
Glossary

A-type: refers to an igneous rock, usually a granite, with alkaline characteristics; an alkali granite.

Aa: lava, usually basic, typified by a spiny, clinkery scoriaceous surface.

Accretionary lapilli: concentrically layered, spherical, lapilli-sized volcanic clasts that form as moist aggregates of ash in eruption clouds.

Accretionary prism: a complex structural juxtaposition of inclined strata formed above an active subduction zone by the underthrusting of successively younger units of oceanic crustal rocks, which become attached to the leading edge of the overlying tectonic plate.

Acid: describes igneous rocks rich in silica (SiO_2 more than 63%).

Agglomerate: a pyroclastic rock with predominantly rounded clasts greater than 64 mm in diameter.

Albitization: replacement of a feldspar by the sodic plagioclase, albite.

Alkaline: describes igneous rocks that contain more sodium and/or potassium than is required to form feldspar and hence contain, or have the potential to contain (i.e. in the norm), other alkali-bearing minerals such as feldspathoids, alkali pyroxenes and alkali amphiboles.

Amygdale: a gas bubble cavity in an igneous rock that has been infilled later with minerals.

Aphyric: textural term, applied to igneous rocks that lack relatively large, conspicuous crystals (phenocrysts) compared with the grain size of the groundmass (or non-porphyritic).

Aplitic: describes relatively finer grained areas, or typically veins, within an igneous rock (contrast with pegmatitic).

Appinitic: describes a heterogeneous suite of coarse-grained ultramafic, mafic and intermediate igneous rocks, characterized by shoshonitic geochemical affinities and the presence of abundant hydrous minerals, particularly euhedral amphibole.

Ash-fall tuff: lithified pyroclastic fall deposit with grain size less than 2 mm in diameter.

Ash-flow tuff: equivalent to ignimbrite; term used typically in North America and, in this volume, in descriptions of volcanic rocks of Wales.

Assimilation: the addition of solid material such as country rock to a magma, changing its composition.

Asthenosphere: a weak layer within the Earth's mantle and immediately below the lithosphere.

Aureole: a zone around an igneous intrusion in which the texture, mineralogy and/or composition of the country rocks has been changed by heat and fluids from the intrusion.

Autobreccia: breccia caused by fragmentation of the chilled crust of lava or intrusion by continued flow of its fluid interior.

Basic: describes igneous rocks relatively rich in the 'bases' of early chemistry (MgO , FeO , CaO , Fe_2O_3); silica (SiO_2) is relatively low (nominally 45–52%).

Batholith: a very large discordant igneous intrusion or coalescing mass of related intrusions that extends to great depth in the Earth's crust.

Bentonite: a light coloured rock, mainly composed of clay minerals and colloidal silica, produced by devitrification and chemical alteration of glassy fine ash.

Block lava: lava, usually intermediate to acid, typified by a coarse, angular blocky surface.

Blueschist: a schistose rock containing blue sodic amphiboles, indicative of high pressure metamorphism.

Breccia: rock composed of angular broken fragments greater than 64 mm in diameter; can be volcanoclastic, sedimentary or fault related.

Caldera: a circular, basin-shaped depression, usually many times greater than the size of any individual volcanic vent, caused by collapse of the roof of an underlying magma chamber following an eruption; also refers to the underlying volcanic structure.

Calc-alkaline: describes a suite of silica-oversaturated igneous rocks, characterized chemically by the steady decrease in iron content relative to silica during evolution of the magma; typical of magmas generated during orogenesis at destructive plate margins.

Carbonatite: an igneous rock that contains more than 50% primary carbonate minerals.

Clast: a fragment in a rock.

Cleavage: plane of incipient parting in a rock, produced by the alignment of platy crystals such as mica in response to confining pressure during deformation.

Cognate xenolith: an inclusion in an igneous rock to which it is genetically related, for example as an earlier crystallized product of the same magma.

Complex: used herein to refer to a large-scale spatially related assemblage of igneous rock units possibly, but not necessarily, with complicated igneous and/or tectonic relationships and of various ages and diverse origins.

Coulee: a thick viscous lava of limited length with blocky, very steep flow fronts; intermediate in shape between elongate lava flow and equidimensional lava dome.

Cumulate: an igneous rock formed by crystals that precipitated early from a magma and accumulated due to gravitational settling, current activity or other magmatic processes without modification by later crystallization.

Deuteric: describes reactions between primary minerals and the water-rich fluids that separate from the same body of magma at a late stage in its cooling history.

Diagenesis: the process of mineral growth and/or recrystallization leading to lithification of unconsolidated sediment to form rock.

Diapir: a dome-shaped body of magma or mobile rock that has risen through country rocks as a result of its lower density and/or greater plasticity.

Diatreme: a breccia-filled volcanic pipe formed by a gaseous explosion.

