERNATIONAL REPORTING TEMPLATE

for the public reporting of

EXPLORATION TARGETS, EXPLORATION
RESULTS, MINERAL RESOURCES AND MINERAL
RESERVES

November 2019



Category definitions for Minerals International Reporting Standards

Topical - Industrial Minerals

PERC, CRIRSCO, and UNFC: minerals reporting standards and classifications

Stephen Henley* and Ruth Allington

There are two internationally recognised systems for classification and reporting of reserves and resources of solid minerals: the CRIRSCO family of reporting standards and the United Nations Framework Classification (UNFC). Despite a common perception that these are in competition, they are in fact closely linked, and they address different sets of requirements. The CRIRSCO standards, which include PERC, JORC, and the Canadian CIM standard among others, were developed for public reporting by companies listed on stock exchanges to provide a consistent terminology as well as quality assurance in company estimates of mineral resources and reserves. The underlying objective is protection of the public (in this case investors) by ensuring that the reports produced use consistent terminology and core content so that they can be understood and compared, and that those who prepare public disclosure reports are competent to do so and are prepared to take personal responsibility for their own work. There are minor differences among the CRIRSCO standards as a result of differing regulatory regimes in the countries in which they are used, but all share identical core definitions and classification. The United Nations classification was developed to provide an all-inclusive system that could be used for mineral inventories and minerals policy planning by governments and companies alike. Where the two systems overlap, CRIRSCO provides the detailed specifications for the corresponding UNFC categories. This paper outlines the history and use of the two systems.

Il existe deux systèmes, avec reconnaissance internationale, concernant la classification et le compte-rendu des réserves et des ressources minières : le CRIRSCO définissant les modalités de rapport et le Système de Classification des Nations Unies (UNFC). Bien que ces deux systèmes soient perçus communément comme en compétition, ils sont en fait étroitement liés et répondent à des besoins différents. Les standards du CRIRSCO qui incluent entre autres les standards du PERC, du JORC et du canadien CIM ont été établis pour les rapports publics émis par les compagnies représentées à la Bourse, pour fournir une terminologie cohérente et aussi une assurance qualité dans l'estimation par une Compagnie des ressources et réserves minières. L'objectif sous-jacent est la protection du public (les investisseurs ici) en garantissant que les rapports émis utilisent une terminologie cohérente, un exposé de la réalité de telle manière qu'ils puissent être compris et comparés et que ceux en charge d'élaborer les rapports destinés au public soient compétents pour le faire et prêts personnellement à assumer leur responsabilité pour leur propre travail. Il existe quelques différences mineures dans les standards CRIRSCO provenant des différents systèmes de régulations pour les pays où elles sont utilisées mais tous les rapports partagent les mêmes définitions de fond et la même classification. L'UNFC a été créée pour fournir un système complet pouvant servir aussi bien pour un inventaire minier que pour un programme de politique minière définie par les gouvernements et les compagnies. Là où les deux systèmes se recouvrent, le CRIRSCO fournit des spécifications détaillées pour les catégories correspondantes de l'UNFC. Cet article décrit l'histoire et l'utilisation des deux systèmes.

Existen dos sistemas de clasificación y declaración de recursos minerales reconocidos internacionalmente: la familia de los códigos CRIRSCO y la Clasificación Marco de Naciones Unidas (UNFC). A pesar de que existe una cierta percepción de que ambas compiten entre ellas, en realidad están íntimamente relacionadas y se refieren a una serie de requisitos diferentes. Las normas CRIRSCO, que incluyen -entre otras- a las PERC, JORC y la norma canadiense CIM, se desarrollaron para la declaración pública de compañías cotizadas en las bolsas de valores, con objeto de proporcionar una terminología unificada así como el control de calidad en las estimaciones de recursos y reservas de las empresas. El objetivo de fondo es la protección del público (en este caso los inversores) asegurando que los informes emitidos tienen una terminología y contenido nuclear congruente de modo que se puedan entender y comparar y que los autores de esos informes para el público tengan la adecuada competencia y estén dispuestos a asumir la responsabilidad personal que implica su firma. Hay pequeñas diferencias entre las normas CRIRSCO como consecuencia de los diferentes regímenes regulatorios en los países en los que se utilizan, pero todas tienen las definiciones y clasificaciones fundamentales idénticas. La clasificación de Naciones Unidas se desarrolló para proporcionar un sistema global que se pudiera utilizar en inventarios minerales y en planes de planificación minera tanto por Gobiernos como por empresas. En aquello en que los dos sistemas se solapan, CRIRSCO proporciona las especificaciones detalladas para las categorías UNFC correspondientes. En este artículo se describe la historia y el uso de los dos sistemas.

