CLASSIFICATION OF MICAS*

GIVING COMPOSITION, CHARACTERISTICS, MODE OF OCCURRENCE, AND TRADE NAMES, ETC., OF THE PRINCIPAL MICAS OF COMMERCE: WITH SPECIAL REFERENCE TO SPECIMENS IN THE COLLECTION OF THE INSTITUTION OF ELECTRICAL ENGINEERS.

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THE MICAS.

Silicates of aluminium with potassium, magnesium, ferrous iron, ferric iron, sodium, lithium, fluorine, and often traces of other elements.

All crystallize in the monoclinic system but with close approximation to either rhombohedral or orthorhombic symmetry; the plane angles at the base are in all cases 60° or 120°.

They are all characterized by a highly perfect basal cleavage, yielding very thin, tough and more or less elastic laminæ.

Specific gravity 2·6 to 3·2.

MUSCOVITE.

POTASSIUM MICA.

The most common of the micas. Characteristic of the granites and pegmatites: invariably associated with quartz and feldspar, and often with topaz, tourmaline, etc.; frequently with biotite and lepidolite.

Commonly with interlaminar inclusions of magnetite and hematite (black) and goethite (red): *see* spotted muscovites.

Also with kaolin (decomposed feldspar), clay, etc.: *see* stained muscovites.

Sometimes with small inclusions of quartz, garnets, tourmalines, etc.

SiO_2	Al_2O_3	K_2O	FeO, Fe_2O_3	F	H_2O
45·1	36·6	11·8	Trace to 3·0	Trace	4·5

OPTIC AXIAL ANGLE

55° to 75°

Optic axial plane at right angles to the plane of symmetry. Pleochroism strong in dark-coloured varieties. Axial angle decreases slightly with increase of temperature.

COLOUR..... Brown, yellow, green, grey to colourless; colour probably increases in depth with iron content.

LUSTRE..... Vitreous, to more or less pearly in altered varieties.

CHEMICAL TESTS... In the closed tube gives water, often with reaction for fluorine. B.B. whitens and fuses on thin edges (F=4·5 to 5·0) to a grey or yellow glass: with fluxes sometimes gives reactions for iron, manganese, and chromium (rare).

Not decomposed by acids, except hydrofluoric acid. Green and brown colour probably due to ferrous iron.

ASTERISM..... Sometimes exhibits "asterism" by transmitted light.

PHLOGOPITE.

MAGNESIUM MICA.

Characteristic of the crystalline limestones or dolomites and serpentine: usually associated with apatite, pyroxene, etc. Sometimes with inclusions of magnetite.

SiO_2	Al_2O_3	K_2O	MgO	FeO, Fe_2O_3	F	H_2O
39·6	17·0	9·9	26·5	0·5 to 9·0 replacing MgO and Al_2O_3	2·24	2·99

OPTIC AXIAL ANGLE

5° to 18°

Optic axial plane parallel to the plane of symmetry. Axial angle appears to increase with iron content. Pleochroism distinct.

COLOUR..... Pale yellow to foxy-red, brownish red to dark brown; also colourless (rare) and green, often with a copper-like reflection on surface.

LUSTRE..... Pearly to silvery: calcined appearance when altered.

CHEMICAL TESTS... In the closed tube gives a little water; some varieties give reaction for fluorine in the open tube, whilst most give little or no reaction for iron with fluxes. B.B. whitens and fuses on thin edges. Completely decomposed by sulphuric acid, leaving the silica in thin scales. The red-brown varieties contain the most fluorine, whilst the greenish varieties contain the least. Colour deepens with increasing iron content, and then approaches biotite in composition.

ASTERISM..... Often exhibits "asterism" by transmitted light.

BIOTITE.

MAGNESIUM-IRON MICA.

Common constituent of the crystalline rocks, such as gneiss, granite, pegmatite, etc. Often associated with muscovite; also (unlike muscovite) in eruptive rocks of all ages.

SiO_2	Al_2O_3	MgO	K_2O	FeO	Fe_2O_3	F	H_2O
39·0	15·5	11·3	8·6	13·5	9·3	1·3	3·0

OPTIC AXIAL ANGLE

Nearly 0° to Under 5°

Optic axial plane parallel to the plane of symmetry, rarely at right angles to it, as in the variety anomite. Pleochroism strong.

COLOUR..... Deep green to black; very thin laminæ, green, deep red or brown; also pale yellow to colourless (rare).

