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Glossary of special terms of geoscience, mining-archaeology and archaeometallurgy

This glossary is an arbitrarily collected composition of terms mentioned in manuscripts of the Laurion Conference 2018 at Bochum. Please consider this not to be a systematically collected glossary. Not all definitions of certain terms result from one source. They are adapted or enlarged according to the interdisciplinary variety of faculties.

Adit: Drifting an adit from the surface was originally performed to follow a mineralisation exposed at the surface. In a second stage an adit could be constructed for prospecting purposes and transportation of ore.
Batholith: Large, intrusive bodies with steeply dipping walls and lacking any visible floor. Typically composed of granite, granodiorite, and other related acidic rocks.
Blueschist: A metamorphic rock formed under conditions of high pressure and relatively low temperature. Characteristic minerals are glaucophane and kyanite.
Bonanza: Very rich and profitable part of an ore deposit.
Boudinage: Structure found in sedimentary rocks subjected to folding. It consists of strike-elongated “sausages” of more rigid rocks enclosed between relatively plastic rocks.
Buddle: Shallow annular pit for concentrating finely crushed, slimed, base-metal ores.
Buddle-work: Treatment of finely ground, metal-containing materials by gentle sluicing in which a heavier fraction of a fed pulp is built up (buddled) while the lighter fraction flows to discard. This is continued until a satisfactory concentrate is produced.
Cataclasis: Cataclasis is a rock deformation accomplished by fracture and rotation of mineral grains or aggregates without chemical reconstitution.
Cataclasite / Cataclastic rocks: The terms are used for solidified metamorphic rocks formed by low temperature and pressure. Cataclastic rocks are widespread concomitants of fault belts (compression fault, subduction zones, shear zones). They are composed of different sized, angular fragments embedded in changing amounts of fine-grained material (clay minerals, mica). Not solidified cataclastic rocks, so-called fault gouges, are often feeder conduits for hydrothermal solutions. Frequently secondary minerals are formed here by decomposition of primary sulfidic ores such as galenite and chalcopyrite which are malleable by cataclastic input. Well known in old mining activities in Germany is the term "Bleischweif". Other minerals are brittle (pyrite) and will be broken and squeezed out (cataclasic deformation).
Chamber: A large irregular or rounded body of exploited ore, occurring alone or as an extension of a vein.
Chamber and Pillar Mining: It is a mining system in which the crushed material is extracted across a more or less horizontal plane, creating arrays of rooms (chambers) and pillars or blocks. “Rooms» of ore are dug out while «pillars» of untouched material are left to support the roof overburden. Calculating the size, shape, and position of pillars is a complicated procedure, and is an area of active research. The technique is mainly used for overwhelming flat-lying deposits. Room and pillar mining reduces the risk of surface subsidence compared to other underground mining techniques. It was one of the earliest mining methods used.
Chipping: The removing of surface defects from semi-finished metal products by pneumatic chisels.
Cobber: Mining-friend and -colleague, German: Kumpel.
Contact (1st, 2nd, 3rd): Name of mineralised interfaces between marbles, schists and shale sequences. Argentiferous lead sulfides (galena) are abundant at Laurion along the 3rd contact than in higher stratigraphic levels.
Crushing: Size reduction into relatively coarse particles by stamps, crushers or rolls.
Croiseur: A single vertical lens of oxidised mineralisation extends about 15 m below the contact at the S end of the main section in Ross et al. this vol. p.Seite 34 fig.6A. It is an example of fractures with primary mineralisation within the Lower Kamariza marble, termed by the French as croiseurs. Marinos and Petrascheck, 1956, noted that croiseurs contained primary and oxidised sulfide mineralisation, commonly trended 20–50 W of N and generally extended no more than 15 m below the third contact. Croiseurs attain their maximum width at the third contact.
Cupel: A porous ceramic, often made from bone ash or other refractory components. The cupel is used to extract or assay precious metals that have been dissolved in metallic lead by the process of cupellation. See Cupellation.
Cupellation: Process used for extracting silver and/or gold from lead. The principle involves first the dissolution of the material to be tested in molten lead, then

the oxidation of this lead to litharge (PbO) in a shallow, dish-shaped crucible often made of bone ash (cupel), leaving the precious metals behind as a molten globule. A temperature of about 1,000 ºC is needed. The litharge volatilizes or is skimmed off, or is combined with the bone ash in the cupel.