Distal: far from the source.

Dolerite: used herein as a synonym of micro-gabbro (see (Figure G2)).

Dyke: a tabular body of igneous rock, originally intruded as a vertical or steeply inclined sheet.

Dynamothermal: type of metamorphism involving directed pressure and shear stress as well as a wide range of confining pressures and temperatures.

Effusive: describes eruption as lava rather than as pyroclasts.

Enclave: an inclusion (xenolith) within an igneous rock, usually of some other igneous rock, which may or may not be related.

Euhedral: describes a mineral grain, such as a phenocryst, with well-formed crystal faces.

Eutaxitic: textural term describing elongate fiamme and glass shards, and produced through compaction and welding in an ignimbrite/ash-flow tuff; gradational to parataxitic.

Facies: the characteristic features of a rock unit, including rock type, mineralogy, texture and structure, which together reflect a particular sedimentary, igneous or metamorphic environment and/or process.

Felsic: describes light-coloured minerals (feldspar/feldspathoid and *silica*) or an igneous rock containing abundant proportions of these minerals; the opposite of mafic. (Figure G1)

Felsite: a field term for glassy and fine-grained felsic igneous rocks.

Fenitization: metasomatism by alkali-rich fluids.

Fiamme: dark, devitrified lenses in welded tuff, typically formed from the collapse of pumice during welding.

Flaser-banded: streaky layering with platy mineral aggregates surrounding lenticular bodies of granular material.

Fluidization: mobilization resulting from passage of a fluid (usually a gas) through a granular solid.

Foliation: the planar arrangement of components within a rock.

Foreland basin: a sedimentary basin developed by depression of a convergent continental margin due to the weight of sediment accumulating in front of the orogenic belt.

Fractional crystallization: process in which the early formed crystals in a magma are removed or otherwise prevented from equilibrating with the residual liquid, which consequently becomes progressively more evolved in composition (i.e. more fractionated).

Glomeroporphyritic: a porphyritic rock containing clusters of phenocrysts.

Graben: an elongate down-faulted crustal block, commonly with a marked topographical expression.

Granitization: the theory of the origin of granites by the chemical transformation of rock in its solid state by liquids and/or gases.

Granophyric texture: texture of an acid igneous rock in which quartz and alkali feldspar penetrate each other, having crystallized together.

Greenschist facies: the temperature and pressure conditions characteristic of hydrous low-grade regional metamorphism.

Greisen: a quartz-muscovite rock formed from the hydrothermal alteration of granite.

Hornfels: a well-baked, hard, splintery rock resulting from thermal (contact) metamorphism.

Hybridization: the intermixing of two or more magmas, which crystallize as a single rock, commonly having heterogeneous texture and complex mineralogy.

Hydroclastic: describes fragmentation of magma or hot rock by its interaction with water; (see also hydrovolcanic and phreato-magmatic).

Hydromagmatic: processes driven by the interaction of magma with water.

Hydrothermal alteration: changes in mineralogy and chemistry in rocks resulting from the reaction of hot water with pre-existing minerals (cf. metasomatism).

Hydrovolcanic: volcanic processes driven by the interaction of magma with water.

Hypabyssal: describes an igneous intrusion, or its rock, emplaced at a depth intermediate between plutonic and volcanic.

Hypersolvus: describes granites and syenites in which a single type of alkali feldspar crystallized, rather than separate sodic and potassic feldspars.

I-type: refers to an igneous rock, usually a granite, that formed by the partial melting of some other igneous or meta-igneous rock, e.g. in the mantle or lower crust (contrast with S-type).

Incompatible elements: trace elements that are not readily accepted into the crystal structure of common rock-forming minerals during the crystallization of magma and hence are concentrated preferentially into the remaining liquid. They are also concentrated in the first liquids produced during partial melting.

Ignimbrite: the rock, typically silicic and pumiceous, formed by deposition from a pyroclastic flow; may partly or wholly comprise welded tuff (see also ash-flow tuff).

Intermediate: applied to an igneous rock that is transitional between acid and basic (i.e. SiO_2 between 52% and 63%).

Juvenile: applied to volcanic fragments that have been derived directly from magma.

Klippe: an isolated thrust-bound structural unit that is an erosional remnant of a large thrust sheet or nappe.

Laccolith: an igneous intrusion, roughly circular in plan and concordant with the structure of the country rock; generally has a flat floor, a shallow domed roof and a dyke-like feeder beneath its thickest point.

Lag breccia: coarse breccia of rock fragments, associated with ignimbrite; occurs typically near to the eruption site.

Lamprophyre: name used for a distinctive group of largely hypabyssal rocks characterized by abundant phenocrysts of mafic minerals, with felsic minerals confined to the groundmass. See (Figure G5) for subdivisions.