LUSTRE..... Splendent, to more or less pearly when altered.

CHEMICAL TESTS... In the closed tube gives a little water, often with reaction for fluorine. B.B. whitens and fuses on thin edges to a brownish or yellowish glass (F=5). With fluxes gives usually strong reaction for iron. Completely decomposed by sulphuric acid, but not so readily as phlogopite.

LEPIDOLITE.

LITHIUM MICA.

As muscovite; associated with tourmaline, spodumene, amblygonite, etc.: often with tin.

SiO_2	Al_2O_3	K_2O	MnO	Li_2O	Fe_2O_3	F	H_2O
51·5	25·9	11·0	0·2	4·9	0·3	5·8	0·95

OPTIC AXIAL ANGLE

Nearly 0° to 75°–85°

Optic axial plane at right angles to the plane of symmetry.

COLOUR..... Rose-red, lilac, yellowish, greyish white, white. Lilac colour due to manganese.

LUSTRE..... Vitreous, to more or less pearly when altered.

CHEMICAL TESTS... In the closed tube gives reaction for fluorine, with water. B.B. fuses with ease to a white or grey glass, colouring the flame crimson (lithia) at moment of fusion. Gelatinizes with hydrochloric acid.

RUBY TYPE.

Characterized by a hard and brilliant appearance. Very stiff in thin plates. Usually a pale brownish red in thin plates (0·5 mm.) and a beautiful ruby-red in thick plates (10 mm.)—hence the name "ruby". May also be yellow, brown, or green in colour; these may be distinguished from the next type (green type) by a harder, harsher feel and a greater mechanical strength (or molecular cohesion), which enables this type to be split easily to 0·001" in thickness, without the thin films breaking up.

The clear mica of this type is the best, electrically and mechanically, of all the micas.

GREEN TYPE.

Colour usually green, greenish brown to brown, yellowish brown, pale to dark, with a brilliant surface.

Not so hard as the ruby type; frequently contains moisture between the laminæ and is characterized by a lower mechanical strength. Frequently with internal "hair-cracks", the polished edges of which show by reflected light.

Mica of this type does not split so readily into thin perfect laminæ; the plates being frequently broken into and across by internal "hair-cracks" which develop on splitting. The mica appears to be in a state of greater crystalline tension.

AMBER TYPE.

Usually has a softer, less brilliant appearance as compared with muscovite or biotite. Thin plates are more or less opaque to transmitted light; this opacity decreasing if the light is allowed to pass through at an angle to the surface.

Softer and more flexible than the other types. Sometimes like leather, without elasticity. Not so strong electrically as the muscovites, but stronger than the biotites.

Does not split so readily into thin laminæ, cohesion between the films being often strong enough to induce tearing without splitting.

BLACK TYPE.

Usually has a very brilliant black surface and does not split easily into thin laminæ. Rather brittle.

Thin plates bent sharply give way with a "snap" instead of softly, like phlogopite.

Electrically the weakest of the micas.

LITHIA TYPE.

Hard and brilliant appearance. Rather brittle and does not split easily into thin laminæ. Only mined for its lithia content.

