



Australian Government
Geoscience Australia



Identification of any issues arising from differences in national reporting standards to which the Authority should respond

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Presentation Outline

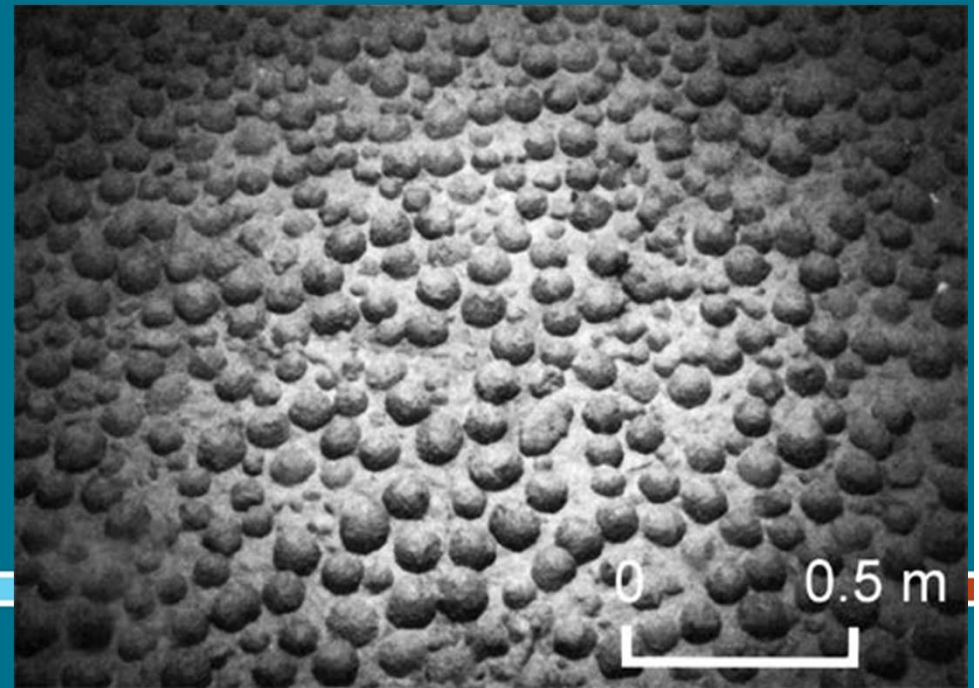
Describes Australian national minerals resources reporting system, based on company reports of individual deposits, but reported differently

Reviews jurisdictional reporting under the UNFC, by detailing how Australia's national system maps to the Committee for Mineral Reserves International Reporting Standards (CRIRSCO) Template and UNFC, informing on resources likely to be available for mining over time

Details relevance of CRIRSCO, UNFC and other reporting schemes to issues facing the International Seabed Authority

Unique seabed resource considerations and issues arising from differences in reporting standards

Establishes framework for mining



Introductory Comments

Jurisdictions (usually countries) with significant mining sectors should regularly evaluate known and available mineral resource stocks

- Consistent, standard information provides a basis for policy and decisions regarding what is likely to be available for mining

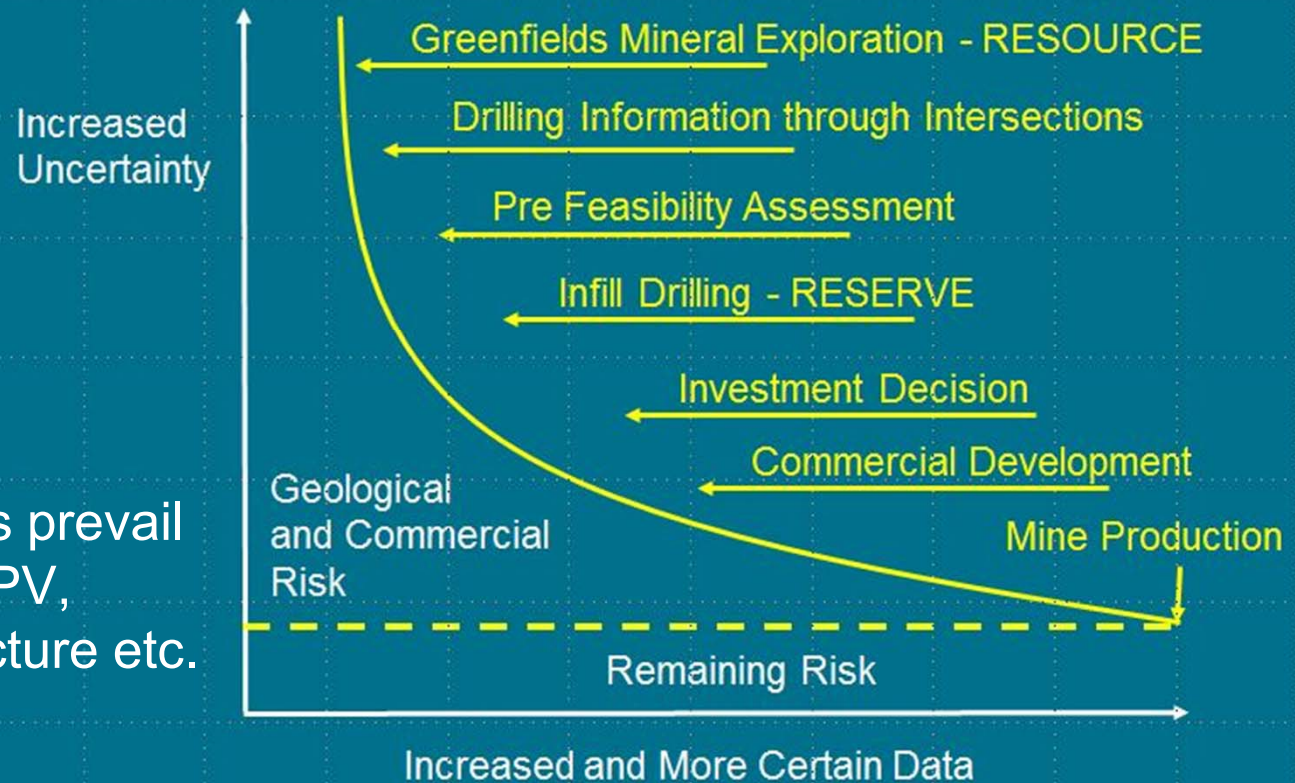
Ideal time at this early stage to set the framework for the International Seabed Authority to work with experts from UNECE in agreeing the details of a reporting regime that captures the maximum amount of relevant information



Economic Mineral Assessment

- A mineral resource represents a geological concentration of an element which has reasonable prospects for eventual economic extraction.