Lapilli-tuff: pyroclastic rock predominantly comprising clasts with an average size of between 2 and 64 mm in diameter.

Lava: molten rock at the Earth's surface (contrast with magma).

Lava tube: a hollow space beneath the solidified surface of a lava, formed by the draining out of molten lava after the crust had formed.

Leucocratic: describes light-coloured igneous rocks containing few mafic minerals.

Lithosphere: the outer layer of the solid Earth, including the crust and upper part of the mantle, which forms tectonic plates above the asthenosphere.

Mafic: describes dark-coloured minerals, rich in magnesium and/or iron (Fe), or an igneous rock containing substantial proportions of these minerals, mainly amphibole, pyroxene or olivine; the opposite of felsic. (Figure G1). (Figure G3)

Magma: molten rock beneath the Earth's surface (contrast with lava).

Mantle: part of the interior of the Earth, beneath the crust and above the core.

Mass-flow: the transport, down slope under the force of gravity, of large, coherent masses of sediment, tephra or rock; commonly assisted by the incorporation of water, ice or air.

Megabreccia: a breccia of blocks so large that the brecciated nature of the rock may be obscured; commonly formed during collapse to form calderas.

Mélange: a chaotic rock unit, characterized by the lack of internal continuity of contacts between component blocks and including fragments of a wide range of composition and size.

Megacryst: any crystal (phenocryst or xenocryst) in a crystalline rock that is very much larger than the surrounding groundmass.

Melanocratic: describes dark coloured igneous rocks rich in mafic minerals.

Mesobreccia: breccia in which the clasts are visible within a single exposure; commonly used to describe tabular sheets in the upper and middle parts of pyroclastic deposits filling calderas (see also megabreccia).

Mesocratic: describes igneous rocks intermediate between leucocratic and melanocratic in colour.

Meta: prefix added to any rock name to indicate a metamorphosed variety e.g. metabasalt is a metamorphosed basalt.

Metaluminous: degree of alumina-saturation in igneous rocks in which the molecular proportion of Al_2O_3 is greater than that of $Na_2O + K_2O$, but less than that of $Na_2O + K_2O + CaO$.

Metasomatism: process involving fluids that introduce or remove chemical constituents from rock thus changing its chemical and mineralogical composition without melting.

Mid-ocean ridge: a continuous median mountain range within the oceans along which new oceanic crust is generated by volcanic activity.

Mid-ocean ridge basalt (MORB): type of tholeiitic basalt, generated at mid-ocean ridges. A world-wide, voluminous basalt type widely used as a fundamental standard for comparative geochemistry.

Migmatite: a partially melted rock generally consisting of light-coloured layers of igneous-looking felsic minerals and darker layers, richer in mafic minerals and having a metamorphic appearance.

Moho (=Mohorovicic Discontinuity): the boundary surface within the Earth below which there is an abrupt increase in seismic velocity; marks the base of the crust above the underlying mantle. Geophysical and petrological criteria define slightly different positions for the boundary.

Molasse basin: a sedimentary basin in an orogenic mountain belt within which thick sequences of coarse elastic sediments accumulate.

Nappe: a coherent body of rock, that has been moved a considerable distance away from its original location on a near-horizontal surface by thrusting or recumbent folding.

Norm: a recalculation of the chemical composition of an igneous rock to obtain a theoretical mineralogical ('normative') composition; useful for classification purposes and for comparison with experimental studies of magma crystallization.

Obduction: the over-riding/overthrusting of oceanic crust on to the leading edge of continental lithosphere during plate collision.

Olistostrome: a sedimentary deposit consisting of a chaotic mass of intimately mixed heterogeneous materials, commonly including very large blocks, and formed by submarine slumping of unconsolidated sediment.

Ophiolite: an ordered sequence of related ultramafic rocks, gabbros, sheeted dykes and basalt lavas that originated through the generation of oceanic crust.

Orogenesis: crustal thickening following the collision of tectonic plates and resulting from magmatism, folding, thrusting and accretion, leading to regional uplift and mountain building.

Outflow tuff: rock formed from pyroclastic flows that extend beyond the confines of a caldera.

Pahoehoe: basalt lava with a smooth, ropy surface.

Parataxitic: textural term, similar to eutaxitic, but where the fiamme and glass shards are extensively streaked out.

Partial melting: the incomplete melting of a rock to produce a magma that differs in composition from the parent rock.

Pegmatitic: textural description of an area within an igneous rock that is notably more coarsely crystalline and commonly forming veins and dykes (contrast with aplitic).

Pelean: a volcanic eruption characterized by gaseous ash clouds associated with the growth and collapse of volcanic domes.

Peperite: describes a breccia characterized by isolated blocks and lobes of igneous rock, commonly chilled and mixed with fluidized host sediment; typically present at the margins of high-level sills intruded into water-bearing sediment.