Dipp: The angle of a slope, vein, rock stratum or borehole is measured from the horizontal plane downward.

Drainage: Drainage is meant to include all provisions to reduce the water in mines and its planned removal from the underground workings.

Dressing: Rock ore crushing and screening to required sizes.

Edge runner mill, rotary mill driven by animals: Edge runner mill, also known as Chilean mill or Roller stone mill, consists of one or two heavy stone or steel rollers mounted on a horizontal shaft and turned round a central vertical shaft on a bed of steel or granite. The stones may vary from 0.5–2.5 m in diameter, the larger size weighing up to about 6 tonnes. The material to be ground is kept in the path of the runner by scrapers. The beneficiation is partly due to crushing: by the weight of the stones, but more to friction between the surfaces of contact between the runners and the bed stone. The Chilean mill was an artisanal machine used for the beneficiation of gold. The machine was composed of two rotating wheels that would revolve over a pan filled with gold-bearing rocks. The idea was that the wheels would break open the rocks with gold, so they could harvest gold from multiple rocks at a time.

Ekvolades: Ekvolades refers to ore relatively low in metal (lead, silver, copper) which was extracted in the ancient mines, but was judged as unprofitable for further metallurgical processing. It was abandoned as waste near exits of galleries. Ekvolades were enriched by beneficiation in workshops (ergasteria).

Elutriation: This is a process for separating very fine-grained particles based on their size, shape and density, using a stream of liquid flowing in a direction usually opposite to the direction of sedimentation. The smaller or lighter particles rise to the top (overflow).

Exploitation: A) The process of winning or producing from the earth oil, gas, minerals or rocks that have been found by exploration. B) The extraction and utilization of ores.

Fabric: The sum of all the textural and structural features of a rock.

Film sizing: Concentration of finely divided heavy minerals by gently sloped surfaces which may be plane, riffeled, or vibrated.

Gallery: A horizontal or nearly horizontal underground passage in a mine. Drifting a gallery can be done within an ore deposit or in the adjacent host rock to open a mine.

Glancing of silver: At the end of the cupellation silver will be segregate when lead is oxidized to litharge and is removed. Silver will remain in the bottom of the cupel and it will appear quite characteristic as the glancing of silver (German Silberblick). In actual metallurgical jargon this separation is called a “dore”. This raw silver contains impurities.

Gossan: Term for a rusty-coloured, iron-rich, leached outcrop of a sulfidic ore deposit at surface. The gossan / leached capping formation process commences when ore assemblages and their associated wall rocks encounter the interface between the water table and the overlying surficial zone. This is in essence the transition from a reducing to an oxidising environment. A gossan may be divided in 2 zones. 1: Surficial total leached capping. Minerals: quartz, Fe-(hydr-) oxides (limonite, goethite, jarosite) and carbonates (siderite, ankerite). This part is also called Iron Hat. 2: Decreasing leaching with remnant sulfides (galena, chalcopyrite etc.) become visible at lower depths. Major formation of metalliferous secondary minerals zone (malachite, cerussite).

Granite: Light-coloured, coarse-grained felsic igneous magmatic rock composed of quartz, feldspar and ferromagnesium minerals (muscovite, hornblende). It is the intrusive equivalent of rhyolite.

Granodiorite: It is similar to granite. There are transitions, but granodiorite contains twice the amount of plagioclase over orthoclase, and biotite and/or hornblende.

Gravity separation: is a physical process which consists of the separation of different minerals in ores and rocks due to differences in specific gravities. Force of gravity is present in nature (rivers), but can be influenced extensively by centrifugal force, resistance to motion by a fluid (e.g. air, water) etc. Gravity separation is the oldest known ore beneficiation technique and led probably to the discovery of gold.

Griffon: Term used by French miners at Laurion in the 19th century AD to designate near-vertical, irregular, downward-thinning lenses of zinc oxide calamine, often associated with iron oxides and galena rich ore. Formation by redistribution of zinc and iron from contact mineralisations into underlying marble. Strongly influenced by steeply dipping of pre-existing fractures.

Grinding: Comminution of minerals by dry, or more common wet methods in rod, ball, or pebble mills.

Helicoidal washery: Helicoidal washeries do not exist in Laurion. The objects in question were misinterpreted by K. Konophagos. Instead, they are → edge runner mills or pan grinders.