Mineral Resource - Information and Risk Curve



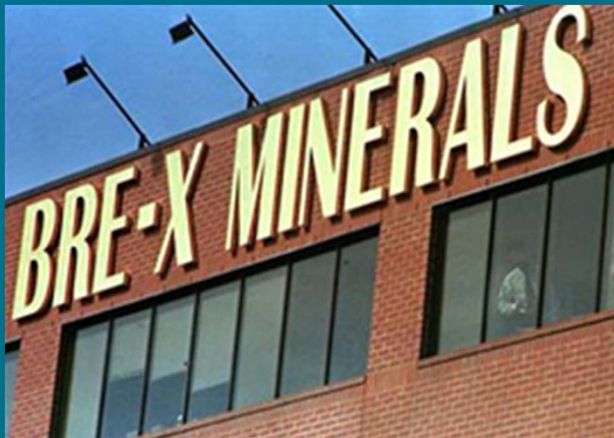
- Commercial and economic factors prevail – Risk, Legal, NPV, Social, Infrastructure etc.

Management of Risk

Many project risks stem from the financial trade offs in securing information, for the technical side of projects, striking a balance with increased information is the key to reducing risk

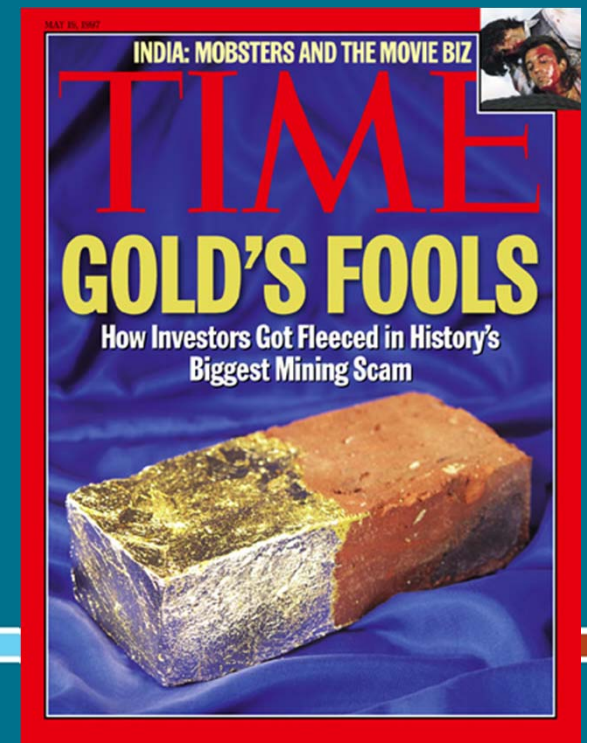
Resource reporting requires systematic responses and enforcement, scientific truth and rigour is critical

Commercial risks, such as the market can be managed but not prevented



Bre-X Borneo Indonesia
Feb.1997 200 million oz.
March 1997 Freeport finds inconsistencies in core

Bre-X geologist falls 250m from a helicopter



What do countries report?

United States Geological Survey (USGS) publishes “Reserves”

- Comparable to Australia’s Economic Demonstrated Resources (EDR)
- USGS “Reserves” do not equate with JORC/CRIRSCO “Reserves”

Canada publishes Reserves (JORC equivalent) in operating mines, but not resources – shorter term perspective on national - to avoid confusion UNFC-2009 explicitly avoids use of the word “reserves”

Global inventories not well known, country comparisons unreliable

CRIRSCO “Resources” for deposits of varying commercial attractiveness

- Granularity in commercial data, deposits short term to long term

UNFC sub-classes “**Development Pending**” and “**Development on Hold**” provide a useful subdivision and indicate general development time frame and would provide ISA with some economic guidance

Identification of Systemic Issues

Australian national minerals resources reporting system is based on company reports, but reported differently and maps Australia's national system to CRIRSCO (*Committee for Mineral Reserves International Reporting Standards*) Template and UNFC (*United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources*)

Governments with strong parallels to the jurisdictional bodies such as the International Seabed Authority (ISA) find difficulty conducting resource assessments for all known mineral deposits, Staffing/expertise limitations and lack of access to sensitive data on economic viability of deposits

Effective national/jurisdictional reporting requires access to company reports on individual deposits, some companies use UNFC for internal reporting purposes due to greater granularity

