THE CLASSIFICATION AND NOMENCLATURE OF CLAY MINERALS

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ABSTRACT

A report is given of the decisions reached at a meeting on the classification and nomenclature of clay minerals held under the auspices of Comité International pour l'Etude des Argiles at Brussels in July 1958. Tables of recently-proposed classification systems are included and some comments made on problems requiring agreement.

The increasing interest in the classification and nomenclature of clay minerals over the last decade or so may be attributed largely to the development of investigational methods which enable a much more precise characterization of fine-grained minerals than was previously possible. In addition, however, the absence of any hard-and-fast rules as to new mineral nomenclature has led to a multiplicity of names through "new" minerals being described on the flimsiest of evidence, without regard as to whether they might be considered varieties of an already-established entity or indeed without, in many instances, adequate evidence of homogeneity. The resulting confusion is considerable, and the stage has now been reached when international agreement upon the main features of classification and nomenclature ought to be obtained.

In an attempt to clarify the position representatives of ten countries met, under the auspices of C.I.P.E.A., during the Journées Internationales d'Etude des Argiles in Brussels in July, 1958.* Several decisions of interest were made at this meeting.

(*a*) The following definition was adopted, subject to confirmation at the next meeting: **Crystalline clay minerals are hydrated silicates with layer or chain lattices consisting of sheets of silica tetrahedra arranged in hexagonal form condensed with octahedral layers; they are usually of small particle size.**

(*b*) A sound nomenclature is necessarily based on a satisfactory classification scheme. Accepting the above definition, and limiting attention to crystalline silicates a suitable initial division would appear to be (the names in brackets being alternatives):

*A list of those attending is given in the Appendix.

- Crystalline silicates
  - Chain lattices
    - Palygorskite
    - Sepiolite
  - Layer lattices
    - 1 : 1 (Diphormic)
    - 2 : 1 (Triphormic)
    - 2 : 2 (Tetraphormic)

(*c*) It was agreed that recent classification systems be drawn up in tabular form and that these receive wide publicity so that individual clay mineralogists could compare the systems and express their preference, or suggest an alternative. A meeting of national representatives who would be *au fait* with opinion in their own countries would then be held in Copenhagen during the International Geological Congress in August 1960, when an attempt would be made to reach some agreement.

Tables of the various classification schemes have now been drawn up (Tables 1-7) and are reproduced here in order to bring them to the attention of members of the Clay Minerals Group, who are invited to send comments to the author.

A classification not tabulated is that of Konta (private communication) who has suggested that clay minerals be divided up on the basis of their crystal structure into 7 groups, each group to be named after the most abundant mineral of the group. This gives: 1. Allopane group (including hisingerite), 2. Kaolinite group, 3. Montmorillonite group, 4. Illite group, 5. Vermiculite group, 6. Chlorite group (including septechlorites), 7. Sepiolite and palygorskite group. This suffers from the disadvantage noted in (*g*) below—and, in addition, involves a decision upon the most abundant mineral in each group.

In general, all Tables commence in the way recommended in paragraph (*c*) above, but after this there is considerable diversity. Nevertheless, the differences are sufficiently small to give rise to hope that agreement may soon be reached.

The following notes upon features of the Tables may be of interest (they are lettered consecutively after the above paragraphs for ease of reference):

(*d*) It is interesting to note that while shape factors are only considered in one classification (Table 1), swelling properties are considered in four (Tables 1, 4, 5 and 6).

(*e*) The most logical classification is undoubtedly that in Table 4, but difficulties arise in translation, and it is preferable that mineral names be international. For example, use of *ferriferous beidellite* (*beidellite ferrifère*) for *nontronite* is clumsy,

TABLE 1—Tabulation of the classification proposal of *Grim* (1953).

