Glossary

Banded iron-formation: chemical sediments showing alternate bands of iron-rich and silica-rich minerals precipitated in shallow to deep sedimentary basins in the Archean and Proterozoic Eras.

Biogenic textures: physical characteristics of goethites formed by iron replacement/precipitation on the outer shell envelopes of microorganisms, following by their eventual death and fossilization (Montiero et al., 2014; Levett et al., 2016, 2020). Biogenic textures are also produced by rapid and pervasive goethite replacement of wood fragments or dead organisms that may allow the complete preservation of plant cells and delicate soft tissues (e.g., McCurry et al., 2022). Porous (yellow) goethite replacing wood fragments or soft tissues may have poor He retentivity, imposing challenges for its use in (U-Th)/He geochronology.

Colloform (or botryoidal) goethite: botryoidal goethite precipitates in empty spaces when iron species in solution interact with the exposed surfaces of host rocks, previously formed goethites, or other supergene phases (e.g., cryptomelane, malachite, etc.). Colloform goethite displays concentric growth bands showing clear bases and terminations; commonly, each band consists of goethite crystallites oriented in the growth direction. In some cases, a goethite band is overlain by a different mineral band (e.g., Mn-oxides, hematite, Cu-carbonate) before resumption of goethite precipitation. Tens-of-centimeter-thick colloform goethite is common in weathered massive sulfide deposits, karst environments, and some weathered pegmatites. The size and purity of colloform goethite suggest high concentrations of iron in solution. Colloform goethites provide ideal samples for geochronology due to their mineralogical purity and often the protracted history of iron precipitation they record. When colloform goethite forms features similar to a bunch of grapes, they are called botryoidal goethite.

Duricrust: a horizon in a weathering profile that is indurated by authigenic cements. It can occur at the surface or in the shallow subsurface, and its minerology depends on the composition of the weathered rocks and environmental conditions. If the cements are iron oxyhydroxides, the duricrust is called a **ferricrete**; if the cement is amorphous, cryptocrystalline, and crystalline silica, the duricrust is called a silcrete; there are also calcretes (calcite-cemented), manganocretes (Mn-oxide-cemented), bauxites (gibbsite- and/or boehmite-cemented), etc.

Gossan: iron-rich leached caps developed during weathering of rocks rich in sulfides.

Hypogene minerals: primary minerals of igneous, magmatic-hydrothermal, hydrothermal, and metamorphic origins.

Iron-oxide copper gold (IOCG) deposit: volcanogenic-hydrothermal deposits formed by the emplacement of high volumes of iron-rich magmatic fluids near subduction zone and back-arc spreading environments. The interaction between these magmatic fluids and oxidizing meteoric waters induces explosive activities that generate large amounts of brecciated rocks. Fe, Cu, and Au are the most significant mineralization in IOCG deposits. Mineralization is structurally controlled.

Lateritic profile: the product of the prolonged and intense rock weathering at Earth's surface that leads to the formation of chemically and mineralogically stratified profiles. A typical lateritic profile will include all or most of the following horizons, from top-to-bottom: soil, Fe-Al duricrusts, mottled zone, bleached zone, saprolite, saprock, and unweathered bedrock.

Limonite: generic term used to designate a mixture of fine-grained iron oxides and hydroxides often mixed with clay minerals and other phases. Limonite is often use as a mineral name, but limonite is not a

recognized mineral by the International Mineralogical Association. In nickel laterite profiles, a soft horizon formed mostly of fine-grained goethite that overlies the saprolite is commonly called the “limonite horizon”.

Massive goethite: Massive goethites lack growth bands notable in botryoidal goethites. Massive goethites may show complex textures associated with multiple nucleation sites, cross-cutting goethite veins, Fe-metasomatism of existing rocks and minerals, and the possible coexistence of the newly formed goethite with remnants of primary Fe-bearing minerals such as magnetite, hematite, and ilmenite.

Massive sulfide deposit: generic term applied to mineral deposits where metal sulfides make up important economic ore minerals.

Mottled zone: a horizon in lateritic profiles characterized by multicolor (orange-purple-white) patches of soft and indurated material resulting from the alternation of oxidizing and reducing conditions due to the fluctuation of the groundwater.

Pisolith: a pisolith is a spherical to semi-spherical pedogenic concretion formed of μm-thick goethite concentric bands around a central nucleus composed of pure goethite or fragments of rocks, sediments, pieces of broken pisoliths, or ferruginized wood. They occur in diverse geological environments and can be detrital or formed in situ.

Pisolithic goethite: goethite precipitated as concentric layers around a pisolith’s nucleus.

Pore-filling goethite: goethite cement filling small open spaces within weathered rocks, sediments, and duricrusts. Generation after generation of iron-rich solutions penetrate the pores, often in waves, partially corroding the mineral matrix and precipitating thin layers of goethite. Pore-filling goethites also precipitate within and around root casts.

Saprock: the lowermost horizon in lateritic profiles where the original texture and fabric of the parental material are still preserved and < 20% of the weatherable primary minerals have been weathered.

Saprolite: horizon above the saprock in lateritic profiles where the original texture and fabric of the parental material are still preserved and > 20% of the weatherable primary minerals have been weathered.

Supergene processes: any process associated with the downward transport of weathering solutions and their dissolved loads. *Absolute enrichment* occurs when metals are mobilized from upper parts of the profile through partial dissolution of primary minerals, and then transported and re-precipitated in lower horizons as secondary minerals. This process leads to a net addition of metals in specific zones, increasing their absolute concentrations compared to the parent material. *Relative enrichment* of a chemical element occurs when more mobile elements are leached out of a weathering profile, resulting in an apparent increase in the concentration of less mobile elements. This type of enrichment is relative because it reflects the residual accumulation of immobile elements rather than their absolute addition.

Supergene minerals: minerals formed by supergene processes.