

COURSE TITLE: *Where Stuff Comes From: The Earth's Material Resources*

INSTRUCTOR: Stephen Marshak (Professor Emeritus, Dept. of Geology, University of Illinois)

DESCRIPTION: Society utilizes an immense variety of materials that don't come from plants or animals, but rather from the Earth itself. In the version of this course in 2019, we focused on those resources that provide energy. In the version taught in 2020 we turn our attention to material resources including, for example: the lithium in a battery, the concrete in a sidewalk, the copper in a wire, the glass in a window, the diamond in a ring, the phosphorous in a fertilizer, the pigment in a painting, the clay in pottery, the water in a city water supply—you could fill pages with the names of such Earth resources. We will consider the geological origin of these resources, the processes by which they are found and extracted, the ways in which people transform them into useable forms, and the environmental sustainability issues associated with resource extraction and use.

NO PREREQUISITES: There is no prerequisite for this course. It will be entirely new material to participants who took the 2019 version of *Where Stuff Comes From*, but it does not depend on the 2019 version. So, both participants in the 2019 course, and people who did not take the 2019 course, are more than welcome.

— COURSE OUTLINE —

• **WEEK 1: General Introduction; Minerals and Rocks; Gems**

- What is a material resource, and what is resource sustainability?
- Example: Lithium (from volcanoes, to deserts, to mood stabilizers, to batteries, to more batteries)
- The general categorization of Earth materials.
- Introducing minerals and rocks.
- Something special—Gems!
- Where do diamonds come from.
- The global diamond cartel.

• **WEEK 2: Non-Metallic Mineral Resources**

- The first non-metallic mineral resource: pigments
 - - *By the way* . . . how does a cave painting differ from a petroglyph?
- The Stone Age
 - - *By the way* . . . what makes a good arrowhead?
- What does this category include, and how much is being used?
- Dimension stone: from quarry to slab to the walls of Krannert
- Crushed stone: from quarry to crusher to roadbed
- Brick: from rock to clay to adobe to durable blocks
- Concrete: seashells to limestone to lime to cement to concrete
- Glass: from rock to sand to sandstone to glass
- The Sand Crisis: There actually aren't enough grains of (accessible) sand in the world.

• **WEEK 3: Metallic Mineral Resources**

- What's an ore, and how do they form? The mineralogy of ore.
- Finding ore: An application of Plate Tectonics.
- The gold rush.
- Exploration and extraction of ores
- Transforming ore into metal, from ancient times to today
- Bronze Age, then Iron Age, then Aluminum Age: Why in that order?
- Global distribution of mineral reserves, and its implications.
- The crisis of "strategic minerals" (including Rare Earth Elements).
- Environmental challenges.

• **WEEK 4: Soil, Water, and the Earth's "Critical Zone"**

- Origin, evolution, character, and classification of soil.
- Soil as a resource; soil erosion.
- The "Green Revolution" (the 1960s one), and its implications.
- Fertilizer chemicals.
- Sources of freshwater, and their limits
- The water crisis.