Mineral resources and reserves have been estimated systematically for many decades, but with expansion of the minerals industry interna-

tionally, and with increasing involvement of capital markets in financing mining ventures, it became clear during the 1980s and 1990s that systematisation and regulation were needed. An early warning sign came in 1970-71 when a major nickel discovery by Poseidon in Western Australia sparked a wave of speculative company flotations,

many based upon unsubstantiated estimates of resources. A much more serious case was the Bre-X fraud in 1997, in which a Canadian company announced a gigantic gold discovery in Indonesia based on data from drill-hole core which had been 'enriched' before assaying with extra gold grains. In both cases - and in many other smaller scale

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PERC, CRIRSCO, and UNFC: minerals reporting standards and classifications

Stephen Henley* and Ruth Allington

European Geologist vol. 36, Nov. 2013

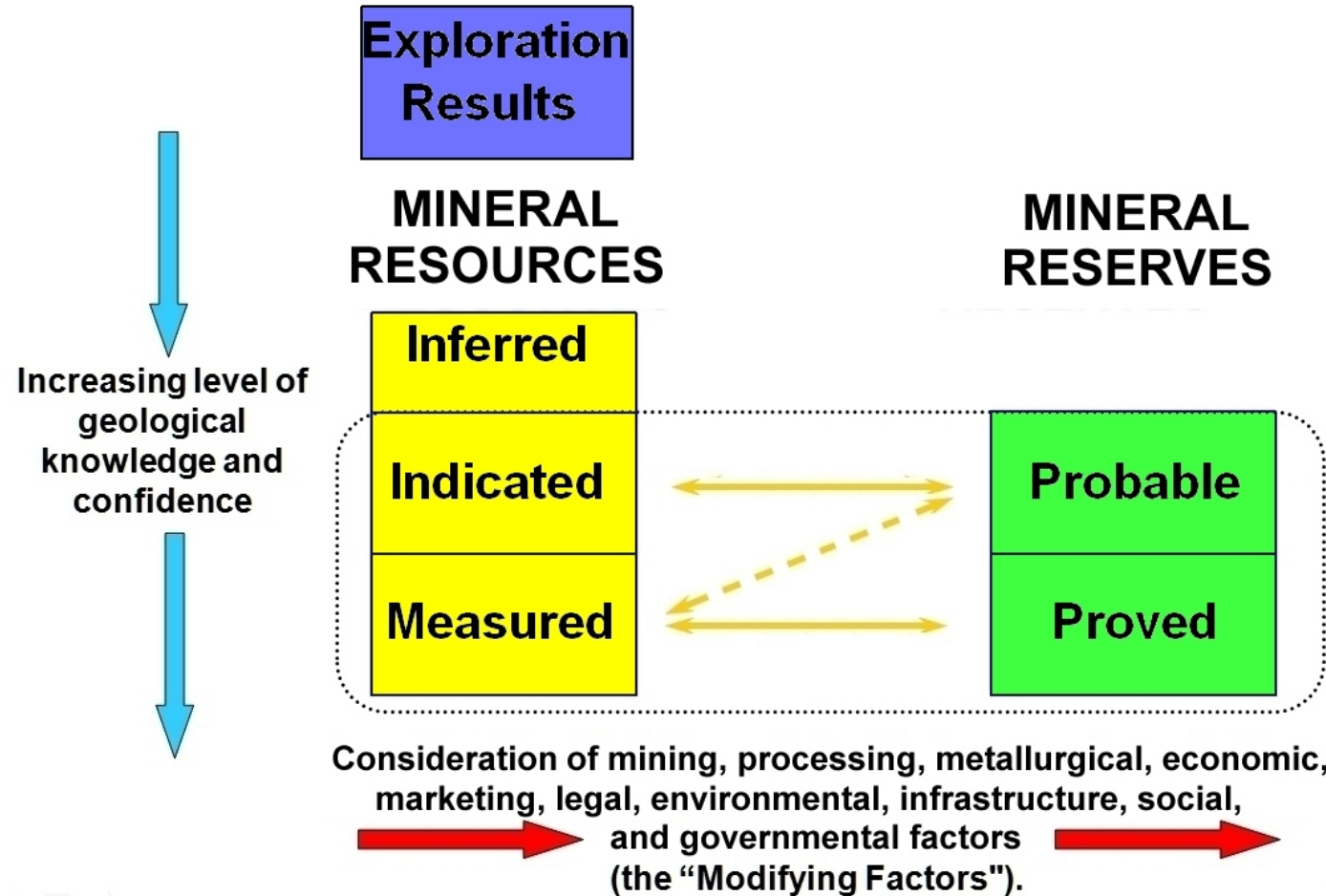
<https://percstandard.org/wp-content/uploads/2021/06/EGM-PAPER-PERC2013.pdf>



