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PRACTICAL APPLICATION OF THE UNITED NATIONS FRAMEWORK
CLASSIFICATION FOR RESERVES/RESOURCES

China's new scheme for resources/reserves
classification for solid minerals

(Submitted by the Government of China) */

The socialist market economic system in China is taking shape and being perfected. In order to fit the requirements of the new economic system and provide enough mineral resources for sustainable development of the national economy, it is an urgent matter to revise the old mineral reserves classification system, which was used for several decades under the central control economic system. Work on revising the "Mineral Reserves Classification and Categorization" was started in 1991. Since September 1996, the revised "Mineral Resources Law of the People's Republic of China" and "UN International Framework Classification for Reserves/Resources" have been issued one after another. On the basis of the above documents and having considered the principles on mineral reserves/resources classification of some major mining countries as reference, the new scheme for "Mineral

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Reserves/Resources Classification for Solid Minerals" was proposed in 1998, after being discussed and modified in several cycles by Chinese Academicians, geologists, mining engineers, economists and government officers. The new scheme is presented below.

1. PRINCIPLES FOR REVISION

The revision must uphold the policies of economic reform; the new scheme should not only incorporate the UN International Framework, but also fit the requirements of China's socialist market economic development and link up with China's status quo. We take the UN international Framework and USA classification in 1980 as the references, absorb their reasonable contents, combine with the practice of China, to establish China's classification framework. It is necessary to move between mineral resources and reserves rationally; the UN International Framework's three dimensional method can be adopted in principle: the terminology to be used should be in keeping with usual practice, which has continued for several decades; and the old categories of A,B,C,D will no longer be used in the new scheme.

2. THE NEW SCHEME OF RESERVES/RESOURCES CLASSIFICATION FOR SOLID MINERALS

(a) Figure 1 shows China's new classification scheme, which is also three dimensional and similar to the UN International Framework. The differences are: the horizontal axis on the UN International Framework shows stages of geological study whereas in our scheme it represents the geological reliability which is achieved in different stages of geological study. The vertical axis in the UN International Framework is divided based on the different degrees of feasibility study, while we use the results gained in the different feasibility studies, which are more audio-visual.

The connotations of demonstrated, controlled, inferred and predicted on the horizontal axis are similar to measured, indicated, inferred and reconnaissance of the UN International Framework and USA classification, and their corresponding geological study stages are exploration, detailed prospecting, prospecting and initial prospecting. The terms of economic, marginal economic and intrinsic economic used on the vertical axis have the same meaning as in the UN International Framework; sub-economic is equal in meaning to submarginal economic.

The classification scheme gives prominence to economic importance, stresses timeliness and avoids concept confusion which in the past resulted from using A,B,C,D reserve categories in reserves statistics.

(b) The reserves/resources are divided into three classes: i.e. minable reserve, in situ reserve and resource, which are further differentiated into thirteen categories.

Minable Reserve: A minable reserve is that minable part of in situ reserve on which the factors such as economic, mining, metallurgical, environmental, market and government, have been considered and corresponding modification has been made during the feasibility study and preparation of the annual mining plan. The results demonstrate that this part is economically minable or has

already been mined; it is expressed by actual minable tonnage or volume, from which the losses of designing and mining have been deducted; it exists only within the exploration area, the feasibility study has been done, and is economic. This class is equal to the proven reserve in the UN International Framework and reserve of the USA classification. This class has only one category, the economically minable reserve.

In situ reserve: An in situ reserve is a part of identified total mineral resources, which can satisfy the index (includes grade, quality, thickness and technical conditions for mining, etc.) requirements or current mining, and is expressed in terms of tonnage or volume, in which the losses of designing and mining have not been deducted; it is located in the controlled reserve extending area, in which exploration or detailed prospecting and prefeasibility study have been done, and the results demonstrate marginal economic. This analogous class can be correlated to a part of resource in the UN International Framework and the reserve base in the USA classification and can be divided into five categories: their codes are 121, 122, 2M11, 2M21 and 2M22 respectively.

Resource: Resource consists of a part of the total mineral resource and undiscovered mineral resource predicted by geological evidence. The former includes the special part of in situ reserves, for which mining is not viable under current mining technical conditions and not rational economically demonstrated by feasibility study or prefeasibility study; the resources on which some kinds of exploration or prospecting have been done, but for which feasibility or prefeasibility studies have not been carried out, are also included. ***Resources distributed in the areas of exploration on which, detailed prospecting and initial prospecting have been carried out, as well as on which feasibility or prefeasibility studies may have been done with the result of economics belonging to intrinsic resources.*** The latter belongs to undiscovered mineral resources, which is analogous to a part of resource in the UN International Framework, and sub-economic resource and undiscovered resource in the USA classification. This class differentiates seven categories – 2S11, 2S21, 331, 332, 333, 334 in Figure 1.

The mutual relationship between mineral reserves/resources classification, feasibility study and result of geological study, and the coding of the categories in the new scheme, are identical with the UN International Framework.