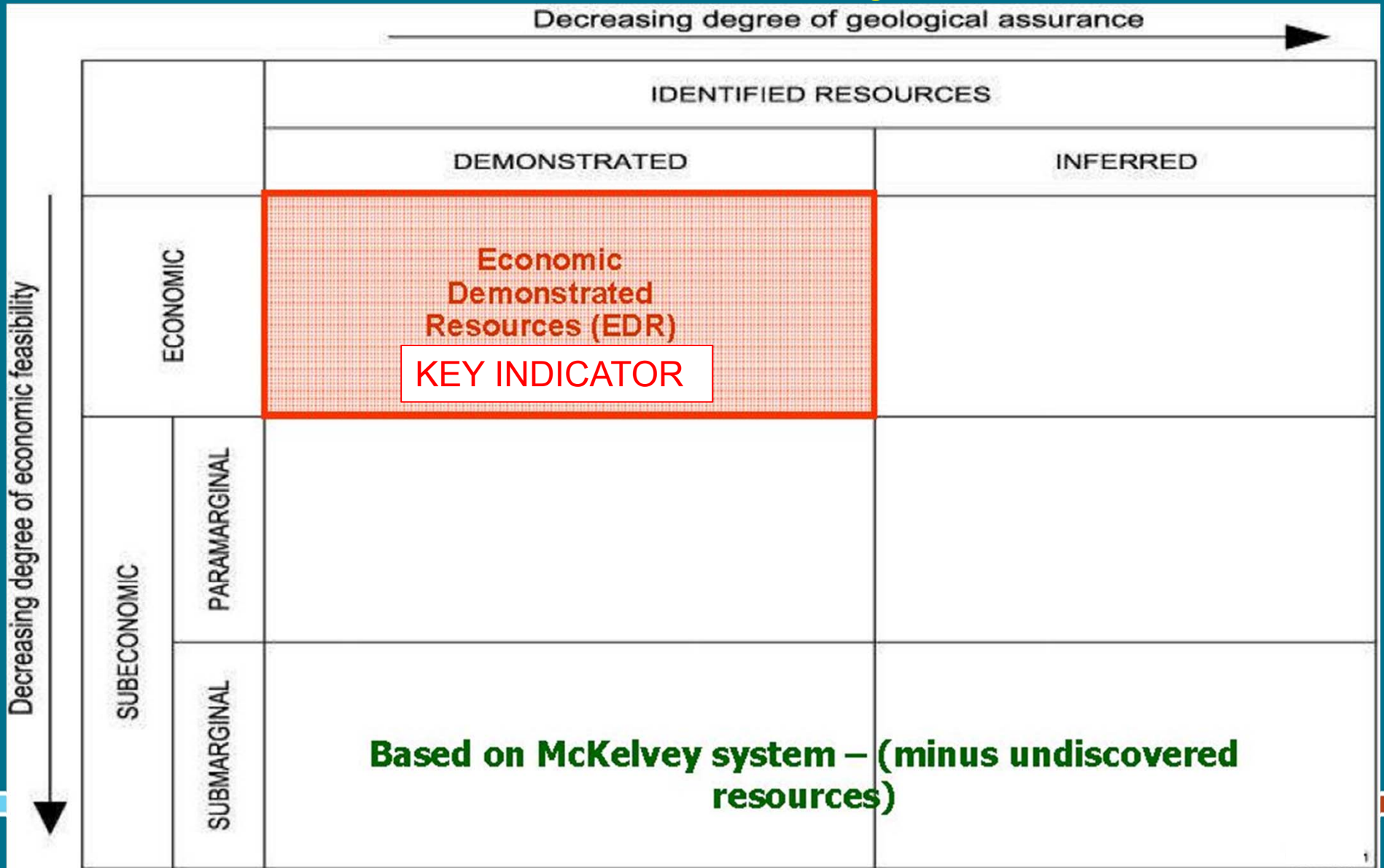


Australian Experience

Based initially upon the USGS McKelvey mineral assessment system, Geoscience Australia (and prior organizations) has conducted an annual nationwide assessment of Australia's identified resources since 1975

- To **assist long-term Australian government policies** by providing information on what is likely to be available for mining.
- GA "Resources" (including sub-economic resources) must have "**reasonable prospects for economic extraction**" in the foreseeable future
- The **Economic Demonstrated Resources (EDR)** in the Australian national resource system is the key resource category applied in policy development, particularly for land use issues.
- Australia's national mineral resource inventory is published online as ***Australia's Identified Mineral Resources***
- Companies are required to report publicly, using the CRIRSCO (*Committee for Mineral Reserves International Reporting Standards*), which in Australia is the JORC (*Joint Ores Reserves Committee*) Code

Estimating and reporting national mineral inventories: Australia's system



Detail in Australia's national reporting

Australia's EDR may be sub-divided to distinguish what is likely to be available in short, intermediate and longer time frames

- Economic Resources (“EDR 1”) = JORC Proven and Probable Ore Reserves = UNFC Commercial projects (11x)
- Potential Medium Term Economic Resources (“EDR 2”) = JORC Measured and Indicated Mineral Resources in existing mines and undeveloped deposits which have had a positive feasibility study/development has been announced = UNFC Potentially commercial projects – development pending (22x)
- Potential Long Term Economic Resources (“EDR 3”) = JORC Measured and Indicated Mineral Resources in deposits where grade and tonnage characteristics are similar to deposits mined elsewhere, but not subjected to a feasibility study/current consideration of mining = UNFC Potentially commercial projects – development on hold (32x)

Total EDR = EDR1 + EDR2 + EDR3

Correlation of Australia's resource system and UNFC

The Committee for Mineral Reserves International Reporting Standards (CRIRSCO) template **is the international system** for public reporting of mineral reserves and resources in individual deposits

- CRIRSCO Template is equivalent to Australia's JORC Code from which much of Australia's resource inventory is derived
- Correlation between the Australian national resource system and the UNFC-2009 must comply with the CRIRSCO bridging document in Annex III of the Specifications Document.
- The **JORC Reserves** component of EDR correlates with the UNFC's class of Commercial Projects as defined by mineral resource categories 111 & 112.
- The **JORC Resources** component correlates with Potentially Commercial Projects as defined by categories 221 & 222.
- **Inferred Resources** are identified by the UNFC geological criterion G3 and are defined by 223.

Detailed correlation, Australia's system with UNFC

National perspectives		UNFC Classes defined by categories and sub-categories								
		Extracted	Sales production		Non-sales production					
			Class	Sub-class	Categories					
				E	F	G				
Short term	Total commodity in place	Known deposit	Commercial projects	EDR 1	On production	1	1.1	1	2	
					Approved for development	1	1.2	1	2	
					Justified for development	1	1.3	1	2	
Intermediate term	Total commodity in place	Known deposit	Potentially commercial projects	EDR 2	Development pending	2	2.1	1	2	3
				EDR 3	Development on hold	2	2.2	1	2	3
Long term	Total commodity in place	Known deposit	Non-commercial projects		Development unclarified	3.2	2.2	1	2	3
					Development not viable*	3.3	2.3	1	2	3
				Additional quantities in place		3.3	4	1	2	3
			Potential deposit	Exploration projects	(No sub-classes defined)	3.2	3			
			Additional quantities in place		3.3	4				4

UNFC Axes

Australia's National Resource System



From company reports to a national inventory

Australia's mineral resources inventory is based on company reports made available on the Australian Securities Exchange (ASX)