TYPE AND CHARACTERISTICS			TRADE NAME	HARDNESS, SHORE'S TEST	AX. IN AIR	LOCALITY AND SPECIMEN No.
RUBY TYPE.	Normal	Clear	Best Clear Ruby A	93	69	Bengal 1A
			do	104	69	Brazil 16
			do	.....	....	Madagascar 52
			do	.....	....	Norway 89
			do	.....	....	Tanganyika Territory 80
			do Brownish	.....	....	Bengal 88
			Clear Pale Brown	.....	....	do 93
			Clear Yellow	.....	....	do 77
			Clear Pale Yellow	.....	....	do 70
			Clear Brown	.....	....	do 87
			do	.....	....	Central Provinces India 56
			do	.....	....	Argentina 57
			do	.....	....	Norway 90
			Clear Dark Brown	.....	....	South Australia 91
			Clear Ruby Brown	.....	....	Bengal 1B
		Stained	Slightly Stained Ruby	93	68	Bengal 2
			Stained Ruby	88	68	do 3
			do	76	70	Brazil 17
			Heavily Stained Ruby	97	68	do 4
			do	86	64	do 18
		Spotted	Spotted Ruby	96	66	Bengal 76
			do	.....	....	Central Provinces India 6
			do	.....	....	do 62
			do	.....	....	do 60
			do	.....	....	Brazil 65
			do	.....	....	Argentina 64
			do	.....	....	Madagascar 92
	Altered	Calcined	Bastard Ruby	.....	....	Canada 49
			do	.....	....	Brazil 50
			White	87	71	Bengal 5
			Silver	.....	....	do 51
		Hydrated	Soft Stained Green	.....	....	Bengal 105
			Soft Stained Brown	.....	....	do 106
GREEN TYPE.	Normal	Clear	Clear Pale Green	.....	....	Madras 82
			do	.....	....	Chosen 53
			do	.....	....	Canada 85
			Clear Green	92	72	Madras 10
			do	.....	....	do 75
			do	.....	....	do 73
			do	.....	....	do 74
			do	.....	....	
			do	.....	....	Tanganyika Territory 54
			Clear Dark Green	.....	....	Guatemala 79
			Clear Pale Brown	.....	....	Madras 78
			do	.....	....	West Australia 55
			do	.....	....	South Africa 96
			Clear Dark Brown	106	66	Madras 11
			do	.....	....	do 97
			do	.....	....	Tanganyika Territory 58
		Stained	Light Brown Stained	79	63	Madras 9
			Brown Stained	.....	....	do 98
			Green Stained	.....	....	West Australia 66
			do	.....	....	Tanganyika Territory 69
		Spotted	Green Spotted	90	69	Madras 7A
			do	.....	....	do 72
			do	.....	....	do 100
			do	.....	....	South Africa 94
			do	.....	....	West Australia 63
			do	.....	....	Peru 59
			do	.....	....	Tanganyika Territory 99
			Greenish Brown Spotted	94	60	Madras 7F
			Brown Spotted	91	64	do 7B
			do	92	64	do 7C
			do	97	65	do 7D
			do	90	60	do 7E
			do	.....	....	Tanganyika Territory 61
			Brown Heavily Spotted	81	64	Madras 12
	Altered	Calcined	Soft Light Brown Stained	.....	....	Madras 81
		Hydrated	Soft Clear Green	103	68	Madras 67
			Soft Stained Green	92	70	do 8
			do	.....	....	do 68
			Soft Stained Brown	.....	....	do 83
			Soft Stained and Spotted Brown	93	59	13
			Soft Spotted Green	.....	....	Madras 101
AMBER TYPE.	Normal		Light Amber	.....	....	Canada 19
			do	.....	....	do 20
			do	.....	....	British Central Africa 21
			do	101	25	Cochin India 15
			do	.....	....	Hudson Bay 102
			do	.....	....	Burmah 103
			Medium Amber	.....	....	Canada 22
			do	.....	....	Cochin India 23
			do	.....	....	Mexico 24
			do	.....	....	Canada 27
			do	.....	....	Ceylon 28
			do	.....	....	Canada 29
			do	.....	....	do 30
			Dark Amber	.....	....	Mexico 25
			do	.....	....	Ceylon 26
			do	.....	....	British Central Africa 31
			do	.....	....	Canada 32
			do	.....	....	South Africa 33
	Altered	Calcined	Silver Amber	.....	....	Greenland 36
			do	.....	....	Canada 37
			do	.....	11	do 38
			do	77	8	do 14
			do	.....	11	Mexico 39
			do (No. 31 altered)	.....	....	British Central Africa 40
			do	.....	....	do 41
			do	.....	16	Canada 42
			do	.....	....	Ceylon 43
			do (No. 33 altered)	.....	6	South Africa 44
			do (No. 26 altered)	.....	7	Ceylon 45
			do	.....	20	do 46
			do (No. 102 altered)	.....	....	Hudson Bay 104
			do	.....	12	Chosen 47
			do	.....	....	Peru 48
BLACK TYPE.	Normal		Black Amber (Biotite)	.....	....	Canada 34
			do	.....	....	British Central Africa 35
				.....	....	
				.....	....	
				.....	....	
				.....	....	
	Altered	Calcined		.....	....	
				.....	....	
				.....	....	
				.....	....	
				.....	....	
LITHIA TYPE.	Normal		Purple Mica	.....	....	West Australia 84
				.....	....	
				.....	....	
				.....	....	
				.....	....	
				.....	....	
				.....	....	
	Altered	Calcined	Purple Mica	.....	....	West Australia 95
				.....	....	
				.....	....	
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