Peralkaline: degree of alumina-saturation in igneous rocks in which the molecular proportion of Al_2O_3 is less than that of $\text{Na}_2\text{O} + \text{K}_2\text{O}$.

Peraluminous: degree of alumina-saturation in igneous rocks in which the molecular proportion of Al_2O_3 is greater than that of $\text{Na}_2\text{O} + \text{K}_2\text{O}$.

Petrogenesis: the origin and evolution of rocks.

Petrography: the study of the mineralogy, texture and systematic classification of rocks, especially under the microscope.

Petrology: the study of the origin, occurrence, structure and history of rocks; includes petrography and petrogenesis.

Phenocryst: a crystal in an igneous rock that is larger than those of the groundmass, usually having crystallized at an earlier stage.

Phreatic: describes a volcanic eruption or explosion of steam, not involving juvenile material, that is caused by the expansion of ground water due to an underlying igneous heat source.

Phreatomagmatic: describes explosive volcanic activity caused by the contact of magma with large volumes of water, producing intensely fine ash and abundant steam.

Phreatoplinian: a rare type of explosive volcanic eruption and its deposits produced by phreatomagmatic processes (contrast with plinian).

-phyric: as in 'plagioclase-phyric', a porphyritic rock containing phenocrysts of plagioclase.

Pillow lava: subaqueously erupted lava, usually basaltic in composition, comprising an accumulation of smooth pillow shapes and lava tubes produced by rapid chilling.

Plinian: type of explosive volcanic eruption and its deposits; magma is fragmented through the release of magmatic gas and released at high velocity to form an eruption column that extends high into the Earth's atmosphere.

Pluton: an intrusion of igneous rock, emplaced at depth in the Earth's crust.

Plutonic: describes igneous rocks formed at depth in the Earth's crust.

Poikilitic: a texture of an igneous rock in which small crystals of one mineral are enclosed within a larger crystal of another mineral.

Porphyritic: textural term, for an igneous rock, in which larger crystals (phenocrysts) are set in a finer grained or glassy groundmass.

Porphyry: a field term for an igneous rock that contains phenocrysts within a fine-grained groundmass of indeterminate composition; usually preceded by a mineral qualifier indicating the type of phenocryst present; e.g. feldspar porphyry.

Protolith: the source rock from which an igneous rock was formed, most commonly by melting.

Proximal: near to the source.

Pumice: light-coloured pyroclast of generally acid, highly vesicular, glass foam.

Pyroclast: a fragment (clast) ejected from a volcano; ash, lapilli and block or bomb are pyroclasts that are respectively less than 2 mm, 2 to 64 mm and more than 64 mm in diameter.

Pyroclastic: describes unconsolidated deposits (tephra) and rocks that form directly by explosive ejection from a volcano.

Pyroclastic breccia: a rock comprising predominantly angular pyroclasts with an average size greater than 64 mm in diameter.

Pyroclastic fall deposit: tephra deposited by fall-out from a volcanic eruption cloud.

Pyroclastic flow: a volcanic avalanche; a hot density current comprising pyroclasts and gases, erupted as a consequence of the explosive disintegration of magma and/or hot rock; also describes the deposit from this eruption.

Pyroclastic surge: similar to a pyroclastic flow but turbulent and less dense.

Radiometric age: the age in years calculated from the decay of radioactive elements.

Restite: the material remaining after partial melting.

Rheomorphic: describes a very densely welded tuff that is characterized by folds and shears as evidence of the plastic deformation of the welding foliation by mass flow.

Rodingite: a rock that has suffered extensive calcium metasomatism; used here for veins rich in calcic pyroxene and garnet within serpentinite.

S-type: refers to an igneous rock, usually a granite, that formed by the partial melting of sedimentary or metasedimentary rocks (contrast with I-type).

Serpentinization: hydrothermal alteration of ultramafic rocks in which the mafic minerals are replaced by a range of hydrous secondary minerals, collectively known as serpentine.

Sheeted dykes: closely spaced dykes intruded parallel to each other; a major component of an ophiolite.

Shoshonitic: describes a suite of igneous rocks common to continental destructive plate margins with higher values of K_2O than calc-alkaline rocks.

Silica-saturation: a measure of the amount of silica available to form the major mineral components of an igneous rock, usually calculated from the norm. Silica-oversaturated rocks may contain free silica as quartz; silica-undersaturated rocks may contain feldspathoids in addition to feldspars.

Silicic: alternative term to acid.

Sill: a tabular body of igneous rock, originally intruded as a sub-horizontal sheet and generally concordant with the bedding or foliation in the country rocks.

Spherulite: spherical mass of acicular crystals, commonly feldspar, radiating from a central point; commonly found in glassy silicic volcanic rocks as a result of devitrification.