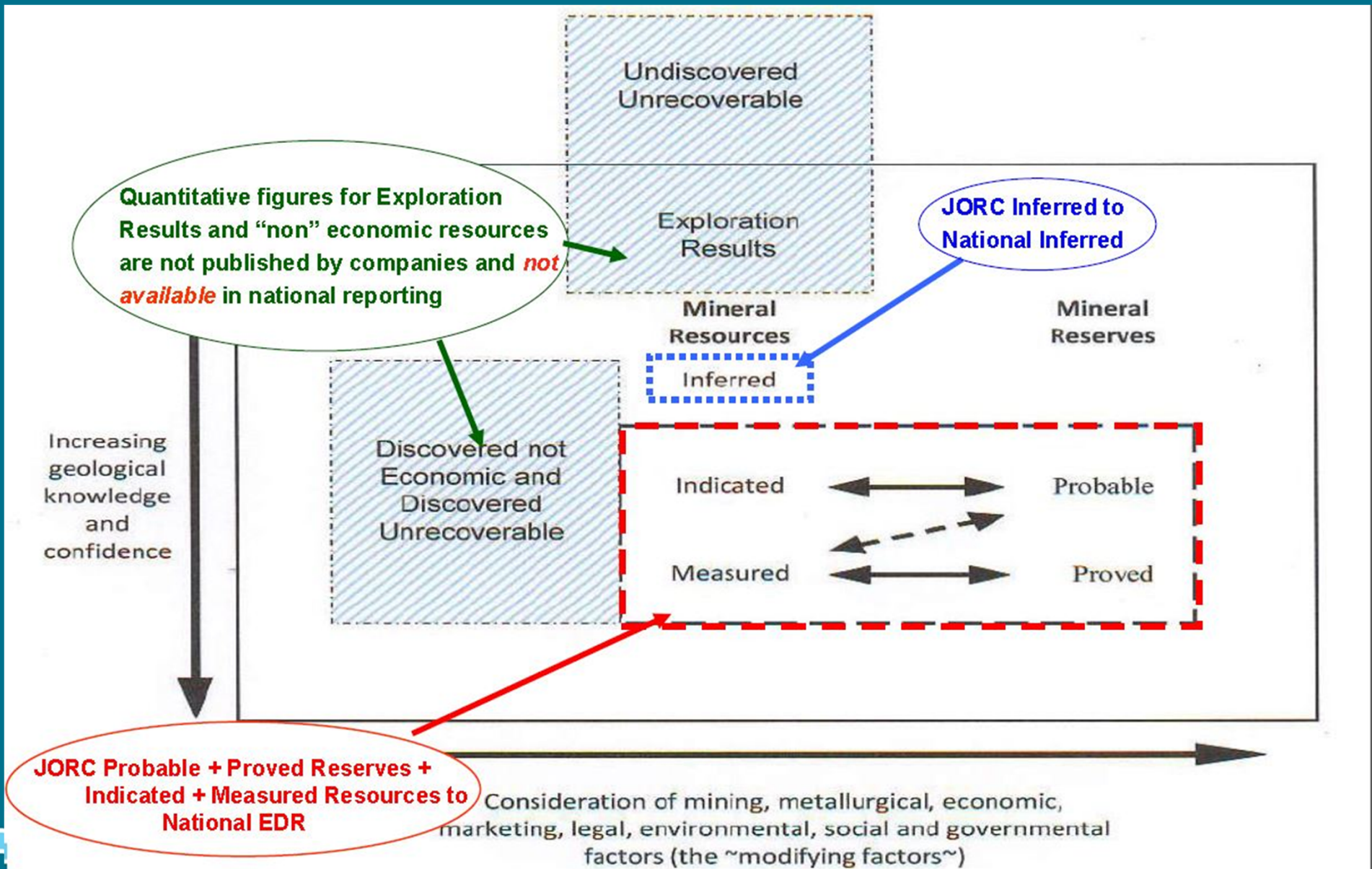
Companies listed on the ASX report publicly on Ore Reserves and Mineral Resources, using the Joint Ore Reserves Committee (JORC) Code (<http://www.jorc.org/>)

JORC Resources must have “reasonable prospects for economic extraction” in the foreseeable future: JORC Reserves provide a commercial (short term) view of what is to be mined

Parallels with the International Seabed Authority and reports produced by Contractors in the Area

Economic Demonstrated Resources (EDR) are current JORC Code Resources, along with historic company reports and GA estimates, however, the information is not sufficient to determine economic status

What is available from company reports?



Granularity in national reporting

Australia's Economic Demonstrated Resources (EDR) can sub-divided to:

- Distinguish what is likely to be available in short, intermediate and longer time frames

Based on different levels of assurance of production

Australia's EDR can readily be mapped to the UNFC, providing a reasonable and objective indication of what is likely to be available for mining in the foreseeable future (25 years)

For the national context adding JORC Reserves and Resources is not considered a problem, both "inherently economic"

– EDR "anticipates" movement of Resources to Reserves

In addition to EDR, Geoscience Australia also reports national JORC Reserves and Inferred Resources in separate categories

National/jurisdictional informational mineral inventories: Not a precise science

Estimating the total amount of each commodity likely to be available for mining in the longer term is not a precise science

- CRIRSCO (JORC) 'Reserves', will generally be mined
- Most CRIRSCO 'Measured' and 'Indicated' Resources could be mined
- Some current JORC 'Inferred' Resources will also be mined
- Some subeconomic resources will become commercial
- New discoveries (including extensions to known deposits) will add to the resource inventory

Limited commercial issues for the International Seabed Authority

- ISA reporting requirements reflect national reporting

Company reports to jurisdictional inventory

CRIRSCO Template provides standards for public reporting by mining companies - CRIRSCO Template reporting code for Australasia (JORC)

All resources must have “**reasonable prospects for economic extraction**”

Several JORC categories are aggregated into the key national reporting category = **Economic demonstrated Resources (EDR)**

