

Sedimentary Kx - basin fill (Miocene? toocene)

Ts Tuffaceous basin fill strata - Tuffaceous
mudstone + shale (Tuff - a general term for all
consolidated pyroclastic rock) fine to med grain
tuffaceous sandstone + lenticular beds of
conglomerate w/ a sandy, tuffaceous matrix.



Type Clastic sedimentary rock.

Class Coherent pelite.

Appearance Color gray, pink or reddish; texture clastic with fairly coarse grain-size, not well sorted and with angular grains, structure defined by poor stratification, with frequent current imprints. No fossils.

Components The grains are mainly feldspar, with a little quartz, biotite, muscovite and other minerals derived from igneous rocks and lithic fragments. The cement may be silicate (quartz, illite), calcitic or limonitic.

Geological environment Degradation of granitic and gneissic rocks, followed by movement over a short distance, and deposition in a fluvial, lacustrine or shallow marine environment.

Occurrence Large deposits of arkose are widespread throughout all geological periods. Precambrian examples are the sparagmites of Scandinavia and the Torridon Sandstone of Scotland. Paleozoic examples occur in the marine-subaerial sedimentary series around the Hercynian Chain (the Vosges, France; the Black Forest, Germany; Wales; Bohemia). The arenaceous rocks in the Californian Coast Ranges are predominantly arkose from the Jurassic to the present day.

Uses Local use in building, like sandstone.



Type Clastic sedimentary rock.

Class Coherent arenite.

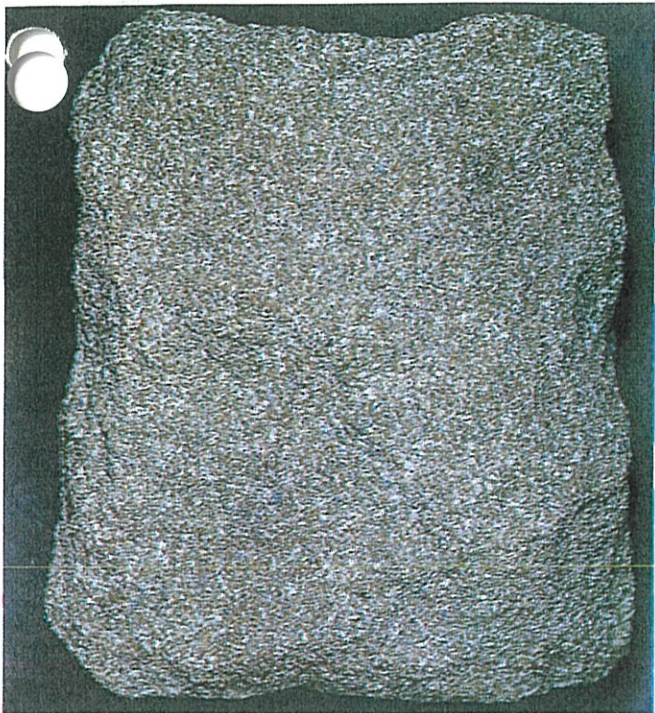
Appearance Color fairly dark, from gray to brown, sometimes greenish; texture clastic and not well sorted, with very angular grains, in a muddy or clayey matrix; the stratification is often in very thick banks (or bars) and is characterized by clear-cut gradation; frequent slip structures, curling of individual strata, grooves from dragging, and inorganic imprints. Fossils very rare and fragmentary.

Components The clasts consist of quartz, feldspar, and rock fragments (mafic igneous, schist, etc.) in almost equal amounts; the matrix and the cement are clayey or chloritic, with iron oxides and hydroxides.

Geological environment Produced by currents of submarine silt, in deep water; they slip over the edge of the continental slope and are then gradually redeposited. Typical of the initial phases of tectonic movements.

Occurrence Very common, especially in the Silurian Torridon Sandstone in West Virginia (USA); the Lower Paleozoic grits of England and Wales; the Rhine Valley, Germany; the Northern Apennines of Italy; and the Cretaceous rocks of Kyushu, Japan.

Uses Local use as construction stone.



▲ Arkose (ca. $\times 1$). Vosges Mountains, France.



▲ Graywacke (ca. $\times 1$). Rhine Valley, Germany.



Type Intrusive igneous rock.

Chemistry Felsic.