Category definitions for Minerals

International Reporting Standards

The CRIRSCO classification



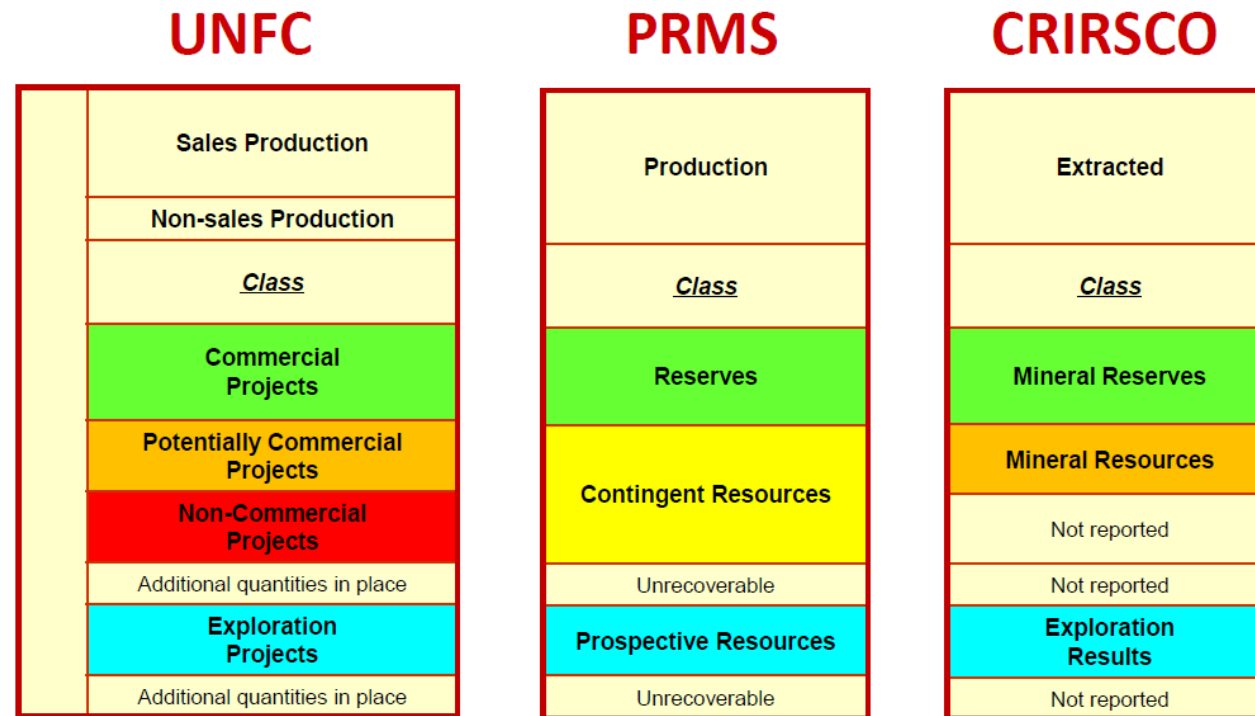
Category definitions for Minerals

International Reporting Standards

Alignment of systems (schematic)