Provides long-term perspectives of what is likely to be available for mining

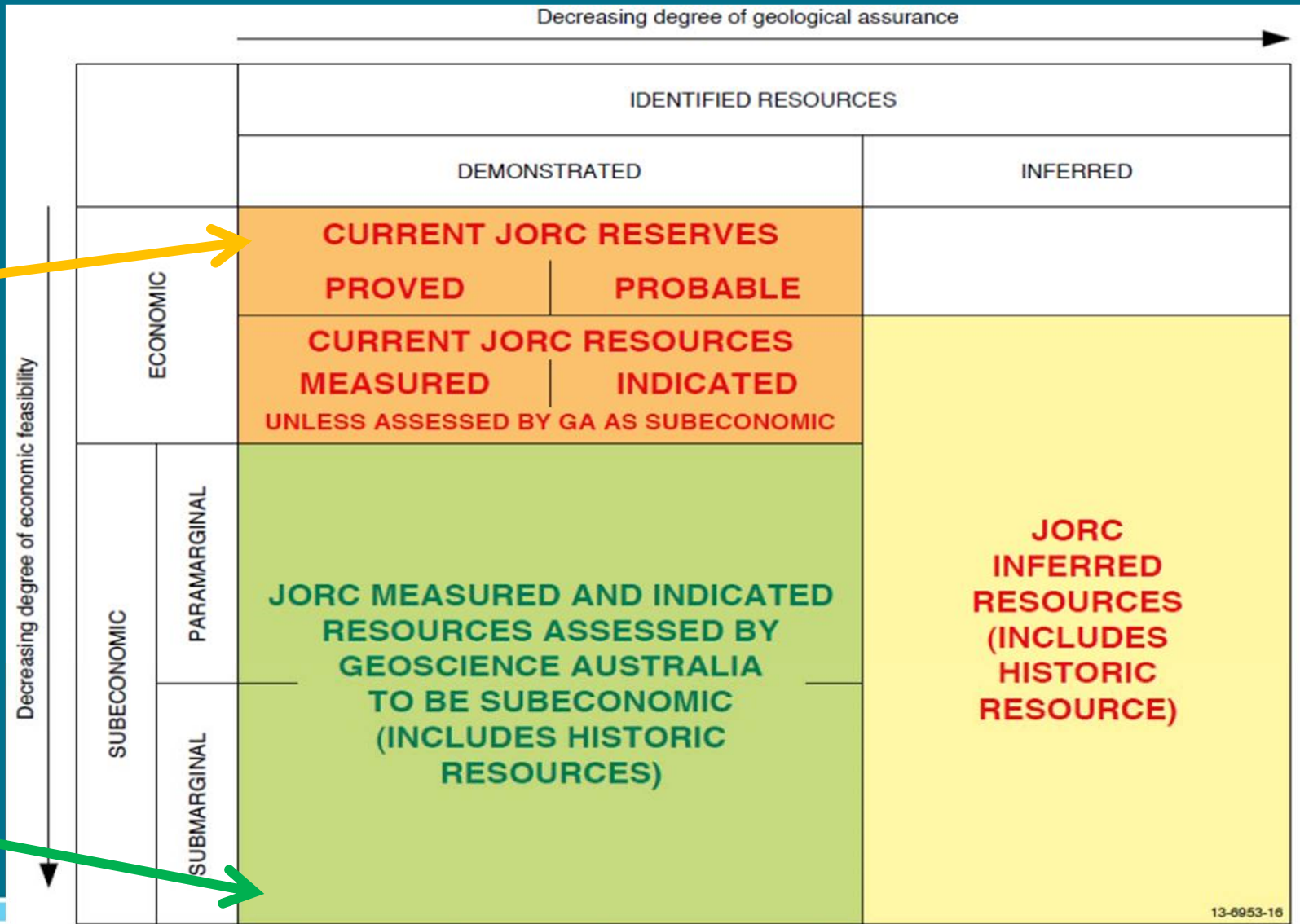
Aggregation must take into account whether Resources are inclusive or exclusive of Reserves



Australian company reports to jurisdictional inventory

EDR
Prov.
Prob.
Meas.
Indic.

Sub-
Econ



 Economic Demonstrated Resources (EDR)

How are national/jursidictional resources reported?

National resources are reported as tonnes of individual commodities

Many mineral deposits have more than one commodity, financial credits from by-products

- Commodity mixes and grades vary
- Meaningless to report national grades and tonnages, the tonnage only is pertinent to making a national/jurisdictional assessment

National/jurisdictional resources are derived from commercial company reports, but are presented differently for a separate objective

Copper case study: National System Limitations

Copper occurs in different types of deposits with a range of different metals. For example:

Project 1:

Reserves = 355mt @ 1.2% Cu; 3g/t Au

Measured and Indicated Resources = 245mt @ 1.0%Cu; 2g/t Au

(Exclusive of Reserves)

Project 2:

Reserves = 556mt @ 0.9% Cu; 0.05% U; 1g/t Au

Resources = 796mt @ 0.8% Cu; 0.04% U; 0.8g/t Au

(Inclusive of Reserves)

Project 3:

Reserves = 90mt @2.3% Cu

Resources = 113mt @ 2.0% Cu

(Inclusive of Reserves)

What is reported in Australia's national inventory?

Includes CRIRSCO Reserves

Commodity	Units	Australia							World	
		JORC Reserves (% of Accessible EDR)	Demonstrated Resources			Inferred Resources	Accessible EDR	Mine Production 2013	Economic Resources 2013	Mine production 2013
			Economic (EDR)	Subeconomic						
			Para-marginal	Sub-marginal						
Antimony	kt Sb	63 (47%)	134	9	0	207	134	5.0	1800	163
Bauxite	Mt	2125 (33%)	6464	144	1429	1558	6464	81.1	28 000	263
Black coal										
<i>in situ</i>	Mt		79 074	1552	5341	93 773				
<i>recoverable</i>	Mt	20 657 (37%)	62 095	1225	4017	64 041	55 213	538 ^(h)	690 530 ⁽ⁱ⁾	6926 ^{(j)(k)}
Brown coal										
<i>in situ</i>	Mt		49 075	37 465	16 873	123 529				
<i>recoverable</i>	Mt	n.a. ^(l)	44 164	33 402	15 185	103 052	34 095	73 ⁽ⁱ⁾	201 000 ⁽ⁱ⁾	905 ^(k)
Cobalt	kt Co	385 (36%)	1068	285	29	1228	1068	6.40 ^(m)	7271	117.00
Copper	Mt Cu	25.5 (27%)	93.1	1.4	0.4	44.1	93.1	1.0	696	17.9

Mapping to a universal template

It is useful to map the various classification and reporting systems for mineral and energy resources to a common base to

- Check harmony between the systems
- Enable valid comparisons between countries'/jurisdictions' inventories and better estimates of total world stocks

The UNFC-2009 is a universal template

- Covers more resource categories than CRIRSCO Template – particularly along the E axis
- Includes non-commercial and undiscovered

UNFC as universal template

UNFC development has drawn on reporting of individual deposit scale

- Important to get this agreed – now differences between systems have been illuminated
- Focus shifting to harmony with national reporting

Industry, financial, national and international resource reporting systems are being/should be mapped to UNFC-2009

- To clarify the similarities and differences between systems in use around the world and align reporting

