المحاضرة الاولى (industrial Rocks and minerals)

Definitions:

Economic geology is one of Geology (Earth sciences) branches, which is concerned with earth's crust or Lithosphere materials that can be used for economic or industrial purposes. These materials called economic resources, which include, metals (like gold, &platinum), nonmetallic minerals (like sulphur & graphite), industrial minerals & rocks (like limestone, claystone & gypsum) which is used in manufacture of (cement, ceramic, lime, & glass), energy resources or fuels (petroleum, coal, & natural gas) and water. With the exception of water these resources are called Economic minerals, they are an accumulation of minerals having economic value for the benefit of mankind, which are concentrated in sufficient quantity as to be capable of economic extraction. Different economic minerals presents as mineral deposits in earth's crust, they are concentrated accumulations of ore minerals and industrial minerals and rocks.The elements that enter into the mineral deposits have been derived either from the rocks of the earth's crust and upper mantle or magma. 99 % of the earth's crust is made up of major elements (O, Si, Al, Fe, Ca, Na, K, Mg, & Ti), many other elements are 1 %. So geologic processes must concentrate these elements hundreds to thousands of times to make ore deposit. Classification of economic minerals about using as raw materials for the different industries (Gregory, 1980):

1- Metallic minerals (minerals that yield metals):

Precious metals: gold, silver, platinum Base metals: copper, lead, zinc, tin

Steel industry metals: iron, nickel, chromium, manganese, molybdenum, tungsten, vanadium Light metals: aluminum, magnesium Electronicindustry metals: cadmium, bismuth, germanium Radioactive metals: uranium, radium

2- Nonmetallic minerals:

Insulating materials: mica, asbestos Refractory materials: silica, alumina, zircon, graphite Abrasives and gems: corundum, emery, garnet, diamond, topaz, emerald, sapphire General industrial minerals: phosphate rock, rock salt, limestone, barite, borates, feldspars, gypsum, potash, trona, clays, magnesite, sulphur - Fuel minerals:

Solid fuels: anthracite, coal, lignite, oil shale Fluid fuels: petroleum oil, natural gas With the exception of Fuel minerals, and Metallic minerals (ores geology), so the term nonmetallic minerals is brief and convenient, it is used to comparison with metallic minerals. But the expression industrial minerals and rocks is more accurate and descriptive. It indicates

both a natural industrial minerals & rocks, and manufacturing product materials. Exploration stages of Economic mineral deposits (nonmetallic ores):

The mineral deposits ores can be described as concentrated accumulations of ore minerals or industrial minerals and rocks in sufficient quantity as to be capable of economic extraction.

The exploitation of mineral deposits falls into four stages:

1- Locate the deposits and geological studies.

2- Evaluation of mineral deposits and Estimation of their reserve, then studying the Technical and Economic Feasibility of exploitation these deposits.

3- Mining and Extraction (open-pit & underground mining methods).

4- Processing of treatment and beneficiation.

Mining operations: Minerals may be mined and processed for more than one purpose. The mineral may be a metal ore, when it is used to prepare the metal, as when bauxite (hydrated aluminium oxide) is used to make aluminium. The mineral is classified as a nonmetallic ore when bauxite is used to make material for refractory bricks or abrasives.Mining is the process of extracting minerals of economic value from the earth's crust for the benefit of mankind. A mine is an excavation made in the earth for

the purpose of extracting useful minerals. The four main classes of mining operations (Gregory, 1980):

1- Underground mining: (ore is far from surface, the covered rocks are hard & thick)

Near vertical vein deposits,

Horizontal bedded deposits (metals, nonmetals)

2- Surface mining: (ore is near from surface, the covered rocks are thin)

Quarrying of construction (building) stones

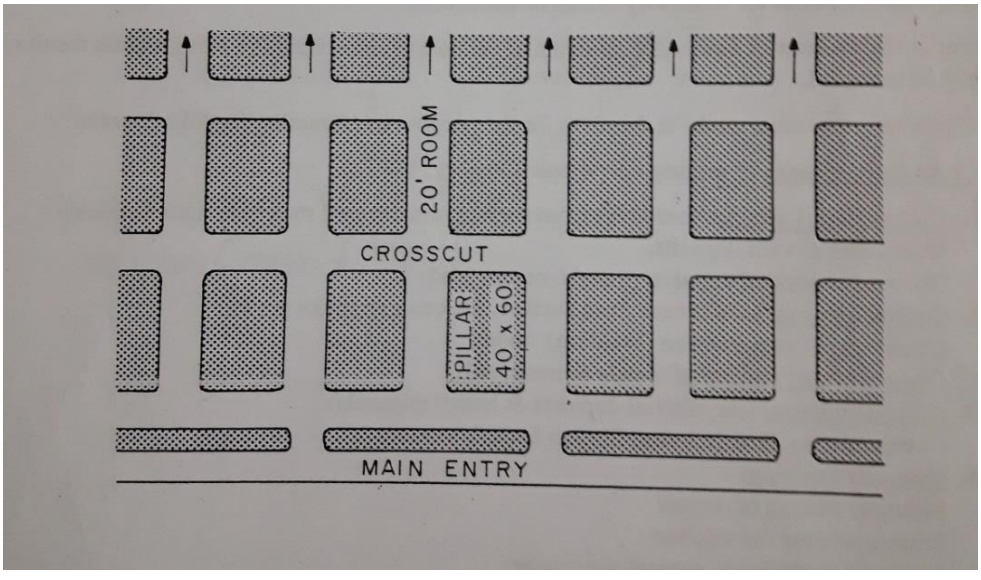
Open-pit (cut) mining of metals & nonmetals

3- Alluvial mining: (for alluvial deposits & heavy minerals) Ocean mining, Beach dunes, Stream beds & terraces

4- Non-entry mining:

Solution mining of copper Frasch process for sulphur Oil wells (petroleum, natural gas, water)

1- Underground or (rooms and pillars) mining method: Designing the mine is controlled by the shape of the ore body. Drilling and blasting underground are much more difficult than on the surface. In this method the ore is extracted by room, a pillar of ore is left intact between adjacent rooms to support the roof rocks. One of the disadvantages of the room and pillar method is that most of the ore is left behind in the pillars.



2. Surface or open-pit mining method:

This method use where deposit occurs at or near the surface. An open-pit mine is a big hole in the ground with a series of step like terraces (benches) round the excavation, this is known strip mining. Drilling and blasting is required to loosen hard overburden material, it is removed to expose the ore deposits. The slope angle of the pit sides is controlled by the rocks properties (hard or soft). The gentle slope in soft rocks more than in hard. The space of terrace (bench) is allow shovels to move and load the ore into transport vehicles. The ratio of waste rock (overburden rock) to the ore deposit is known as the stripping ratio.