UNECE



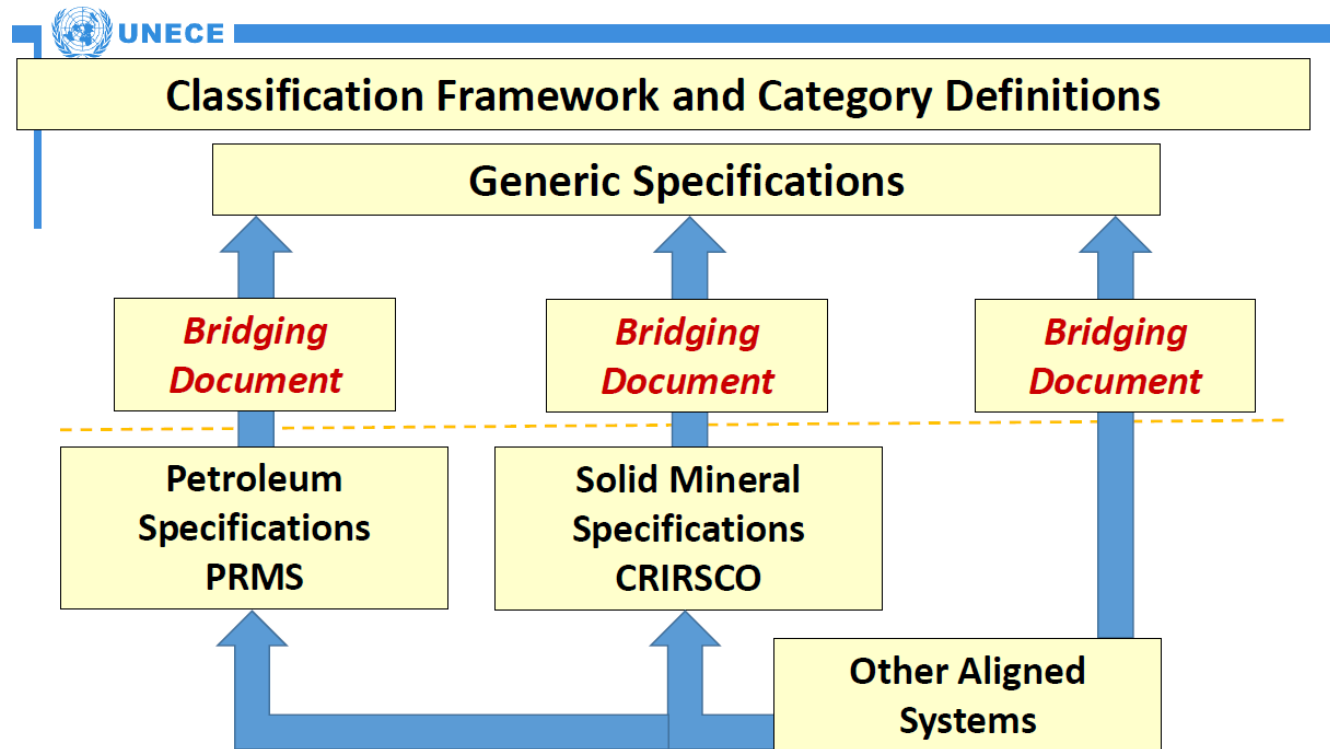
UNECE



Category definitions for Minerals

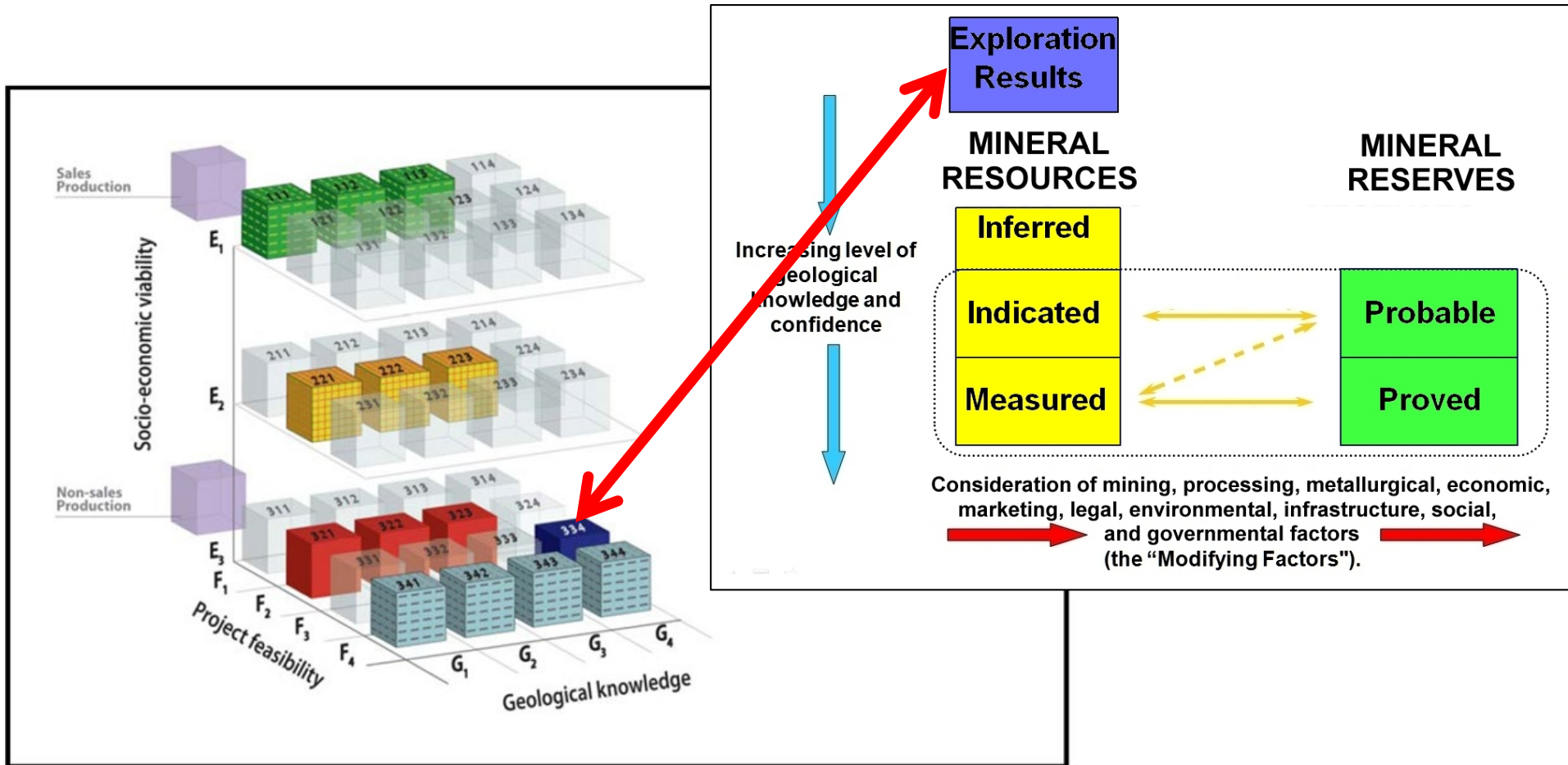