General Distinction	Type	Expansion	Shape	Group	Minerals
Amorphous	—	—	—	Allophane	—
Crystalline	Two-layer	—	Equidimensional	Kaolinite	—
			Elongate	Halloysite	—
	Three-layer	Expanding	Equidimensional	Montmorillonite	Montmorillonite, Sauconite, etc.
			Elongate	Montmorillonite	Nontronite
					Saponite
					Hectorite
		Non-expanding	—	Illite	—
	Regular Mixed-layer	—	—	Chlorite	—
	Chain structure	—	—	—	Attapulgite
					Sepiolite
					Palygorskite

TABLE 2—Tabulation of the classification proposal of Brindley (1955*a*).

Chemical Category	Structural Groups	Sub-Groups	Chemical Species	Structural Varieties
Silicates	Layer Silicates	Kaolin type	Kaolin Minerals	Halloysite Kaolinite Dickite Nacrite
			Serpentine Minerals	Chrysotile(s) Antigorite
			Chamosite Amesite Greenalite Cronstedtite, etc.	— — — —
		Mica type	Talc Pyrophyllite Muscovite Phologopite Biotite Glauconite Illite(s) Montmorillonoids Vermiculite, etc.	Polymorphic varieties
		Chlorite type	Penninite Clinochlore Prochlorite Daphnite, etc.	Polymorphic varieties
		Mixed-layer type	Anauxite Bravaisite, etc.	— —
		Chloritoid	—	—
	Chain Silicates	—	Palygorskite (attapulgite) Sepiolite	—

TABLE 3—Tabulation of the classification proposals of Brown (1955)

In view of the difference in emphasis of certain characteristics (*e.g.*, the group name is subsidiary in the 1:1 Family and principal in 2:1 Family) it has been necessary to divide up the scheme into several discrete tables.

A. DIPHORMIC FAMILY

General Class	Family	Population of octahedral sheet	Group Name	Minerals
Layer Silicates	1 : 1	Dioctahedral	Kandites	Nacrite Dickite Kaolinite Halloysite
		Trioctahedral	Serpentines	Antigorite Chrysotile
			?	Amesite Cronstedtite Berthierine

B. TRIPHORMIC FAMILY

General Class	Family	Group Name	Population of octahedral sheet	Minerals
Layer Silicates	2 : 1	Smectites	Dioctahedral	Beidellite* Nontronite* Volkonskoite* Montmorillonite*
			Trioctahedral	Saponite* Sauconite* Hectorite Stevensite*
		Vermiculites	Dioctahedral	Dioctahedral vermiculite
			Trioctahedral	Jefferisite Ni-vermiculite
		Micas	Dioctahedral	Muscovite→illite Glauconite Paragonite
			Trioctahedral	Phlogopite Biotite→ledikite Lepidomelane
		Brittle Micas	Dioctahedral	Margarite
			Trioctahedral	?
		Talc	Trioctahedral	Talc
		Pyrophyllite	Dioctahedral	Pyrophyllite
		Interstratified Minerals	—	—

*Chemical definitions as in Table 7. If *stevensite* is interstratified (Brindley, 1955*b*) it should be omitted—the same comments applies to Tables 4, 5 and 6—but see Faust, Hathaway and Millot (1959).

C. Chlorite Family

General Class	Family	Group Name	Population of octahedral sheets	Minerals
Layer Silicates	?	?	Dioctahedral-Dioctahedral	?
		Leptochlorites	Dioctahedral-Trioctahedral	Cookeite, etc.
		Orthochlorites	Trioctahedral-Trioctahedral	Unoxidized chlorites Oxidized chlorites

D. Palygorskite and Sepiolite Family

General Class	Minerals
Chain silicates	Palygorskite Sepiolite

E. Amorphous* Minerals

Primary Distinction	Group	Mineral	Chemical Formula
Amorphous	Oxides	Opaline Silica Limonite Kliachite Wad	$SiO_2.nH_2O$ $Fe_2O_3.nH_2O$ $Al_2O_3.nH_2O$ $MnO_2.nH_2O$
	Silicates	Allophane Hisingerite	$Al_2O_3.2SiO_2.nH_2O$ $Fe_2O_3.2SiO_2.nH_2O$
	Phosphates	Evansite Azovskite	$Al_3PO_4(OH)_6.nH_2O$ $Fe_3PO_4(OH)_6.nH_2O$

*Amorphous is defined as "any material not shown by the method of investigation to be crystalline."