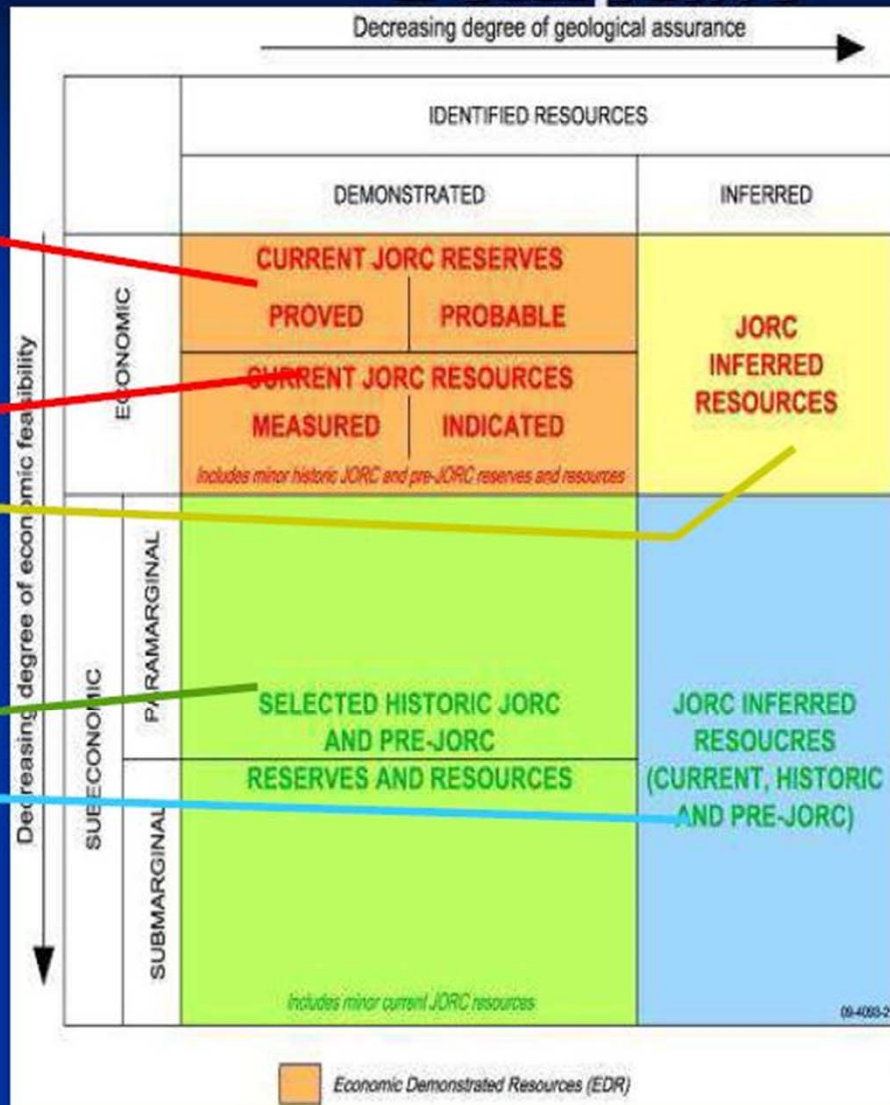
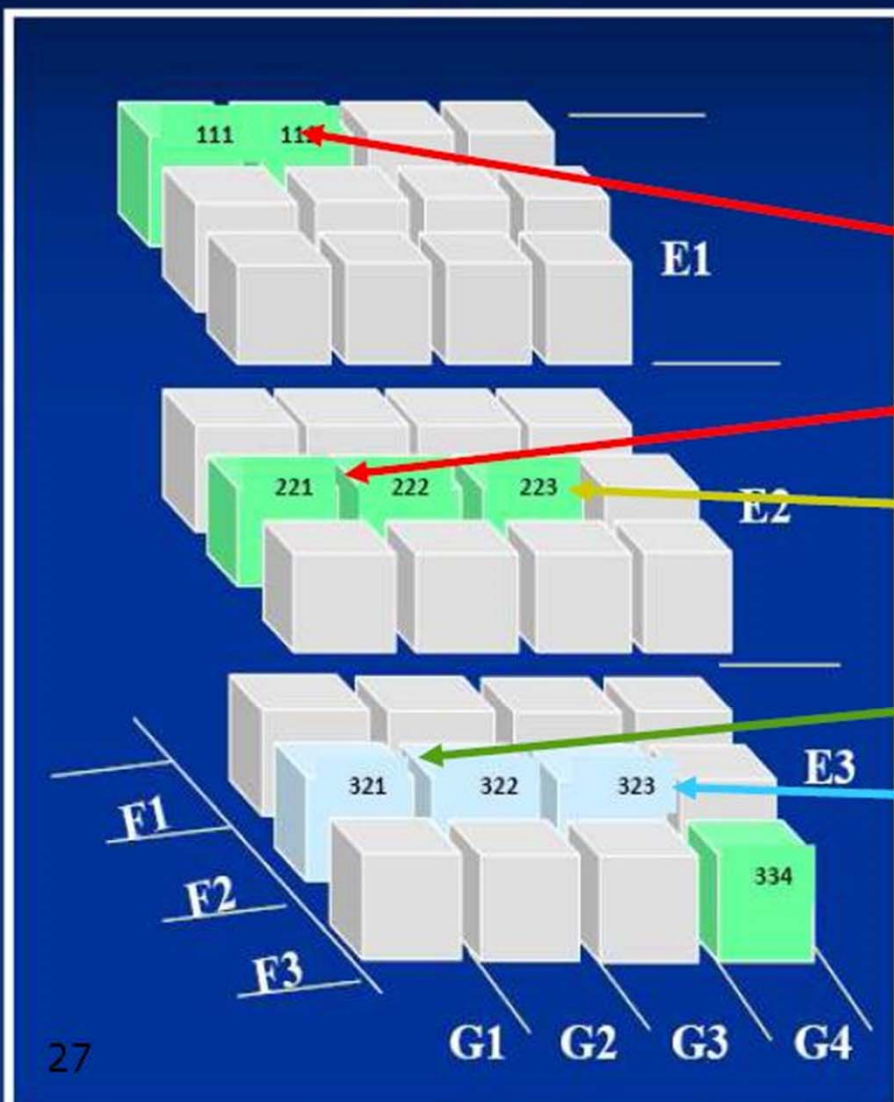
Many jurisdictions already have mandated commercial reporting systems

