Bharathidasan University

Tiruchirappalli – 620 023, Tamil Nadu

6 Yr. Int. **M.Tech. Geological Technology & Geoinformatics** programme

Course Code: MTIGT0306

CRYSTALLOGRAPHY AND MINERALOGY

UNIT–6 : Current Contours – Field Mineralogy

Georgius Agricola, 'Father of Mineralogy'

German scientist '**Georg Bauer**' - named by birth;
his *First book on Mineralogy was published during* 1530
entitled : ***'Bermannus, sive de re metallica dialogus'***
(A description of the ore mountain-Ergebrge, Silver mining district)

René Just Haüy (1743 –1822)

"Father of Modern Crystallography"

French (Paris) Mineralogist generally known as **Abbé Haüy**

Prepared by
Dr. K.Palanivel
Professor, Department of Remote Sensing

MTIGT0306: THEORY – CRYSTALLOGRAPHY AND MINERALOGY 4 credits

1. **Elements of Crystallography**: Crystalline and Amorphous forms - Symmetry and Classification of Crystals - System of Crystal Notation - (Weiss and Millerian) - Forms and Habits. Crystal Systems (Isometric, Tetragonal, Hexagonal, Orthorhombic, Monoclinic, Triclinic, Twinning - Crystalline Aggregates – Columnar, Fibrous, Lamellar, Granular - Imitative shapes and Psudomorphism. **12 Hrs.**
2. **Crystal Properties:** Space Symmetry Elements- Translation – Rotation- Reflection - Inversion Screw and Glide-point groups and Crystal classes - Derivation of 32 Crystal classes based on Schoenflies notation - Bravais lattices and their Derivation - An outline of Space Groups. X-ray Crystallography. **12 Hrs.**
3. **Physical Mineralogy**: Physical Properties: (Colour – Structure – Form – Luster - Transparency – Streak – Hardness – Specific Gravity – Tenacity – Feel – Taste – Odour) - Electrical, Magnetic and Thermal properties-Determination of Specific Gravity (Jolly's spring balance, Walker's steel yard, Pycnometer methods) - Empirical and Structural formula of minerals – Isomorphism, Polymorphism and Psudomorphism - Atomic substitution and Solid solution in minerals - Non Crystalline minerals - Fluorescence in minerals - Metamict state. **16 Hrs.**
4. **Optical Mineralogy:** Optical Properties (Colour – Form – Cleavage - Refractive Index - Relief – Alteration – Inclusions – Zoning – Pleochroism – Extinction - Polarization colours – Birefringence) – Twinning - Optic sign (Uniaxial and biaxial)- Interference figures - Primary and Secondary Optic axes - Optic axial angle measurements – Optic Orientation – Dispersion in Crystals - Optic anomalies. **12 Hrs.**
5. **Mineral Groups:** Ortho and Ring Silicates (Olivine group - Garnet group). Alumino silicates (Epidote group - Zircon – Staurolite – Beryl - Cordierite and Tourmaline). Sheet Silicates (Mica group - Chlorite group and Clay minerals) - Chain Silicates (Pyroxene group - Amphibole group and Wollastonite). Frame work Silicates (Quartz -Feldspar - Feldspathoid - Zeolite and Scapolite groups) - Non-silicate (Spinel group, Carbonates and Phosphates). **12 Hrs.**

6. **Current Contours: (Not for Exam, only for Discussion):** Preparation of Field Kit for testing and identifying minerals during field survey; preparation of mineral and crystal samples for making thin sections, x-ray crystallographic studies. Learn how minerals together form different types of rocks.

Text Books:

1. Dana, E.S, A Text Book of Mineralogy, Wiley Eastern, 1955.
2. Flint, Y, Basic Crystallography, Mid Publishers, 1970.
3. Phillips, F.C. Longman, An Introduction to Crystallography, 1956.
4. Bloss.F.B., Crystallography and crystal New york 1971
5. Read, H.H, Rutley's Elements of Mineralogy, CBS Publishers & Distributors, Delhi,1984.

