8- Metasomatic deposits

- *Definition*
- Uranium deposits of this type are related to alkaline metasomatites of sodium or potassium series. The metasomatites are developed in ancient shields and median masses, where they form stockworks controlled by long-lived ancient faults. Sodium metasomatites are predominantly albite in composition, usually with minor carbonate and alkalineamphiboles and pyroxenes—albitites. Potassium metasomatites are essentially potassium feldspar rocks with minor carbonate.

- The largest uranium deposits in sodium metasomatites occur in the Kirovograd Ore District, Ukraine. Other regions with similar deposits are Beaverlodge (Canada), Itatiaia (Brazil), Jaduguda (India), and Kokchetav Massif (Kazakhstan). Uranium deposits in potassium metasomatites are known in the Elkon Horst, the southern Yakutia (Russian Federation).

9- Surficial deposits

- *Definition*
- Surficial uranium deposits are broadly defined as young (Tertiary to Recent) near-surface uranium concentrations in sediments or soils.
- These deposits usually have secondary cementing minerals including calcite, gypsum, dolomite, ferric oxide and halite.
- Uranium deposits in calcrete (calcium and magnesium carbonates) are the largest of the surficial deposits.
- The calcrete bodies are interbedded with Tertiary sand and clay, which are usually cemented by calcium and magnesium carbonates.
- Calcrete deposits form in regions where uranium-rich granites were deeply weathered in a semi-arid to arid climate

- **10- Collapse breccia pipe deposits**
- ***Definition***
- **Collapse breccia pipe deposits occur as vertical chimney-like structures that are filled with down-dropped fragments.**
- **Uranium mineralization, which was introduced into the pipes by ascending groundwater and was deposited in response to changes in temperature and/or pressure or to changes in chemical environment, occurs in the interstices between breccia fragments and in fractures in the annular ring that separates the breccia-filled column from the surrounding wall rock.**
- **Examples include the Hack Canyon deposit complex and the Orphan deposit, northwestern Arizona, USA.**

11- Phosphorite deposits

- *Definition*Uraniferous phosphorite deposits consist of syn-sedimentary, stratiform, disseminated uranium in marine phosphate-rich rocks or phosphorite deposits that formed in continental shelf environments.
- The uranium mineralization is substituted for Ca in cryptocrystalline fluor-carbonate apatite grains. Phosphorite deposits constitute large uranium resources, but are very low grade (25–150 ppm).
- Phosphate rock is a key raw material for the world's chemical fertilizer industry. Therefore, uranium can only be recovered as a by-product of phosphoric acid production.
- Examples of phosphorite deposits include New Wales Florida (land pebble phosphate) (USA), Gantour (Morocco) and Al-Abiad (Jordan). Other types of phosphorite deposits include: 1) Organic phosphate such as the argillaceous marine sediments enriched in phosphatized fish bones with UREE- Re-Sc mineralization in the Melovoe deposit, Kazakhstan; 2) Continental phosphorite deposits such as the Bakouma deposit in Central African Republic

- **12- Black shale deposits**
- *Definition*
- **Stratiform black shale hosted uranium mineralization consists of syngenetic, uniformly disseminated uranium adsorbed onto organic and/or clay particles in organic-rich, pyritic marine shale with thin coalified, phosphatic and/or silty intercalations.**

- **Discrete primary uranium minerals are absent. Other metals (Cu, Cr, Mo, Mn, REE, V and P) occur in small quantities.**

- **13- Metamorphic deposits [Example: Mary Kathleen deposit, Queensland, Australia]**
- ***Definition***
- **Metamorphic uranium deposits result from regional metamorphism of uraniferous sediments or volcanics. Accordingly, they occur in metasediments and/or metavolcanics in which the uranium mineralization resulted directly from metamorphic processes.**
- **Examples include the Mary Kathleen deposit, Australia and the Forstau deposit, Austria The Mary Kathleen zone, which hosts a number of uranium deposits, is 10–20km wide and more than 200 km long. It is comprised of a sequence of Palaeoproterozoic shallow water shelf sediments that have undergone complex folding, regional metamorphism, and granitic intrusion and metasomatism.**

14- Other deposit types

- The preceding list includes all deposit types that are known to host uranium deposits of significant commercial interest. There are, however, other deposit types that host uranium, which either because of their low ore-grades orsmall size, are of limited commercial interest.
- For completeness, however, summary definitions for these deposits follow:
- *1- Uraniferous coal and lignite deposits*
- *2- Limestone and paleokarst deposits*
- 3- By-product–copper processing (Uranium mineralization occurs in low concentrations (50–200 ppm) in many metalliferous deposits. In the past, uranium has been recovered as a byproduct from concentrates derived from processing of copper ores at Palabora (South Africa), Bingham Canyon (USA) and the Singbhum district (India)).