Spilitization: the pervasive alteration of a basalt, commonly in a submarine environment; the dominant process is albitization, together with other hydrous mineralogical changes.

Stoping: the emplacement of magma by detaching pieces of country rock which either sink through or are assimilated by the magma.

Strombolian: type of volcanic eruption and its deposits characterized by continuous small explosive 'fountains' of fluid basaltic lava from a central crater.

Subduction: the process of one lithospheric plate descending beneath another during plate convergence.

Subsolvus: describes granites and syenites in which both sodic and potassic feldspars crystallized simultaneously.

Tephra: an unconsolidated accumulation of pyroclasts.

Terrane: a fault-bound body of oceanic or continental crust having a geological history that is distinct from that of contiguous bodies.

Tholeiitic: describes a suite of silica-oversaturated igneous rocks, characterized chemically by strong iron enrichment relative to magnesium during the early stages of evolution of the magma; formed in extensional within-plate settings, at constructive plate margins and in island arcs.

Transcurrent: a large-scale, steeply dipping fault or shear, along which the movement is predominantly horizontal.

Transpression: crustal shortening as a result of oblique compression across a transcurrent fault or shear zone.

Transtension: crustal extension as a result of oblique tension across a transcurrent fault or shear zone leading to localized rifts or basins.

Tuff: a rock comprising pyroclasts with average grain size less than 2 mm in diameter.

Tuff-breccia: a pyroclastic rock in which between 25 and 75% of the pyroclasts are greater than 64 mm in diameter.

Turbidite: an elastic rock formed through deposition from subaqueous sediment-laden density currents (turbidity currents) that move swiftly downslope under the influence of gravity.

Ultrabasic: describes an igneous rock with a silica content less than that of basic rocks (less than 45% SiO_2).

Ultramafic: describes an igneous rock in which dark-coloured minerals (amphibole, pyroxene, olivine) comprise more than 90% of the rock. (Figure G4)

Ultrametamorphism: metamorphic processes at a temperature and pressure high enough to partially or completely fuse the affected rock and produce a rock with an igneous-looking texture.

Vesicle: a gas bubble cavity, usually in a lava or shallow intrusion.

Vitroclastic: describes a pyroclastic rock characterized by fragments of glass.

Volcaniclastic: generally applied to an elastic rock containing mainly material derived from volcanic activity, but without regard for its origin or environment of deposition (includes pyroclastic rocks and sedimentary rocks containing volcanic debris).

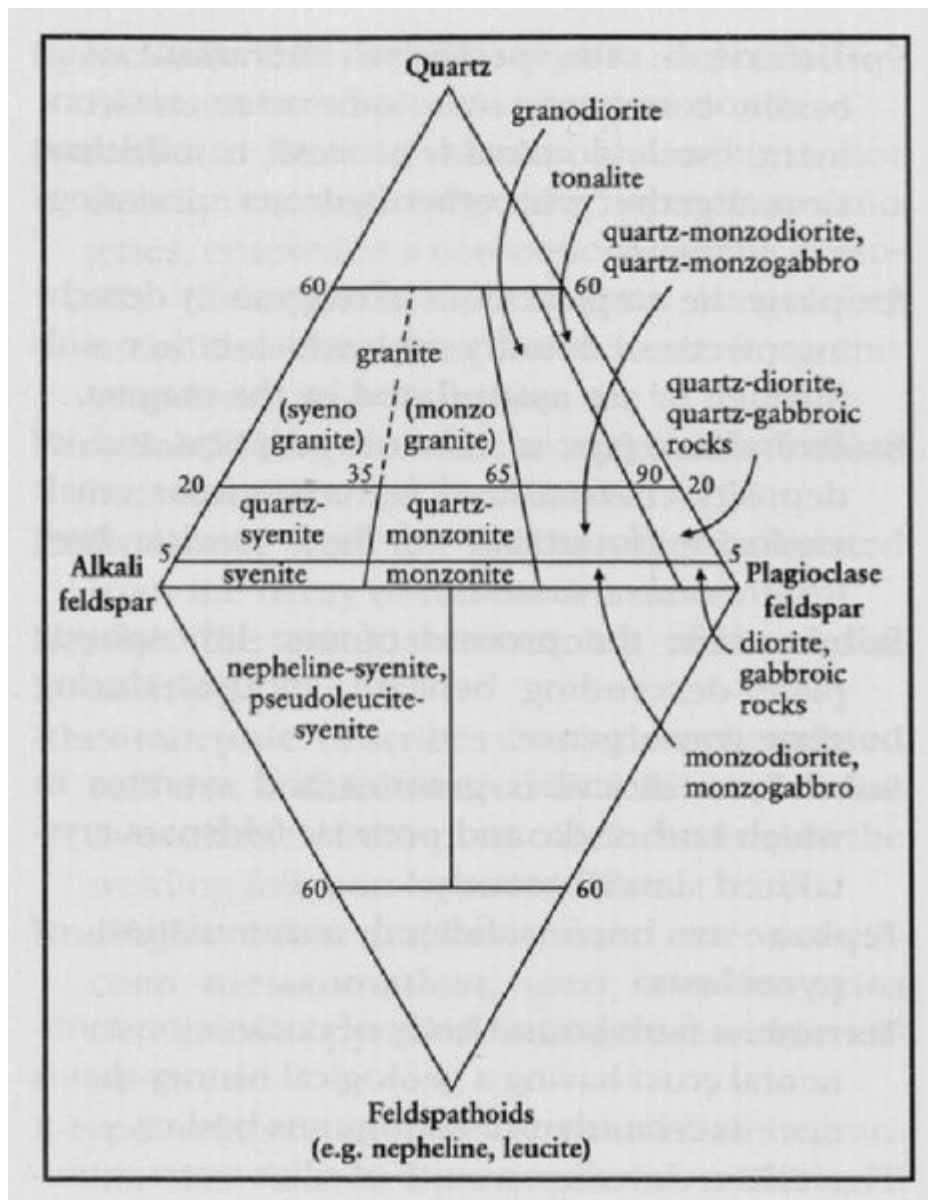
Volcanotectonic fault: fault along which the displacement occurred through subsurface movement of magma or during its eruption.