TABLE 4—Tabulation of the classification

General Class	Family	Population of Octahedral Sheet	Replacements	Expansion	Mineral
Layer silicates	7 Å (1:1)	Dioctahedral	None	Non-swelling	Kaolinite
				Swelling	Halloysite
			Tetrahedral	—	Donbassite (?)
		Trioctahedral	None	Non-swelling	Antigorite
			Tetrahedral	Non-swelling	Magnesian berthierine
	10 Å (2:1)	Dioctahedral	None	Non-swelling	Pyrophyllite
			Octahedral	Swelling	Montmorillonite
			Tetrahedral	Swelling	Beidellite
			Tetrahedral and Octahedral	Swelling	Dioctahedral vermiculite
			Tetrahedral	Non-swelling	Illite
		Trioctahedral	None	Non-swelling	Talc
			Octahedral	Swelling	Stevensite
			Tetrahedral	Swelling	Saponite
			Tetrahedral and Octahedral	Swelling	Vermiculite
			Tetrahedral	Non-swelling	Ledikite
	14 Å (2:2)	Trioctahedral	—	Non-swelling	Leptochlorite
		—	—	Swelling	Pseudochlorite
Semi-layer structure		Trioctahedral	(Al^{3+} between layers)	Non-swelling	Chloritoid
Chain structures	10 Å	Trioctahedral	Tetrahedral and Octahedral	Non-swelling	Palygorskite
	12 Å	Trioctahedral	Tetrahedral and Octahedral	Non-swelling	Sepiolite

proposal of Caillère and Hénin (1957).

Formula	Chemical Varieties and Replacements	Crystallographic and Textural Varieties
$Al_2Si_2O_5(OH)_4$		*Triclinic kaolinite* Nacrite = monoclinic k., $\beta = 90{\cdot}3°$ Dickite = monoclinic k., $\beta = 96{\cdot}8°$ Fireclay = pseudomonoclinic k. Metahalloysite = pseudohexagonal k.
$Al_2Si_2O_5(OH)_4.H_2O$		
$Al_{2+\frac{x}{3}}(Si_{2-x}Al_x)O_5(OH)_4$		
$Mg_3Si_2O_5(OH)_4$	Noumeite – nickeliferous a. (Ni for Mg) Greenalite – ferriferous a. (Fe for Mg)	Chrysotile (Fibrous type) Orthoantigorite = orthohexagonal a. and numerous other types
$(Al_xMg_{3-x})(Si_{2-x}Al_x)O_5(OH)_4$	Ferriferous b. (Fe^{3+} for Al, Fe^{2+} for Mg) Oxidized ferriferous b. (More Fe^{3+}, less H^+) Zinciferous b. (Zn for Mg) Grovesite = manganiferous b. (Mn for Mg) Cronstedtite – ferroferriferous b. (Fe for Mg,Al)	
$Al_2Si_4O_{10}(OH)_2$		
$xM^+.(Al_{2-x}Mg_x)Si_4O_{10}(OH)_2$	Nickeliferous m. (Ni for Mg)	
$xM^+.Al_2(Si_{4-x}Al_x)O_{10}(OH)_2$	Volkonskoite – chromiferous b. (Cr for Al) Nontronite = ferriferous b. (Fe for Al)	
$(x-3y)M^+.Al_{2+y}(Si_{4-x}Al_x)O_{10}(OH)_2$		
$K_xAl_2(Si_{4-x}Al_x)Q_{10}(OH)_2$	Brammallite = sodium i. (Na for K) Chrome ochre = chromiferous i. (Cr for Al) Glauconite = Ferriferous i. (Fe for Al)	
$Mg_3Si_4O_{10}(OH)_2$	Minnesotaite – ferriferous t. (Fe for Mg) Nickeliferous t. (Ni for Mg)	
$2xM^+.Mg_{3-x}Si_4O_{10}(OH)_2$	Hectorite = fluolithiferous s. (Li for Mg, F for OH)	
$xM^+.Mg_3(Si_{4-x}Al_x)O_{10}(OH)_2$	Bowlingite = ferriferous s. (Fe for Mg) Sauconite = zinciferous s. (Zn for Mg)	
$(x-y)M^+.[Fe^{3+}_y(Mg,Fe^{2+})_{3-y}]$ $(Si_{4-x}Al_x)O_{10}(OH)_2$	Batavite = alumino-magnesian v. (Al and Mg for Fe) Nickeliferous v. (Ni for Fe, Mg)	
$K_x(Fe^{2+},Mg)_3(Si_{4-x}Al_x)O_{10}(OH)_2$		
$Mg_3(Mg_{3-x}Al_x)(Si_{4-x}Al_x)O_{10}(OH)_8$	Many varieties, chemical and crystallographic	
—	Corrensite, etc. Brucitic layers incomplete	
$Al_2(Fe^{2+},Mg)_2(Si_2Al_2)O_{10}(OH)_4$		
$(Mg_{5-x}Al_x)(Si_{8-x}Al_x)$ $O_{20}(OH)_2(OH_2)_4$		Attapulgite (textural variety)
$(Mg_{8-x}Al_x)(Si_{12-x}Al_x)$ $O_{30}(OH)_4(OH_2)_4$	Xylotile (Fe^{3+} for Al)	Fibrous and earthy textural varieties