Reference Books:

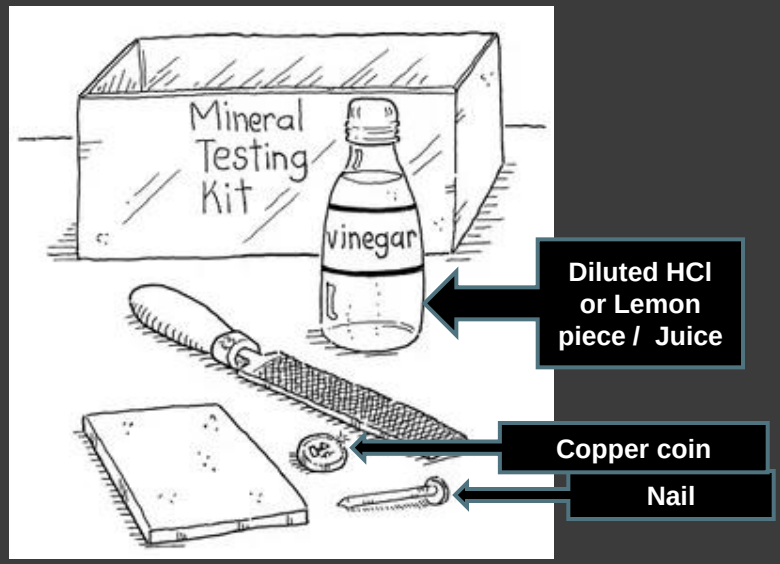
1. Berry Mason, L.G,Mineralogy, W.H. Freeman & co - 1961.
2. D. Perkins, (2002), Mineralogy, 2nd Edition, Pearson Education (Singapore) Pte. Ltd, Delhi, 483pp, ISBN 81-7808-831-2
3. W. D. Nesse, (2000), Introduction to Mineralogy, Oxford University Press, ISBN 0-19- 510691-1
4. Naidu, P.R.J,. Optical Crystallography.
5. Wahlstrom, E.F, Optical Crystallography, John wiley, 1960.
6. Azaroff, L.V,Elements of X-ray Crystallography, 1968.
7. Deer, W.A, Howie, R.A and J.Zussman, LongmansAn Introduction to the Rock Forming Minerals, 1966.
8. Alexander N.Winchell,Elements of Optical Mineralogy, Part I and II,Wiley Eastern (p) Ltd, 1968
9. Ernest, E.Walhstrom, Optical Crystallography, John Wiley & Sons.1960.
10. Kerr B.F,Optical Mineralogy. Mc Graw Hill, 5 th Edition, New York-1995.
11. Mitra, S,Fundamentals of Optical Spectroscopic and X-ray Mineralogy.

Course outcomes:

After the successful completion of this course, the students are able to:

- **Gain knowledge about the source minerals as raw materials for anything on the Earth and for the survival of life**
- **Independently able to classify the crystals based on symmertical elements and face indices**
- **Understand various physical, chemical and optical properties of minerals so as to discriminate them**
- **Provide ideas about the major existence of rock forming silicates at the surface of the Earth**
- **Understand the various properties of mineral groups**
- **Know the crystal and mineral forms and their habits**

