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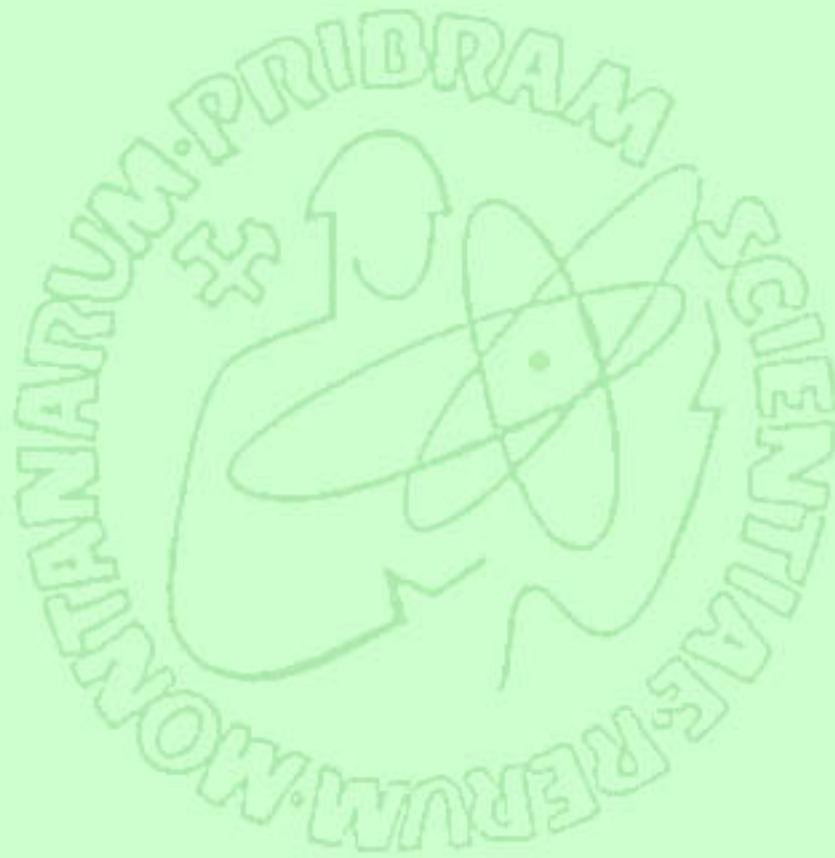
## **ESTABLISHMENT OF INTERNATIONAL CONSENSUS ON THE REVISION OF THE SYSTEMATICS IN PETROLOGY AS A CASE STUDY OF GEOETHICAL PROCESS**

### **Abstract**

*The progress of science has been realized with the development of a special language to facilitate the communication and understanding within the experts. The systematics concerns the classification, nomenclature, terminology and other topics for the standard description of materials and events, and the systematics is an integral part of each science. In the geological sciences, the systematics in petrology defines the rock names to geological specimens, which is used not only as the key item of geological databases but also as the limiting condition of geological theories and models. The systematics in petrology should be revised according to the progress of geological theories and the accumulation of data. The IUGS-CSP (Commission of Systematics in Petrology) had discussed the systematics in petrology for many years, and several important reports and proposals were published especially on igneous and metamorphic petrology. The IUGS-CSP was closed in 2008 because of the decrease of interest on the systematics in petrology within the geological communities. However, further revision of the systematics in petrology is necessary, because the progress of geology is continuing, and because many inconsistencies are still left in the present systematics. For the re-organization of the international commission, it is important to explain the importance of the systematics, encourage the petrologists, and obtain the international consensus for the revision of systematics in petrology. In the course*

of study,  
geoethical view points should be included, such as the negotiation within  
different  
branches of geological sciences, regulation between developed and developing  
countries, balancing of areal distribution of members, planning of road map of  
future  
revision, and others.

**Key words:** Systematics, Classification, Nomenclature, Terminology, Petrology,  
Consensus, Geoethics



## Introduction

The systematics in petrology is a field of research on the systematic description and classification in petrology, and includes the following studies (Nishiwaki, 2002).

- Standardization of data collection and accumulation
- Guideline for description
- Nomenclature/terminology
- Rule of classification
- Classification table and diagram
- Evaluation of classification criteria

The systematics in petrology is diverged because the target areas and rocks are varied according to the development of petrology. New theories and measurement techniques have been developed in recent years, and new types of data have been added to the traditional data. Classical and/or traditional systematics should be reviewed based on current knowledge and hypotheses (Nishiwaki, 2003a,b).

The following types of data should be prepared for the study of the systematics in petrology (Nishiwaki, 2002).

- Sample description (ID, Rock type, Date, Collector, Locality, Depository)
- Geological description (Horizon, Age, Environment, Tectonics)
- Field observation (Thickness, Size, Structure, Weathering, Alternation, Deformation)
- Laboratory observation (Color, Grain size, Roundness, Sphericity, Sorting, Cement, Texture, Fossil)
- Compositional analysis (Granulometry, Mineral composition)
- Chemical analysis (Major elements, Trace element, REE, Isotope)
- Physical analysis (Porosity, Permeability, Resistivity)
- Graphic document (Photo, Sketch, Chart)
- Digital data (Analytical chart, Measurement log, Database)

The systematics should be based on the synthesized data that are globally collected, critically evaluated and standardized, and referred by all researchers.