TABLE 5—Classification proposal of Strunz (1957)

A. STRUCTURE TYPE: MICA-TYPE SHEETS*

	Pyrophyllite-Mica Groups		Montmorillonite-Vermiculite Group ("H_2O-expanded Mica")		Chlorite Group ("OH-expanded Mica")	
	Pyrophyllite-Muscovite Series Dioctahedral	Talc-Biotite Series Trioctahedral	Montmorillonite Series Dioctahedral	Vermiculite Series Trioctahedral	— Dioctahedral	Chlorite Series Trioctahedral
Al:Si =0:4	Pyrophyllite	Talc	Montmorillonite	Stevensite	?	Talc-Chlorite
Al:Si =1:3	Muscovite Hydromuscovite (Illite)	Biotite Hydrobiotite	Beidellite exp. Hydromuscovite (Ca-Illite)	Batavite exp. Hydrobiotite (Stilpnomelane)	?	Clinochlore
Al:Si =2:2	Margarite	Xanthophyllite				Corundophilite

B. STRUCTURE TYPE: KAOLIN-TYPE SHEETS*

	Kaolinite—Serpentine Group		Halloysite Group ("H_2O-expanded Kaolinite")		— ("OH-expanded Kaolinite," so far unknown)	
	Kaolinite Series Dioctahedral	Serpentine Series Trioctahedral	Halloysite Series Dioctahedral	— Trioctahedral	— Dioctahedral	— Trioctahedral
Al:Si =0:4	Kaolinite	Serpentine	Halloysite	"Hydro-Serpentine" (?)	"Hydrargillite-Kaolinite" (?)	"Brucite-Serpentine" (?)
Al:Si =1:3	Donbassite	Berthierine				
Al:Si =2:2	?	Amesite				

*For chemical formulae and attribution of minerals to series, the original (Strunz, 1957) should be consulted.

TABLE 6—Tabulation of the classification proposal of Frank-Kamenetsky (1958)

TYPE A. I.