Welded tuff: a glass-rich pyroclastic rock in which the grains have been welded together because of heat and volatiles retained by the particles and the weight of the overlying material. (This is not synonymous with ignimbrite though many ancient ignimbrites are welded.)

Xenocryst: a crystal, like a phenocryst, but one that is foreign to the igneous rock in which it is found.

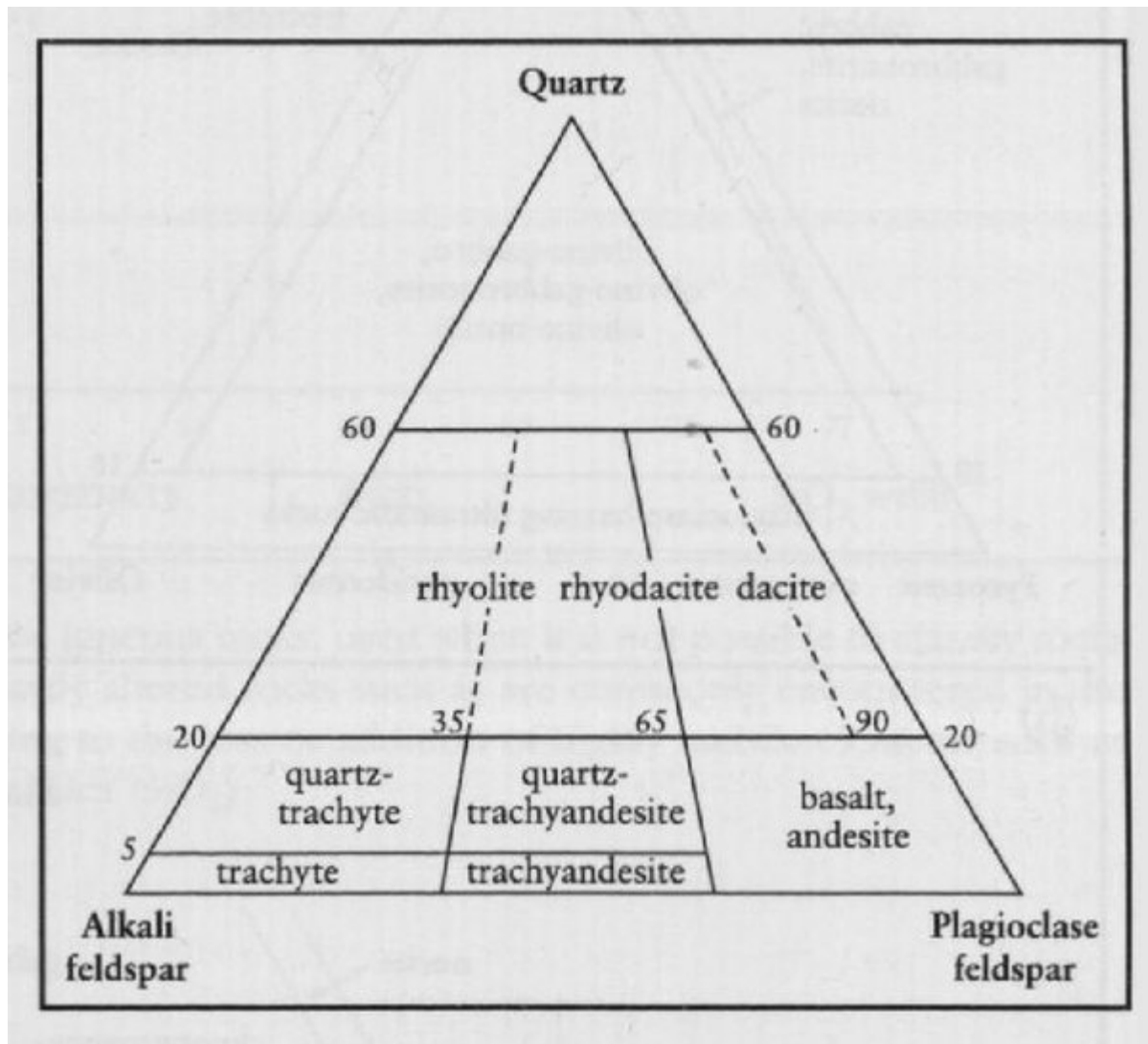
Xenolith: a rock fragment that is foreign to the igneous rock in which it is found.