It is expected that database systems connected with the Internet should be constructed for this purpose (Chayes, 1985, Brandle and Nagy, 1995; Nishiwaki-Nakajima, 1995).

Statistical and mathematical processing are necessary not only for evaluation and standardization of data, but also for clarifying the data structure and constructing geological models. These results should be reviewed and evaluated to extract useful information for new systematics (Brandle and Nishiwaki, 2006; Nishiwaki and Brandle, 2007).

### **Importance of the Systematics**

The nomenclature and standard description of rocks form an integral part of a wide variety of geological data files, and the geological theories also frequently use rock names in their statements (D'Alessandro *et al.*, 1977). A specific science should have an own vocabulary to facilitate the communication and understanding, however they are hindered by the diversity of classification systems, especially by the multiplicity of equivalent or overlapping rock names.

Prof. Streckeisen was very interested in the unification of the petrological classification from 1960's, especially for numerical features on modal analysis in plutonic rocks and chemical composition in volcanic rocks. The importance of the systematics in petrology for the development of geological sciences was recognized, and the IUGS established one subcommission for the systematics in igneous petrology in 1968 (Streckeisen, 1978).

The systematics is not only the descriptive tool but also a fundamental part of petrology, which defines the framework of petrology. So the systematics should be carefully determined.

### **Rule vs Recommendation**

The systematics is composed of different branches, and the definition mode of each branch should be different. For example, the nomenclature should be concretely defined to avoid the confusion such as synonymy and homonymy, and the names without necessary definition should be invalid, like the zoological nomenclature (Stoll, 1964). On the other hand, the description cannot be strictly defined because of variation of material, condition, observation system and model, and only a guideline can be defined. Some part of rule and guideline may be only the recommendation, as the different opinions require different terminology and/or method. It is important to accept such a flexibility for the usefulness of the systematics.

### **Permanent vs Tentative**

It is necessary for the actual application that the systematics in petrology is clearly defined at any time, otherwise no one will use the systematics. The systematics should not be so frequently revised or modified that petrologists and other geoscientists can accept.

However, the content of systematics should be revised to adopt the development of petrology. For example, new data, new rock groups, new observation methods, and new petrological models should be accepted on occasion.

That is, the systematics cannot be permanent, but it should not be tentative at any time.

### **International vs Local**

The petrology is a global science, and the systematics in petrology is principally international, that is, any petrologist in the world will use one systematics. The systematics should be defined under the global discussion, and authorized by an international organization and/or communities.

However it is difficult to gather all the data and opinions in the world to a specific committee, and also it is more difficult to reach a complete consensus. It is not realistic to push a strict rule regardless the local condition. Some part of the systematics should accept some exceptions to adopt the local condition, by replacing the guideline to the recommendations if necessary. Such ambiguity will help the actual use of the systematics.

### **Disciplinary vs General**

The systematics in petrology is a part of petrology, and its main users are petrologists. So the systematics should be defined by the petrological communities in principle, otherwise the exact meaning of the systematics cannot be properly evaluated.

However, the rock name and its compositional data will be used not only within petrology but also in other branches of geoscience as a basic control factor of geological models. Furthermore, the rock name will be used as a part of description of natural phenomena outside of geosciences, without precise

understanding of the classification, which may lead to severe misunderstandings. And we may consider such a use by general citizens. That is, the systematics is a disciplinary guideline, but it should consider the general use.

### **Top-down vs Bottom-up**

The systematics should be defined with an international consensus, which will be obtained by some commissions. The member of commission should be erected by considering not only the speciality but also the area of candidates. The number of commission members is limited, and the draft should be circulated within petrological communities for reviewing and correction by using the Internet reviewing. The final decision of the systematics should be made at the general assembly of the IUGS or other international organization to authorize the systematics.

The construction of the systematics is a bottom-up process in petrological community as cited above. The decided systematics should be used not only by petrologists but also other scientists by proclaiming from the authorized community, and the distribution of the systematics is a top-down process for scientists in general.

### **Distribution and Education**

It is necessary for the actual use to distribute the decided systematics to the world, by publishing the guidebook and technical manual in which the detailed concepts are clearly explained. The technical seminar should be held to support the petrologists who describe the rocks in their academic journals, where actual process of the description is explained. Also the seminar on the concept and use of the systematics for other scientists and technicians is necessary, which will help the proper use of the systematics in petrology. Especially seminars for the database managers are useful, as the petrological data are included in many scientific and technological databases.

Furthermore, the special account for the developing countries is important for the international use of the systematics. Technical seminars should be held at many points in the world to encourage the petrologists in the developing countries near the point, together with the support of the system to introduce the systematics into their laboratories. For this seminar we may cooperate with the UNESCO and other international organizations.

## Conclusion

It is clarified that we may consider many geoethical view points on the construction of the systematics in petrology, such as the negotiation within different branches of geological sciences, regulation between developed and developing countries, balancing of areal distribution of members, planning of road map of future revision, and others. The systematics in petrology cannot be used without these geoethical considerations.

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