General Class	Layers	Population of Octahedral Sheet	Expansion	Group Name	Minerals
Layer silicates	Two-sheet (1:1)	Dioctahedral	Non-swelling	Kaolinite	Kaolinite Dickite Nacrite
			Non-swelling and swelling	Halloysite	Metahalloysite Hydrohalloysite (endellite)
		Trioctahedral	Non-swelling	Serpentine	Chrysotile Antigorite
		Di-trioctahedral	Non-swelling	Kaolinite-based Chlorites	(Pseudochlorite) Cronstedtite Amesite Chamosite

TYPE A. II.

General Class	Layers	Expansion	Group Name	Population of Octahedral Sheet	*Minerals*
Layer silicates	Three-sheet (2:1)	Non-Swelling	Micas-Hydromicas	Dioctahedral	Analogue of paragonite Hydroparagonite-brammallite Analogue of muscovite Hydromuscovite-illite
				Trioctahedral	Analogue of phlogopite Hydrophlogopite (?) Analogue of ferrophlogopite Ledikite (?)
				Di-trioctahedral	Analogue of biotite Hydrobiotite-glauconite
		Swelling	Vermiculites	*	Vermiculite and products of its hydration
			Montmorillonites	Dioctahedral	Montmorillonite Nontronite Volkonskoite
				Trioctahedral	Stevensite (?) Hectorite Sauconite Saponite
				Di-trioctahedral	*Most natural montmorillonite minerals*

*Not specified: it is therefore not clear whether dioctahedral vermiculite would be included here or not.

TYPE A. III.

General Class	Layers	Expansion	Group Name	Minerals
Layer silicates	Three-sheet + one-sheet (2:2)	Non-swelling	Chlorites-Hydrochlorites (?)	Clinochlore Corundophilite, etc.

TYPE B.

General Class	Group Name	Minerals
Ribbon silicates	Sepiolite-Palygorskite Group	Sepiolite Palygorskite

TABLE 7—Classification proposal of

General Class	Composition of Layers	Population of Octahedral Sheet	Group Name
Layer-lattice types	Diphormic (or 1 : 1)	Dioctahedral	Kandites
		Trioctahedral	Septechlorites‡
	Tetraphormic (or 2 : 2)	Dioctahedral, trioctahedral or mixed	Chlorites
	Triphormic (or 2 : 1)	Dioctahedral	Micas
			Smectites
			Vermiculite
		Trioctahedral	Micas
			Smectites
			Vermiculite
	Diphormic, triphormic, tetraphormic, or mixed	Interstratified Minerals	
Chain-lattice types	(Triphormic)	(Trioctahedral)	(?) Hormites§

*In general, the simplest theoretical formula of the end-member is given,
†See paragraph (*f*). ‡See paragraph (*h*).

Mackenzie (1957), with amendments.