References



(Figure G2) The classification of coarse-grained felsic and mafic crystalline igneous rocks. The distinction between gabbroic rocks and diorite is based upon the composition of the plagioclase feldspar present. Medium-grained rocks are

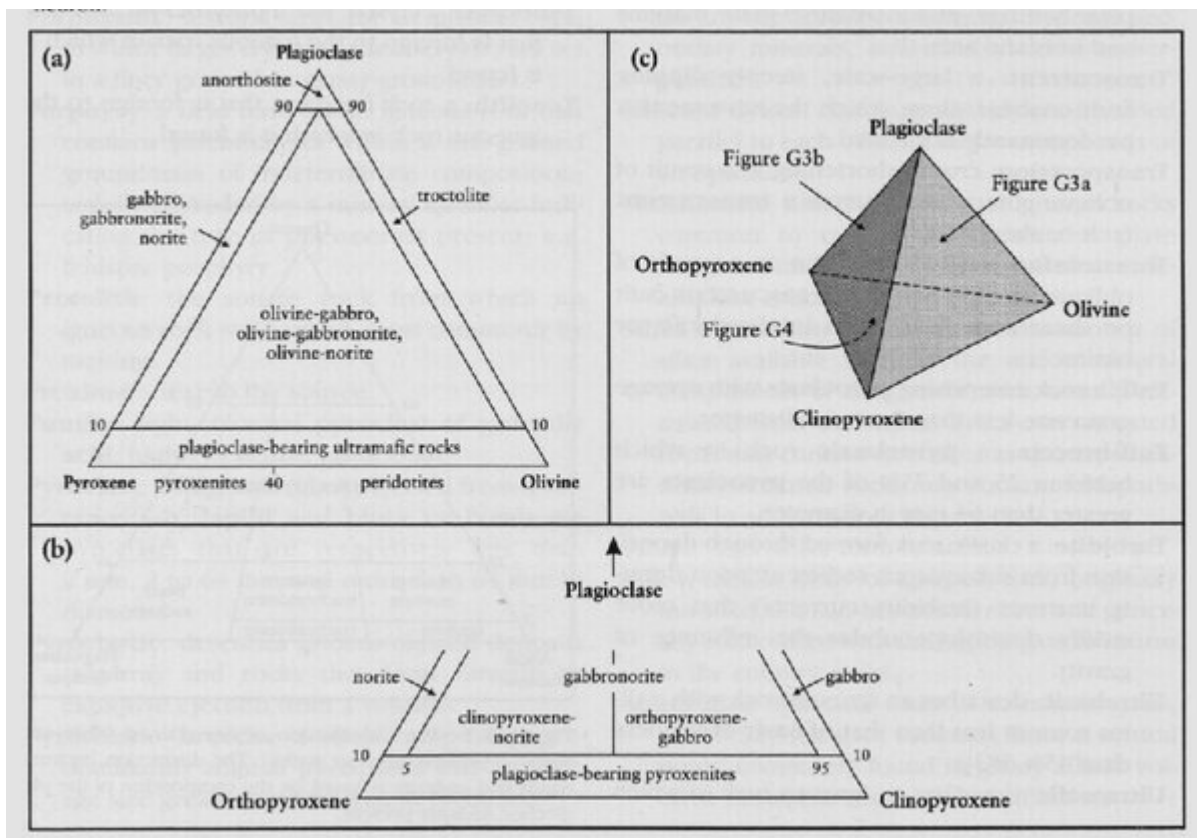
named by attaching the prefix 'micro' e.g. microgranite.



