Ruby deposits: origin and geological classification

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Classification systems for corundum deposits have evolved over time and are based on different mineralogical and geological features. An enhanced classification for ruby deposits based on the geological environment, degree of metamorphism, styles of mineralization and the pressure-temperature conditions of formation is proposed:

Primary ruby deposits are subdivided into two types based on their geological environment of formation: (Type I) Tectonic magmatic-related, and (Type II) Tectonic metamorphic-related.

Type I is characterized by two sub-types: Type IA where xenocrysts or xenoliths of gem ruby of metamorphic origin are hosted by alkali basalts (Madagascar and others); and Type IB corresponding to xenocrysts of ruby in kimberlite (Democratic Republic of Congo).

Type II has two sub-types hosted either in metamorphic deposits sensu stricto (Type IIA) formed in the amphibolite to granulite facies, or metamorphic-metasomatic deposits (Type IIB) formed via high fluid-rock interaction and metasomatism:

- Sub-Type IIA₁ includes ruby in metamorphosed mafic and ultramafic rocks (M-UMR) as found at Montepuez (Mozambique) and Aappaluttoq (Greenland);
- Sub-Type IIA₂ concerns rubies in marble such those from the Mogok Stone Track (Myanmar), and from central and eastern Asia;
- Sub-Type IIB₁ corresponds to desilicated pegmatites i.e., plumasite in M-UMR as in the Rockland mine (Kenya) or Polar Urals (Russia);
- Sub-Type IIB₂ is characterized by ruby in shear zone-related or fold hinge-controlled deposits in different substrata, mainly ruby-bearing Mg-Cr-biotite schist (metamorphosed M-UMR) and marble. It includes the ruby occurrences of Zazafootsy (Madagascar), Kerala (southern India), Mahenge (Tanzania), and the Hokitika deposit (New-Zealand).

Secondary ruby deposits i.e., placers, are termed Tectonic sedimentary-related (Type III). These placers are hosted in sedimentary rocks (soil, rudite, arenite, silt) that formed due to erosion, gravity, mechanical transport and sedimentation along slopes or basins related to neotectonic movements. These are divided in two main sub-types:
- Sub-Type IIIA i.e., gem placers in alkali basalt or kimberlite environments as in eastern Australia, central Madagascar, and the Democratic Republic of Congo;

- Sub-Type IIIB i.e., gem placers in metamorphic environments such as at Montepuez in Mozambique or the Mogok Stone Track in Myanmar.

- Sub-Type IIIC i.e., gem placers with ruby originating from multiple and unknown sources such as at Ilakaka (Madagascar), Tunduru and Songea (Tanzania).