- These jurisdictions need not adopt the UNFC
- Other jurisdictions may choose to use the UNFC

Mapping: UNFC has more categories than CRIRSCO

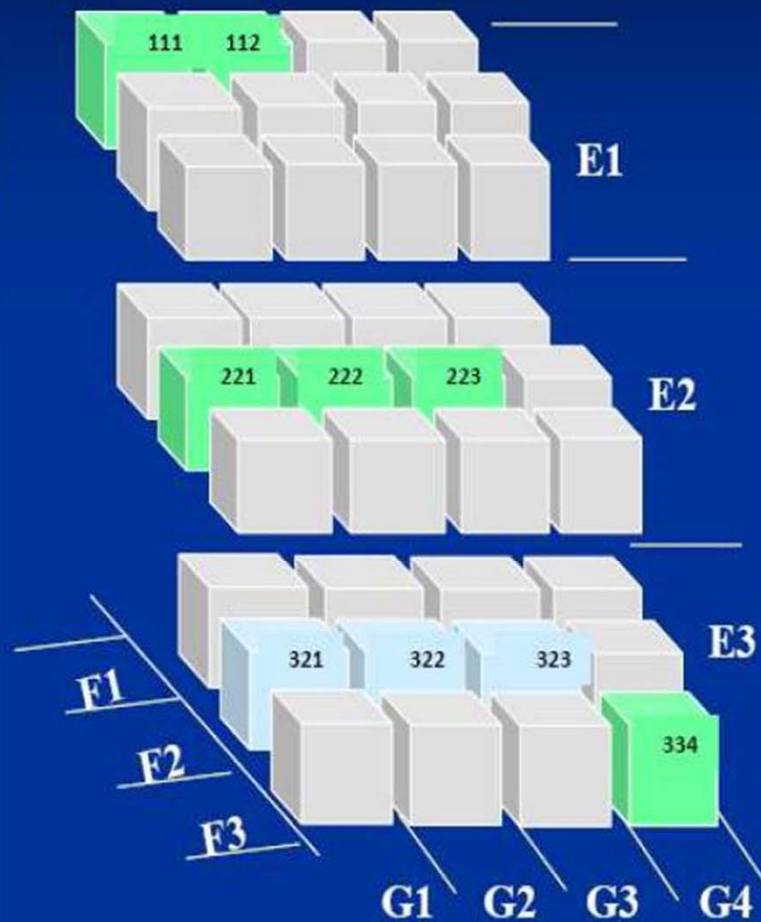
UNFC

Template



Mapping: UNFC-2009 and CRIRSCO reports

Mapping: CRIRSCO has less categories than UNFC-2009



111 = Proved Reserves
112 = Probable Reserves

221 = Measured Resources
222 = Indicated Resources
223 = Inferred Resources

EDR = (111, 112, 221, 222)

334 = Exploration Results
(Notional mapping)

Two Dimensional Sub-class level mapping: UNFC demonstrates greater granularity

UNFC Classes defined by categories and sub-categories						
Total commodity initially in place	Extracted	Sales Production				
		Non-sales Production				
	Class	Sub-class	Categories			
			E	F	G	
	Known Deposit	Commercial Projects	On Production	1	1.1	1, 2, 3
			Approved for Development	1	1.2	1, 2, 3
			Justified for Development	1	1.3	1, 2, 3
		Potentially Commercial Projects	Development Pending	2 ¹⁰	2.1	1, 2, 3
			Development On Hold	2	2.2	1, 2, 3
		Non-Commercial Projects	Development Unclarified	3.2	2.2	1, 2, 3
Development Not Viable			3.3	2.3	1, 2, 3	
Additional quantities in place		3.3	4	1, 2, 3		
Potential Deposit	Exploration Projects	[No sub-classes defined] ¹¹	3.2	3	4	
	Additional quantities in place		3.3	4	4	

CRIRSCO/JORC
RESERVES

CRIRSCO/JORC
RESOURCES

NOT ECONOMIC AND NOT
PART OF CRIRSCO/JORC
TEMPLATE




EDR subdivisions mapped to UNFC-2009

Short,
intermediate
and long term
national
perspectives

Decreasing
degree of
assurance of
production



UNFC Classes defined by categories and sub-categories								
Total commodity initially in place	Extracted	Sales Production						
		Non-sales Production						
	Class	Sub-class	Categories					
			E	F	G			
Known Deposit	Commercial Projects	On Production	1	1.1	1	2	3	
		Approved for Development	EDR 1	1	1.2	1	2	3
		Justified for Development		1	1.3	1	2	3
	Potentially Commercial Projects	Development Pending	EDR 2	2	2.1	1	2	3
		Development On Hold	EDR 3	2	2.2	1	2	3
	Non-Commercial Projects	Development Unclassified		3.2	2.2	1	2	3
		Development Not Viable		3.3	2.3	1	2	3
Additional quantities in place			3.3	2.3	1	2	3	
Potential Deposit	Exploration Projects	[No sub-classes defined]	3.2	3			4	
		Additional quantities in place			3.3	4		4

LEGEND	Australia's National Mineral Resource System
	Economic Demonstrated Resources (EDR 1, 2 and 3 as shown)
	Paramarginal and Submarginal Resources
	Inferred Resources

Mapping to a universal template

Mapping the various classification and reporting systems for mineral and energy resources to a common base to:

- Reveals similarities/differences between the systems
- Enable valid comparisons between countries' inventories and better estimates of total world stocks

The UNFC-2009 provides a universal template:

- Broader coverage than CRIRSCO or PRMS Templates
- Includes non-commercial and undiscovered

Many countries already have mandated commercial reporting systems:

- These countries will not adopt the UNFC
- Other countries may choose to use the UNFC

Correlation of CRIRSCO Template with UNFC-2009

CRIRSCO Template		UNFC-2009 "minimum" Categories			UNFC-2009 Class
Mineral Reserve	Proved	E1	F1	G1	Commercial Projects
	Probable			G2	
Mineral Resource	Measured	E2	F2	G1	Potentially Commercial Projects
	Indicated			G2	
	Inferred			G3	
Exploration Results		E3	F3	G4	Exploration Projects

EDR

Introduction of a universally accepted system

It is up to each country/jurisdiction to decide what categories it reports

- However, to facilitate meaningful comparisons and estimation of global inventories categories should map to UNFC