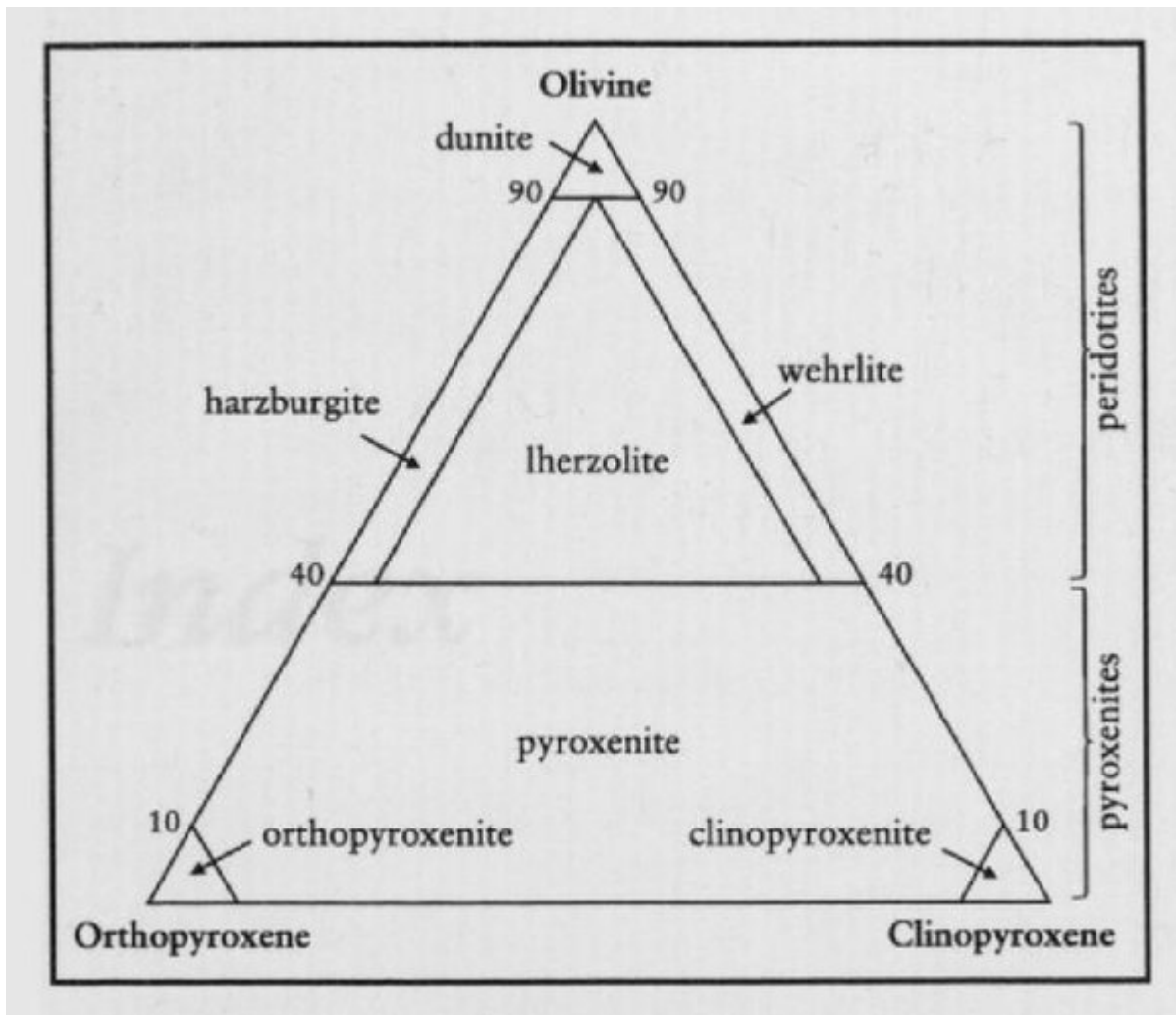
(Figure G1) The classification of fine-grained felsic and mafic crystalline igneous rocks. The distinction between basalt and andesite is based on the composition of the plagioclase feldspar present.

Feldspar	Predominant mafic minerals	
more orthoclase than plagioclase	biotite, diopsidic augite, (\pm olivine)	hornblende, diopsidic augite, (\pm olivine)
	minette	vogesite
more plagioclase than orthoclase	kersantite	spessartite

(Figure G5) The classification of lamprophyres encountered in this volume.



(Figure G3) The more-detailed classification of coarse-grained mafic crystalline igneous rocks, falling in the gabbroic rocks field of Figure G2. (a) Based upon the plagioclase, total pyroxene and olivine content, (b) based upon the plagioclase, orthopyroxene and clinopyroxene content, (c) figures (a) and (b) combine in three dimensions if necessary to form a tetrahedron.



(Figure G4) The classification of coarse-grained crystalline ultramafic rocks. Ultramafic rocks also include 'hornblendite' for rocks with more than 90% hornblende.