Minerals	Formula*
Nacrite	$Al_2Si_2O_5(OH)_4$
Dickite	$Al_2Si_2O_5(OH)_4$
Tc-Kaolinite†	$Al_2Si_2O_5(OH)_4$
ψM-Kaolinite†	$Al_2Si_2O_5(OH)_4$
Metahalloysite	$Al_2Si_2O_5(OH)_4$
Halloysite	$Al_2Si_2O_5(OH)_4.2H_2O$
Anauxite (?)	$Al_2Si_3O_7(OH)_4$ (?)
Antigorite	$Mg_6Si_4O_{10}(OH)_8$
Chrysotile	$Mg_6Si_4O_{10}(OH)_8$
Amesite	$(Mg,Fe^{2+})_4Al_4Si_2O_{10}(OH)_8$
Cronstedtite	$Fe^{3+}{}_4Fe^{2+}{}_4Si_2O_{10}(OH)_8$
Berthierine	$(Fe^{2+},Fe^{3+},Mg,Al)_6(Si_3Al)O_{10}(OH)_8$
Clay chlorites	Variable
Illite	$(K,H_3O)Al_2(Si,Al)_4O_{10}(OH)_2$
Glauconite	$(K,H_3O)(Al,Fe)_2(Si,Al)_4O_{10}(OH)_2$
Montmorillonite	$0·33M^+.(Al_{1·67}Mg_{0·33})Si_4O_{10}(OH)_2$
Beidellite	$0·33M^+.Al_2(Si_{3·67}Al_{0·33})O_{10}(OH)_2$
Nontronite	$0·33M^+.Fe_2(Si_{3·67}Al_{0·33})O_{10}(OH)_2$
Volkonskoite	$0·33M^+.(Fe,Cr,Al)_2(Si,Al)_4O_{10}(OH)_2$
Dioctahedral vermiculite	$0·67M^+.(Al,Fe,etc.)_2(Si,Al)_4O_{10}(OH)_2$
Ledikite	$(K,H_3O)Mg_3(Si,Al)_4O_{10}(OH)_2$
Saponite	$0·33M^+.Mg_3(Si_{3·67}A1_{0·33})O_{10}(OH)_2$
Sauconite	$0·33M^+.(Mg,Zn)_3(Si_{3·67}O_{0·33})O_{10}(OH)_2$
Hectorite	$0·33M^+.(Mg,Li)_3(Si,Al)_4O_{10}(OH)_2$
Vermiculite	$0·67M^+.(Mg,Fe,etc.)_3(Si,Al)_4O_{10}(OH)_2$
Rectorite, etc.	Variable, depending upon composition
Sepiolite	$H_6Mg_8Si_{12}O_{30}(OH)_{10}.6H_2O$
Palygorskite	$H_4Mg_5Si_8O_{20}(OH)_6.6H_2O$

and chemical data for any particular sample may vary somewhat from this.

§See paragraph (*g*).

while *Fe-beidellite*, which would be international, suggests beidellite with exchangeable Fe: in English the most acceptable translation would probably be *ferri-beidellite*.

(*f*) A logical classification of the minerals of the kaolin group could be obtained by adaptation of the mica convention (1M, 2M, 3H, etc.), which would then give: for nacrite, *6M-kaolinite*; for dickite, *2M-kaolinite*; for kaolinite, *Tc-kaolinite* if ordered or *ψM-kaolinite* if the *b*/3 disordered form; and for metahalloysite, *ψH-kaolinite*.

From the brief comments in paragraphs (*e*) and (*f*) it is clear that very logical classification and nomenclature systems for the clay minerals are now possible, but it remains to be seen whether they would be adopted. It seems to the author that some compromise must be arrived at.

(*g*) Group names have always given rise to controversy. To clay mineralogists they can be extremely useful when referring to a member (undefined) of a specific group and avoid using a mineral name in two connotations—*e.g.*, a montmorillonite and montmorillonite—or a rock name as a group name—*e.g.*, kaolin. There has been some doubt about the names kandites and smectites proposed by the Nomenclature Sub-Committee of the Clay Minerals Group (Brown, 1955), but it is interesting to note their gradual appearance in the literature, suggesting that they serve a useful purpose. In addition to these, the new name *hormites** has been suggested for the sepiolite-palygorskite group.

(*h*) The position of the minerals chrysotile, antigorite, amesite, cronstedtite and berthierine (or 7 Å-chamosite) is not clear. Up to the present these minerals have been regarded as trioctahedral analogues of the kaolin minerals, but recently Nelson and Roy (1954, 1958) have classified them as *septechlorites* to indicate their relationship with normal chlorites. In Table 7 their relationships to both the kaolin and chlorite groups is brought out by juxtaposition and by name.

(*i*) Some criteria ought to be established whereby individual clay minerals may be defined. The following have been suggested by Konta: (i) theoretical crystal-chemical formula; (ii) crystal structure with c_0 and/or other parameters (? or adequate X-ray data); (iii) degree of regularity or displacement in stacking of the layers; (iv) allowable chemical substitution; (v) origin of the name together with information as to whether it is adopted because of priority or usage.