Hopper quern: Hopper quern is the upper part of a pair of round stone dishes (quern stones) for hand-grinding a wide variety of materials (vegetal food processing, inorganic materials). The lower stationary stoneslab is called a saddle quern. A handle slot contained a handle which enabled the rotary quern to be rotated. This system was used worldwide since prehistoric times.

Hydrothermal deposit: Precipitation of minerals or ores from hot aqueous ascending solutions from a magma in open spaces (tectonic cleavages, tubes, chimneys, karstic cavities) (“open space filling”). Brekzia-style hydrothermal mineralisation occurs in near surface fissures.

Intercalation: The term means the interbed of layered, lenticular or sheeted layers of remarkable rocks or mineral aggregations in a geological sequence.

Karst: Any uneven limestone topography, characterized by joints enlarged into criss-cross fissures (grikes) and

pitted with depressions resulting from the collaps of roofs of underground caverns. It is formed by the action of percolating waters and underground streams.

Kollergang: see Edge runner mill

Litharge: Lead oxide ($Pb^{2+}O$) formed by cupellation by oxidation of lead. Red modification: stable < 540 °C. Formed by slow cooling down to the environmental temperature. Yellow modification: stable at high temperature. Will be kept at quick cooling.

Mantos: Network of parallel cavity fillings in lead-zinc-silver mineralisations in karstic deposits. At Laurion, manto-style mineralisations occur within marbles as massive replacements.Thickness of mantos varies from a few centimeters to a few meters.

Marble (Upper/Lower Marble): Marble is a metamorphic rock composed of recrystallized carbonate minerals such as calcite and/or dolomite. Marble occurs at several geological units. Monomineralic marble of pure calcite is suitable for sculpting. It occurs at Laurion.

Marl: General term for very fine-grained rock, either clay or loam, with a variable admixture of calcium carbonate.

Massicot: Yellow lead oxide. In metallurgy it is formed by rapid cooling from high temperature. In nature a rare mineral of secondary origin associated with galena.

Melting: In metallurgy the term melting is used if two or more metals are liquefied to produce alloys or larger units out of small particles.

Metabasite: Basic magmatic rocks (gabbro, diabase, basalt and other), which were exposed to regional metamorphic conditions and changed their compositions to new characteristic mineralogical associations.

Mica schist: Mica schist is a crystalline metamorphic rock. Main components are quartz, muscovite, biotite. Mica shist has a pronounced tendency to split into layers (schistosity).

Migmatite: High-grade metamorphic rock consisting of dark, solid old parts (Palaeosome: biotite, hornblende, cordierite) and light, liquefied parts (Neosome: quartz, feldspar).

Mine: Μέταλλον is used as a general term for a “mine” in ancient Greek. It must be distinguished between opencast mining to exploit mineralisations at or closed to the surface. Shafts and galleries were constructed to exploit ore from veins or irregularly formed ore body in the underground.

Mylonite: Strongly deformed, layered, fine-grained solid rock showing layering caused by shearing.

Olynthos mill: Olynthos mill belongs to hand-driven mills. It consists of rectangular-shaped lower and upper stones. The top stone had a long handle and was moved in reciprocal fashion from side to side. The mill also had a hollow cavity (or hopper) with a narrow slot at its centre through which the miller fed the grain. It can not be ruled out whether this mill in addition was used for crushing ore.

Ophiolite suite: Geological complex of basic and ultrabasic magmatic rocks (peridotite, gabbro, basaltic rocks, Deep Sea sediments). Overview of composition of earth’s crust and mantle. Contains frequently volcanogenic massive sulfide-ore deposits (copper).

Orogenic belt: Extended areas in earth crust which were exposed intensive folding and other tectonic activities (metamorphosis, intrusion of magmatic rocks).

Outcrop: see Gossan

Pattinson process: Obsolescent metallurgical process used for the separation of small quantities of silver from lead by partially solidifying a molten bath of the two metals and separating the remaining liquid. This process is repeated several times and the silver is concentrated in the liquid.

Plain table: An inclined ore-dressing table.

Plynite: Residues of ekvolades waste and/or from fine-grained, desilverized litharge produced on the drying floor of washeries.

Refining: Refining is the separation of a metal from its impurities. As such it is applied to a wide range of different processes for different metals (copper, gold, iron.

Rhyolite: Generally light-coloured volcanic rock, high in quartz content (> 20%) and alkali-feldspar. Rhyolite is the extrusive equivalent of granite.