Informative to report categories which provide short, medium and long term views on what is likely to be available for mining (not just reserves)

Introduction of a requirement for ISA Contractors to provide information to the ISA conforming to the universally accepted UNFC-2009 would help clarify potential resources available for mining

- However, the various standards and frameworks exist which have been developed for terrestrial mining in the different countries from which Contractors originate and to which the commercial sector adheres and are not the same as UNFC-2009

Possible CRIRSCO/UNFC Expert Group to align details such as depths, categories, chemistry, metallurgy and expertise needed

Outstanding Issues

Competent persons – potentially a difficult issue because there is no actual history of seabed mining of polymetallic nodules, for most systems a competent person meets a requirement of several years experience in mineral resource estimation regarding the specific type of mining

A process is required to incorporate definitions and other anomalous requirements into UNFC-2009 to cover international assessment and reporting of seafloor mineral resources – risk and uncertainty can have major financial implications – jurisdiction reporting different to deposits

Uncertainty remains until mining and processing proceeds, metallurgy, extraction and financial outcomes are uncertain, varied chemistry may introduce currently unidentified risks

Until extraction starts by commercial entities, classification of reserves will be impossible

Jurisdictional reporting of mineral resources and UNFC-2009

Development of the UNFC has focussed on reporting at the scale of individual deposits/projects

Jurisdictional reporting should be based on data from individual deposits

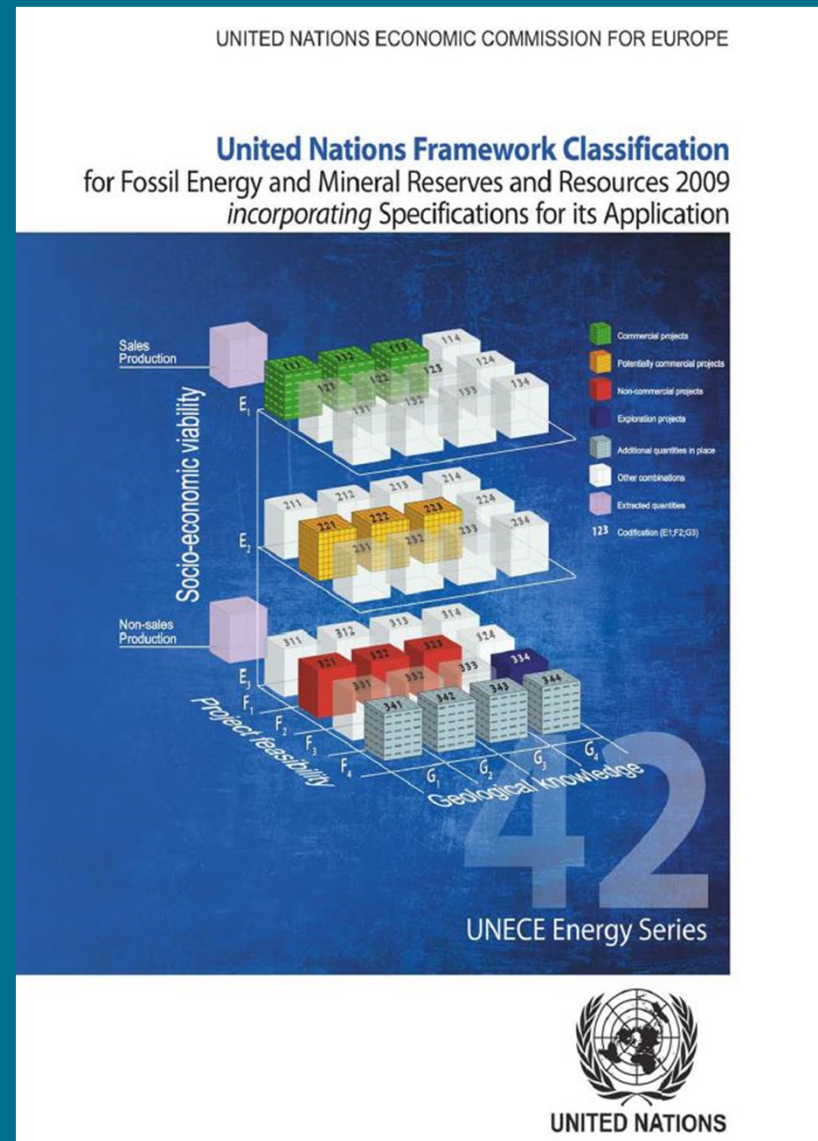
- Only inherently economic/commercial resources should be included

The national total for a commodity in a particular category (e.g. EDR) should be derived by:

- Summing the tonnages of that commodity in all deposits for which resources have been estimated
- Aggregating commercial reporting categories into broader national categories (for example: Reserves + Resources = EDR)

International Mineral Resource Reporting

- Regular evaluation of national and international mineral resource stocks will provide an improved information base.
- Improved data will then inform policies and decisions by providing information on what is likely to be available for consideration as a mineable resource for development.



Summary of Issues Identified

Australia's terrestrial experience help demonstrate and inform debate about national reporting standards for mineral resource assessment

Individual deposit data and commercial reporting can inform available about natural resources

However, fine tuning is required and Australia only offer a guide for what could be done

Commercial entities may have concerns about additional reporting requirement or duplication of effort/costs incurred

Convening an **expert** ISA CRIRSCO UNECE Working Committee to ensure that classification of seafloor mineralization, including resource estimation methodologies, categories and definitions satisfies requirements for commercial and national reporting (at this stage most will be inferred resources), the added granularity describing the status of potential projects would form the basis of a useful universal inventory.

Conclusions

Jurisdictional mineral resource classification systems can be correlated on a broad scale with UNFC-2009, though several UNFC-2009 sub-classes may have to be lumped together

To take advantage of UNFC-2009 granularity, the original resource data needs to be utilised, with little effort contractors could incorporate in-house data for their relevant mineral deposits, gaining granularity

- The CRIRSCO bridging document must be used to transfer JORC compliant resource data to UNFC-2009, thus include subeconomic

Issues remain because mining yet to proceed, so questions of QA/QC and the definition of a competent person and a process is required to incorporate definitions and other anomalous requirements into UNFC-2009 to cover international assessment and reporting of seafloor mineral resources – risk and uncertainty can have major financial implications



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Any Questions

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