(c) It should be noted that even though there are categories of 121 and 122, the demonstrated economic in situ reserve and controlled economic in situ reserve respectively, in the new scheme, the implications are different with the probable reserve having the same codes in the UN International Framework. The former is in situ reserve without deduction of losses, while the latter is the tonnage or volume which can be mined in practice, merely the economic evaluation which has been done is initial with a lower precision. These categories have weak timeliness, can be used only in long-term planing, and have less importance for the administrative agency to make statistics, to it is appropriate to list them in in situ reserve, rather than probable reserve.

Now that the in situ reserve exists in the new scheme of classification, why do the intrinsic economic resource (331) and controlled intrinsic economic resource (332) also appear? The reason is the need to deal with historic data, the new exploration project will not produce these categories.

3. CORRELATION

The new scheme has many modifications compared to the old one, which is still being used. The main variations are the following:

(a) The old scheme was divided only into inside table and outside table reserves and is not complete: this corresponds only to the in situ reserve and sub-economic resource respectively in the new scheme. Now new classes, minable reserve and intrinsic resource, are added in the scheme, and combine with the old classes to constitute three classes: i.e. minable reserve, in situ reserve and resource, which are correlated to the UN International Framework and USA classification system.

(b) The new scheme enhances the timeliness of the reserves, and emphasizes adopting market price and considering factors such as mining, environment, legal and government, etc. at the same time in the economic-technical evaluation, which projects the economic effectiveness principle of the reserves; in the past the price adopted in the economic-technical evaluation was the unchanged price under the central planning economic system.

(c) The new scheme absorbs some concepts from the UN International Framework and several major mining countries' classification systems, and make geological viability correspond strictly to the stages of geological study, e.g. the demonstrated resource occurs only in the exploration district, the detailed prospecting district provides controlled resource, so that the confused status as in the past is avoided, especially for the A,B,C,D categories; one cannot distinguish them by which are produced from exploration, detailed prospecting, prospecting or initial prospecting. The above relations in the new scheme are clear at a glance.

(d) The new scheme abolishes the requirements for the ratio of various categories' reserves, so the classification system is more suitable to the market economic system.

We will not go into detail about the other modifications compared with the old classification system.

4. APPLICATION

Although China's per capital mineral resources are low in the world, the mineral commodities are greater, with some occupying the leading position in the world. How to transform the data in the old statistical table into the new scheme's table is the key factor for the success or failure of the new scheme. A trial using a few commodities' data showed the transformation to be successful in general, but some auxiliary measures need to be promulgated by the government agency.

The principal problems occurring in the transformation in code: (i) how to transform the old categories of A,B,C,D into the new categories of demonstrated, controlled and inferred; (ii) how to transform the inside table and outside table reserves into economic, marginal economic and sub-economic ones. According to the definition, the two categories of inside table reserves can correlate to the economic and marginal economic, and outside reserve can compare with the sub-economic category (Fig. 2), but all the correlations can refer only to the result of the prefeasibility study, not to the feasibility study results. This is because the economic-technical evaluation carried out on the inside and outside table reserves are only equal to the prefeasibility study, and it is noted clearly on the statistical table that mining losses have not been deducted from the reserves. The transformation of the A,B,C,D reserves into new categories should depend on modalities of complexity and exploration types of metallic and non-metallic deposit to be transformed; the I, IIB with simple geological conditions and III, IVC with complex geological conditions can relate to demonstrated categories (Fig. 2); the others can be analogized. The reserves submitted previously all correspond to the in situ reserves, except the outside table reserves, and the previous reserves produced during prospecting should belong to resources (333) because of limited and incomplete information.

The above is only the outline of the new scheme of China's mineral reserves/resources classification, which is still under revision; it has not yet been approved and issued. It is provided only for reference to experts and scholars.

Figure 1: The new scheme of reserves/resources classification for solid minerals

Geological reliability category economic importance	identified total mineral resources			undiscovered resources
	demonstrated	controlled	inferred	predicted
economic	mineable reserve (111)			
	in situ reserve (121)	in situ reserve (122)		
marginal economic	in situ reserve (2M11)			
	in situ reserve (2M21)	in situ reserve (2M22)		
sub- economic	resource (2S11)			
	resource (2S21)	resource (2S22)		
intrinsic economic	resource (331)	resource (332)	resource (333)	resource (334) ?

Figure 2: The comparison of categories between the new scheme and the old classification system

Geological reliability category	identified total mineral resources				undiscovered
	I II B+III IV C	I II C+III IV D	I II D+E	F G	
economic importance	demonstrated (measured)	controlled (indicated)	inferred	predicted	
class A inside table	economic	111 121	122		
	marginal economic	2M11 2M21	2M22		
outside table	sub-economic	2S11 2S21	2S22		
	intrinsic economic	331	332	333	334

Caption: Shadow area shows the class (vertical) and categories (horizontal) in the old system, the blank area is the new scheme. I, II, III, IV are different explorational types, B, C, D, E are reserve categories respectively; they corresponds to A, B, C, D reserves in coal reserve classification system respectively. There are no F, G reserves in the national standard, which have been used in mineral resources prediction.