Shaft: Miners are sinking a vertical or diagonal shaft to follow a mineralisation (vein) exposed to the surface and to open a mine. Further, the construction of shafts served as vertical adits to climb down to an underground mine, for hauling and for ventilation.

Sizing: Sizing is the general term for separation of particles (ores, gangues, rocks) according to their size. There are a number of ways to do this kind of dressing. The simplest sizing process is screening, or passing the particles to be sized through a screen or number of screens.

Skarn: Replacement of limestone or other carbonate-rich rocks (dolomite, marl) close to an intrusive contact caused by high temperatures and magmatic, hydrothermal fluids (metasomatism). Formation of various calc-silicate minerals and metal bearing ores of Cu, Fe, Pb-Ag-Zn. Skarn ore bodies are characterized by irregularly shaped forms caused by lithology and structure of host rocks. Typical are zoning of ores.

Slime: Particle of crushed ore which are of such a size that they settle very slowly in water and through a bed which water does not readily percolate. Such particles are regarded as powder or dust produced by crushing, grinding or rubbing.

Sluice, Sluices: are long, narrow “boxes” used in the exploitation of black sands, gold, and other heavy minerals from placer deposits or form finely crushed ores using water. Traditional sluices have transverse riffles over a carpet or rubber matting, which trap the heavy minerals.

Slurry: Fine carbonaceous discharge of a mine washery. All washeries produce some slurry which must be treated to separate the solid particles from the water (usually by settling) to have a clear effluent for reuse.

Smelting: Smelting is a metallurgical process of extracting a base metal (copper, iron, silver, tin etc.) from its ore by applying heat. This involves a chemical reaction between the ore and the fuel, or between the heated ore and a reducing atmosphere. Most smelting processes are carried

out above the melting point of the metal concerned. So that both the metal and waste products (slag) are liquid and can be separated using gravity. The main exception being iron smelting, before the introduction of the blast furnace process, where the iron remained solid or at least in a pasty state, but the waste products formed a molten slag.
Strake: Gently sloped, flat table used for catching grains of heavy water-borned minerals. The German term is “Gerinne”.
Strike: The course or bearing of the outcrop of an inclined bed, vein, or fault plane on a level surface; the direction of a horizontal line perpendicular to the direction of the dip.
Stripe: Stripe is a long channel similar to the tye.
Structure: In context of geology this term in English is above the terms structure and texture. It refers to folds, cleaving/jointing, parting, segregation etc. Basaltic columns represent a structure. Structure is more or less synonymous with the German "Textur".
Subduction: The geological process of one lithospheric (oceanic) plate descending beneath another.
Subduction zone: Long, narrow belt in which subduction of an oceanic plate takes place. It is characterized by high seismic activities, volcanism and orogenesis.
Tailings: Rejected portion of an ore, waste, gangue. Portion washed away in water concentration. Maybe impounded in a tailings dam or pond, or stacked dry on a dump.
Tailings dam: One used to hold mill residues aftertreatment. These arrive as fluent slurries. Dam may include arrangements for run-of for return of water after the slow settling solids have been depoited.
Texture: In context of ceramic refers to the special relationship among the materials it is composed. Broadest textural classes are crystalline (in which the components are intergrown/interlocking crystals; grain size, particle shape, arrangement), fragmental (accumulation of of clastic temper fragments), glassy (particles are too small to be detected and amorphous arranged). Texture is more or less synonymous with the German "Struktur".
Tye: Strake in which a considerable thickness of low grade concentrate is collected. In German language it is a Schlämmgraben/-kasten.
Ultramylonites: Metamorphic rock close in composition to cataclasite. It is a dense, fine-grained rock showing ± layered structure. It looks like chert or fine-grained volcanic rocks.
Vein: Tabular or sheet-like body of rock or ore penetrating a different type of rock.
Ventilation: This is the term for enhancement of the prevailing air content in a mine. The atmosphere, according to its composition and suitability for breathing,can be fresh, good, stagnant or sticky, noxious or poisonous and gassy (firedamp). In many ancient mines air circulation due to different levels of temperature inside and outside of the mines was sufficient. By using fire setting ventilation shafts, ventilation interconnections or galleries were constructed.
Washery: A place at which (crushed) ore is separated from the waste by washing. Also called wet separation plant; washing plant.

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