International Reporting Standards

Bridging and Aligned Systems



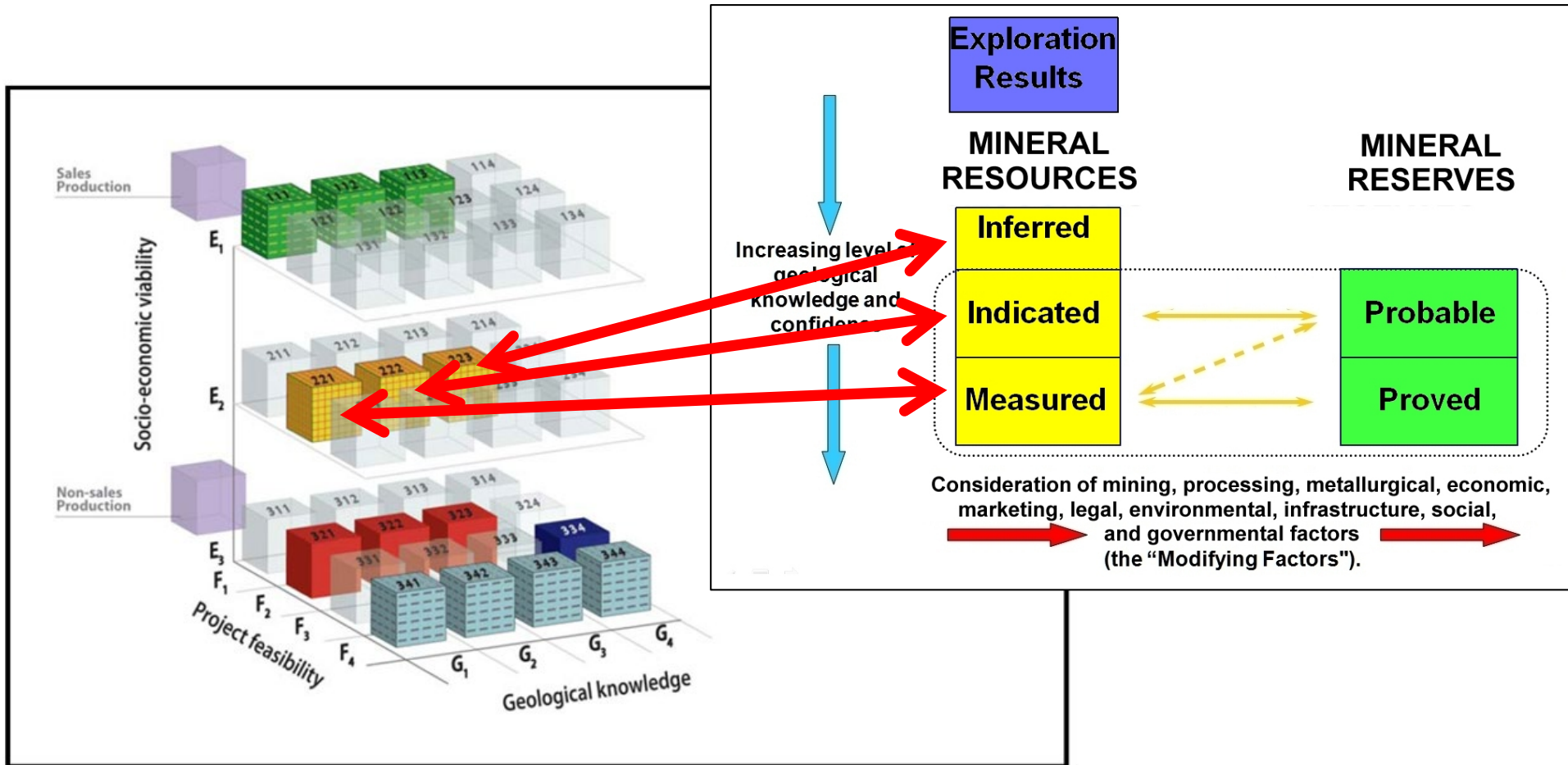
Category definitions for Minerals

UNFC/CRIRSCO Default Mappings