Field Testing Kit for Crystals and Minerals



Field Magnet

Field Lens / Hand lens

A piece of Feldspar & Quartz

Streak Plates

Mohs Hardness Scale

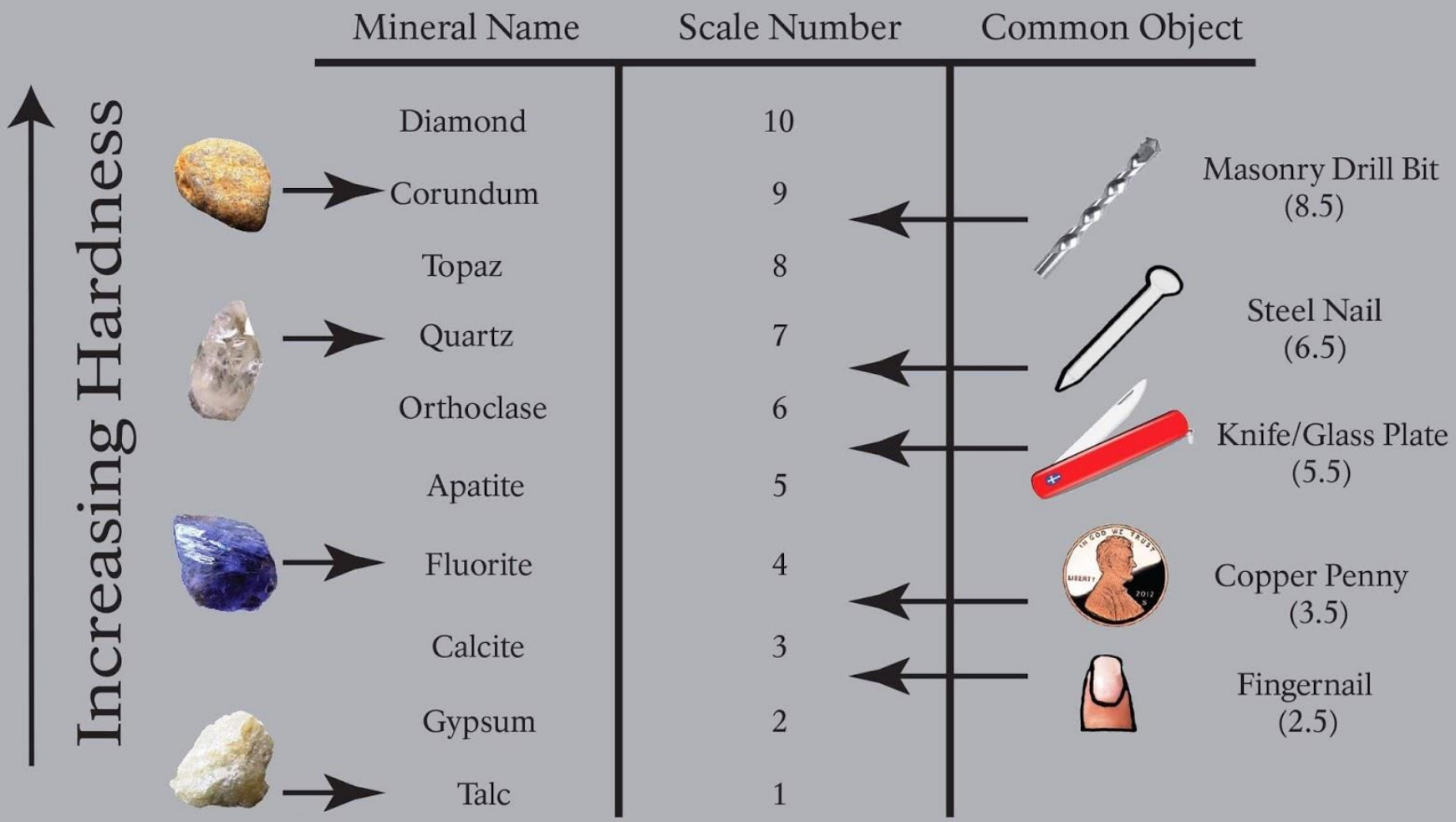


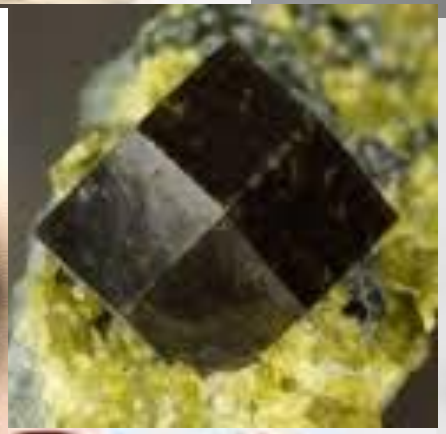
Chart to determine Hardness of minerals

Relative weighing / Specific Gravity

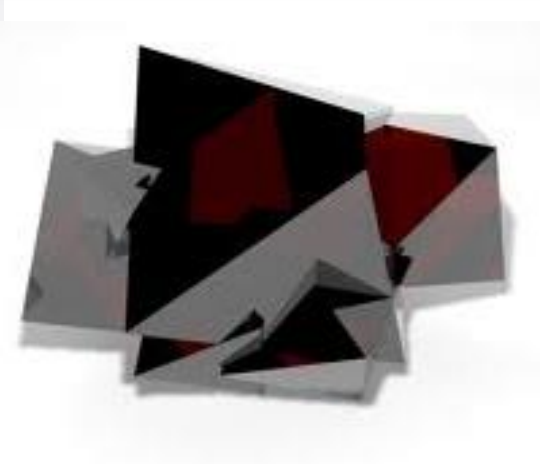
Transparency and Iridescence testing with torch

Zoomed Viewing of crystal / mineral using handlens

Photographs of identical Minerals




Garnets



Thank you

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For your kind cooperation
Patient listening & Joyful Learning
Crystallography

Let us enjoy using Crystals and Minerals more efficiently, effectively & SUSTAINABLY too...