Components **Essentials:** potassic feldspar (orthoclase, microcline), quartz. **Accessories:** plagioclase (oligoclase), biotite, pyrite, zircon, monazite, tourmaline, magnetite, ilmenite. The rocks sometimes contain small quantities of orthopyroxene, clinopyroxene, hornblende and garnet. In the alkaline granite variety oligoclase plagioclase is missing, but alkali feldspars such as albite and anorthoclase are present, together with amphiboles and sodic pyroxenes (riebeckite, barkevikite, acmite, acmite-augite) and, as accessory minerals, fayalite, fluorite, cryolite and ore minerals containing rare earths and radioactive elements.

Appearance Rosy to dark red in color, sometimes with bluish specks; hypidiomorphic granular texture grading to xenomorphic and porphyritic; massive structure, but with numerous miarolitic cavities filled with crystals of olivine, tourmaline, etc. These granites are also often crossed by veins of quartz, apatite and pegmatite which is rich in rare minerals (cryolite, rare earth-bearing minerals, radioactive minerals, etc.).

Geotectonic environment Alkaline feldspar granites form immense homogeneous batholiths in the Precambrian shields, probably derived by anatectic processes. Alkaline granites form as differentiated marginal zones on the edge of minor intrusions, especially those formed at great depth. These are probably products of late differentiation, largely connected with pneumatolytic (gaseous) fluids, and are rich in uncommon chemical elements resulting in rare minerals.

Occurrence A typical alkaline feldspar granite is the so-called Swedish red granite, which also occurs in Norway, Finland and Canada. The granite found at Predazzo (Trento) is rich in alkali feldspar and contains tourmaline, slightly altered. Typical alkaline granites are to be found in Portugal, in the Cascade Range of Oregon and in California (USA), in the Cordillera Blanca in Peru and in certain limited areas of the Sardinian pluton (Fonni, Nuoro).

Uses These rocks are often highly valued as building material, especially decorative in polished slabs. There are at least three commercial varieties of "Swedish red"—"imperial red," "Ivanovich red" and "orchid red"—differing in shades of color and in grain size. Alkaline granites are used almost exclusively for the extraction of rare earth-bearing minerals.



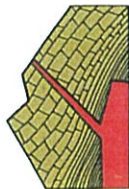
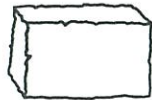
▲ Granite containing tourmaline (ca. $\times 1$). Predazzo, Trento, Italy.



▲ Granite "Swedish red" (or rose or pink) (ca. $\times 1$). Sweden.

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GRANITE PORPHYRY



Type Hypabyssal igneous rock.

Chemistry Felsic.

Components *Essentials:* potassic feldspar (orthoclase, microcline), quartz. *Accessories:* biotite, plagioclase (albite-oligoclase), muscovite, amphibole, magnetite, ilmenite, apatite, zircon, xenotime, cassiterite, molybdenite, etc.

Appearance Color light gray, pink, often red; texture porphyritic with quartz and idiomorphic feldspar phenocrysts but often corroded, set in a microgranular and microfelsic groundmass; structure from massive to zoned with flow alignment, frequently with miarolitic cavities.

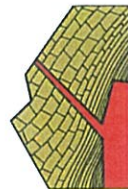
Geotectonic environment Veins and apophyses in granite or in nearby rocks; local marginal zones of a shallow, intrusive, granitic pluton.

Occurrence Present in almost all granitic plutons. It is most characteristic along the margins of the Canadian Shield and at Erzgebirge (Germany).

Uses Local building stone; sometimes contains concentrations of rare sulfides (e.g., molybdenite).

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GRANOPHYRE



Type Hypabyssal igneous rock.

Chemistry Felsic.

Components *Essentials:* potassic feldspar (orthoclase, microcline), quartz. *Accessories:* plagioclase (albite-oligoclase), biotite, amphibole, sodic pyroxene, magnetite, ilmenite, muscovite, apatite, zircon, molybdenite, topaz, fluorite, etc.

Appearance Color light, often reddish; texture porphyritic with quartz and feldspar in a medium-grained groundmass formed by a graphic or micropegmatic intergrowth of the same; frequently zoned, and containing miarolitic cavities lined with minerals in the form of fine crystals.

Geotectonic environment Veins, apophyses, indistinct masses in the peripheral parts of shallow intrusive granitic plutons.

Occurrence Present in almost all plutons, especially in association with granite porphyry. It is even present in intrusions of basaltic magma as the final product of differentiation; found in the upper parts of basaltic sills such as the Palisades sill (New Jersey, USA).

Uses Building stone for curbstones or as ornamental gravel for parks and gardens; sometimes has concentrations of rare minerals that are the source of rare chemical elements.



▲ Granite porphyry (ca. $\times 1$). Erzgebirge, Germany.



▲ Granophyre (ca. $\times 1$). Cuasso al Monte, Varese, Italy.