(*j*) The name halloysite has various connotations. The name was originally applied to the fully-hydrated mineral by Berthier (1826), and from the historical aspect the nomenclature should be *halloysite*, *partially-dehydrated halloysite*, and *metahalloysite*, depending upon the water content (see MacEwan 1947). The issue is confused, however, by the use of the terms *hydrated halloysite* (Hendricks, 1938) and *endellite* (Alexander *et al.*, 1943) for the hydrated form, and *halloysite* for the anhydrous mineral. Intermediates would, in the last two instances, be *partially-hydrated halloysite*. There is also the suggestion of MacEwan (1947) that *halloysite* should be used only as a general term with *hydrated halloysite* and *metahalloysite as* the two end-members.

(*k*) The name beidellite also gives rise to confusion and it has been suggested by some (*e.g.*, Grim, 1955) that it should be dropped. By others it is considered to serve a useful purpose in indicating the end-member of the montmorillonite

*R. H. S. Robertson (private communication) : from the greek ορμος—chain.

group where the cation-exchange capacity arises entirely from Al-for-Si substitution (Ross and Hendricks, 1945; Brown, 1955)—despite the fact that the original "beidellite," and many subsequent samples, have been shown to be mixtures (Grim, 1955). Authentic samples in the Ross and Hendricks (1945) sense are, however, known (Greene-Kelly, 1957).

(*l*) Interstratified minerals (apart from the chlorites which might be regarded as regular interstratifications) have not been included in the tables. Only two suggestions for nomenclature of these are known to the author. Brown (1955) suggests that if interstratification is regular and the nature of the layers is established, a specific name should be given to the material; hyphenated names are suggested for irregular interstratifications—*e.g.*, *chloritic-vermiculite*, *chlorite-vermiculite*, and *vermiculitic-chlorite* for minerals in which the amount of chlorite is less than, approximately equal to, or greater than the amount of vermiculite. Konta (1957) suggests the use of *mixed IM structure* for illite+montmorillonite as in bravaisite or sarospatakite, *mixed ChV structure* for chlorite+vermiculite, *mixed IK structure* for illite+kaolinite as in monothermite, and *mixed NK structure* for nontronite+kaolinite as in faratsihite.

(*m*) Amorphous minerals are excluded from the definition in (*a*) above. In any classification of the minerals occurring in clays they must, however, be considered and one possible scheme (Table 3E) has been included. Another which has been suggested is a simple chemical arrangement—*i.e.*, that they be referred to as *alumina-silica gel*, *ferric oxide-silica gel*, etc.

The various aspects referred to above cover some of the main problems which must be solved in any internationally-agreed system. It is hoped, therefore, that as many clay mineralogists as possible will let their views be known through their national representative,* so that a worthwhile discussion may be held at the proposed meeting of national representatives at Copenhagen and so that some definite decisions upon at least the main points of controversy may be made; this would indeed be in the interests of clay mineralogy at large.

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*See Appendix.

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APPENDIX

The following attended the preliminary meeting at Brussels: M J. J. Fripiat, Belgium; Dr J. Konta, Czechoslovakia; Mlle S. Caillère, France (Secretary); Prof. Dr Th. Ernst, Germany; Dr R. C. Mackenzie, Great Britain (Chairman); Dr H. W. van der Marel, Holland; Dr L. Heller, Israel; Prof. J. L. Martin Vivaldi, Spain; Dr E. Jäger, Switzerland; Dr A. Swineford, U.S.A.

Dr R. Norin, Sweden, and Prof. F. V. Chukhrov, U.S.S.R., were also invited but were unable to attend this session.

In general, all those present at, and invited to, the meeting agreed to be responsible for the collection of views on nomenclature in their own countries. In addition, it is intended to request a clay mineralogist in each of the following countries to act in a similar manner: Australia, Brazil, Bulgaria, Canada, China, Denmark, Finland, Hungary, India, Italy, Japan, Mexico, New Zealand, Norway, Poland, South Africa, Turkey, Yugoslavia.

Anyone who is particularly interested in any of the aspects raised but does not hear from his national representative should contact the author of this note.

*An abstract of the latter paper is given on the following pages.