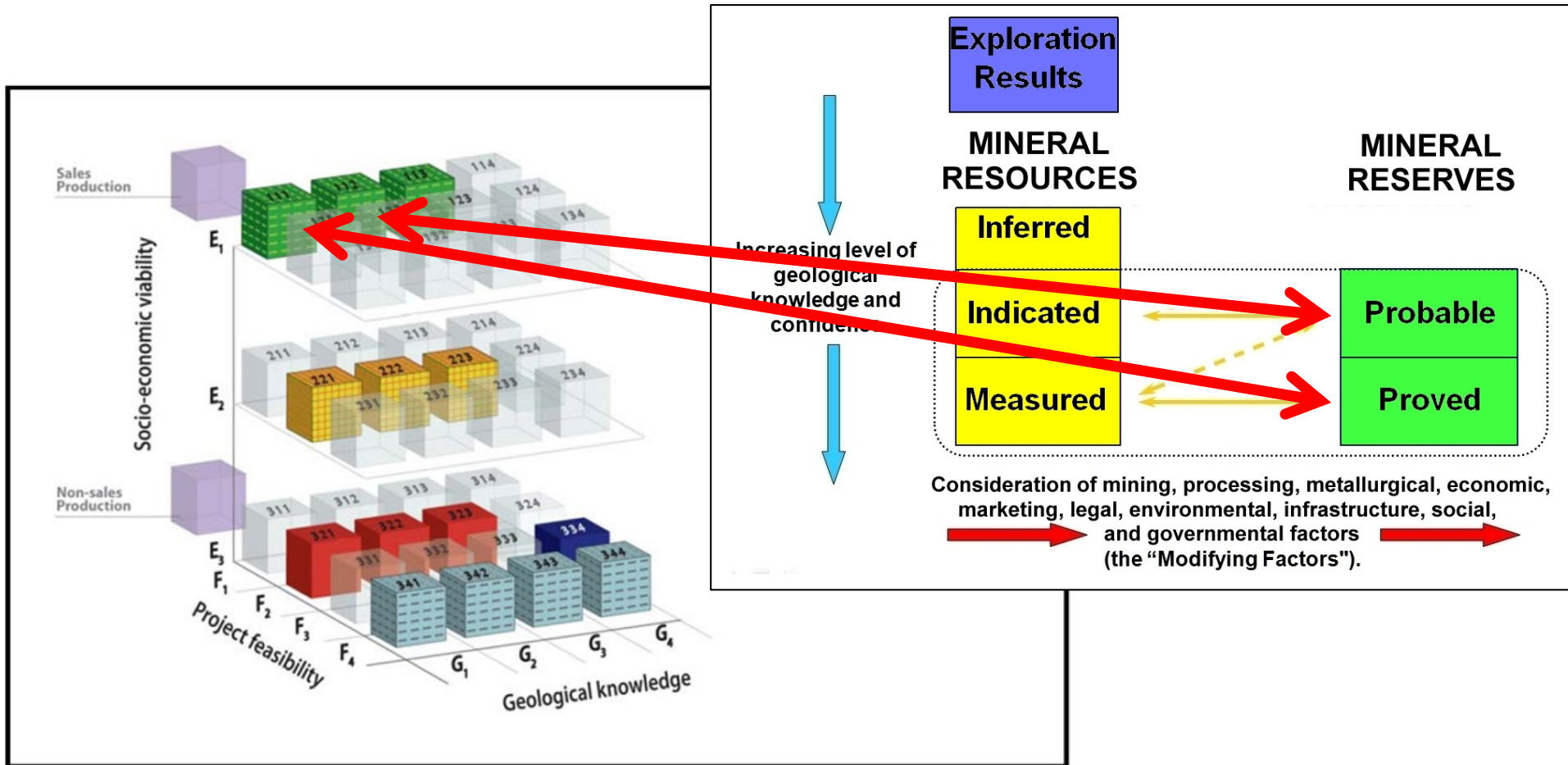
Category definitions for Minerals

UNFC/CRIRSCO Default Mappings



Category definitions for Minerals

UNFC/CRIRSCO Default Mappings





Thank you!

Hendrik Falck
Co-Chair Minerals Working Group

[UNECE](#)

Date 05| 04 | 2022, Yellowknife, Canada

