

6. Migmatites and related rocks

A proposal on behalf of the IUGS Subcommittee on the Systematics of Metamorphic Rocks. Web version of 01.02.07

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Introduction

A Study Group under the leadership of W. Wimmenauer was set up to look at the nomenclature of migmatites and related rocks. In addition to that small group, a number of worldwide specialists were consulted on their views on the more important terms being considered. Their answers were greatly appreciated and provided valuable contributions to the deliberations. This paper presents the definitions together with some notes explaining the reasoning.

In the discussions it turned out that the definition of migmatites and their subgroups is not an easy task. Rosenbusch's statement: 'The essence of rocks is transition' is particularly valid for migmatites. They form, in their total spectrum, a continuous transition from metamorphic to plutonic rocks. The establishment of limits within such a continuum is very difficult and the application of quantitative criteria virtually impossible. Thus, many of the 'definitions' presented below are characterisations of certain prominent rock types rather than definitions *sensu stricto*. Their application to a natural rock will often demand some scientific experience.

It should also be noted that the scale of migmatite structures is such that they mainly require definitions, which refer to rock masses greater than the preferred hand specimen size

The work was greatly facilitated by the existence of two comprehensive glossaries of terms bearing on migmatites, namely Dietrich & Mehnert (1961) and Mehnert (1968).

On the following pages, the definitions proposed by the SCMR are presented in italics; where appropriate, some comments on the reasoning leading to them are added.

Definitions of terms

Migmatite: *A composite silicate metamorphic rock, pervasively heterogeneous on a meso- to megascopic scale. It typically consists of darker and lighter parts. The darker parts usually exhibit features of metamorphic rocks whereas the lighter parts are of igneous-looking appearance (see also leucosome, melanosome, mesosome, neosome, palaeosome). Wherever minerals other than silicates and quartz are substantially involved, it should be explicitly mentioned.*

The essential elements of the above definition received wide approval from the Working Group. The last sentence makes allowance for the comments of some contributors who pointed out that migmatitic structures, as described in the definition, may also occur in non-silicate rocks. For the sake of clearness and simplicity, other versions of the definition, which might also cover very rare and uncommon varieties of migmatites, were eventually abandoned

Anatexis: *Melting of a rock.*

The term is used irrespective of the proportion of melt formed, which may be indicated by adjectives such as *initial, advanced, partial, differential, selective, complete, etc.*

Migmatisation: *Process of formation of a migmatite.*

Leucosome: *The lightest-coloured parts of a migmatite.*

Mesosome: *Rock portion of a migmatite, that is intermediate in colour between leucosome and melanosome. If present, the mesosome is mostly a more or less unmodified remnant of the parent rock (protolith) of the migmatite.*

In spite of the near-identity of most mesosomes with the palaeosome, a purely descriptive term for the intermediate parts of a migmatite appeared desirable.

Melanosome: *The darkest parts of a migmatite, usually with prevailing dark minerals. It occurs between two leucosomes or, if remnants of the more or less unmodified parent rock (mesosome) are still present, it is arranged in rims around these remnants.*

Palaeosome: *Part of a migmatite representing the parent rock (cf. mesosome).*

Neosome: *The newly formed parts of a migmatite (metatectes and restites).*

Restite: *Remnant of a metamorphic rock from which a substantial amount of the more mobile components have been extracted without being replaced.*

Resister: *Rock offering greater resistance to granitisation than another by virtue of its composition or its 'impenetrable' fabric.*

Whereas 'restites' are rock portions, which have undergone essential changes of their earlier composition, 'resisters' are rocks, which have survived the formation of the surrounding migmatite (or granite) without significant changes to their mineralogical and chemical composition. Although the term 'resister' is not widely used, Mehnert's definition is proposed here as a restricted term. Its meaning is not easily covered by another, more frequently used term.

A few members of the Working Group would like to confine the definition to crustal processes, but we believe that it should also be applicable to mantle processes.

Anatexite: Two versions of the definition were discussed in the Subcommission; the first one (a, below) was preferred because the second version could be applied to any magmatic rock believed to be of anatectic origin.

a) *Rock still showing the evidence of in situ formation by anatexis.*

b) Any rock showing structural and/or compositional evidence of formation by anatexis.

Metatexis: *Initial stage of anatexis where the parent rock (palaeosome) has been partly split into a more mobile part (metatect) and a non-mobilised (depleted) restite (cf. palaeosome, metatect, restite).*

Metatexite: *A variety of migmatite with discrete leucosomes, mesosomes, and melanosomes (cf. leucosome, mesosome, melanosome).*

Although the term refers directly to the genetic term ‘metatexis’, a descriptive definition of the rock type is also required.

Metatect: *Discrete, mostly light-coloured body in a migmatite formed by metatexis.*

Arterite: *A type of migmatite where the darker parts are injected by veins of lighter material (leucosomes) introduced from outside.*

Wherever the introduced material is not lighter than the surrounding rock, it should be explicitly mentioned.

Venite: *A type of migmatite in which the material of the lighter veins (leucosomes) is extracted from the parent rock.*

As with ‘arterite’, the definition is explicitly a genetic one. As a non-genetic name for veined rocks, Scheumann’s (1936a) ‘phlebite’ is proposed (see below).

Phlebite: *A veined rock; the veins may have been injected from outside or exuded in situ.*

Diatexis: *Advanced stage of anatexis where the dark-coloured minerals are also involved in melting; the melt formed has not been removed from its place of origin (cf. metatexis).*

Diatexite: *A type of migmatite where the darker and the lighter parts form schlieren and nebulitic structures which merge into one another (cf. diatexis).*

Although the term refers directly to the genetic term ‘diatexis’, a descriptive definition of the rock type is also required.

Nebulite: *Migmatite with diffuse relics of pre-existing rocks or rock structures.*

Agmatite: *Migmatite with breccia-like structure.*

Palimpsest structure: *Structure in a migmatite or granitised rock that can be recognised as pre-migmatitic (or pre-granitic).*

Definition of Mehnert (1968) unchanged. The term is also used in a more general term for relict features.

Dictyonite: *A type of migmatite with a reticulated structure formed by a network of small veins.*

Schollen: *In a migmatite, blocks or rafts of palaeosome within the neosome; the structure is similar to agmatite but the neosome is more abundant so that the disrupted blocks float like rafts.*

Stromatite: *A type of migmatite with regular layers, the layers having two or more different compositions or appearances, for example, the alternation of mesosome and leucosome.*

Palingenesis: *Formation of a new magma by complete or nearly complete melting of pre-existing rocks.*

Granitisation: *A comprehensive term for processes by which pre-existing rocks are converted to granitoids (melting, pervasive influx of chemical components such as silica, potash, soda or other means of pervasive transformation).*

79% of the answers from of the worldwide Working Group to the questionnaire agreed that the term should be defined. Some contributors proposed to abolish the term, but it is widely used, comprehensive, and cannot be replaced by a better one. Some suggested that the term should be restricted to metasomatic processes. However, we consider the term to have a general meaning, and special cases can easily be specified by an appropriate adjective (e. g. metasomatic granitisation, anatectic granitisation).

Degranitisation: *A process by which a rock is depleted in chemical components which are significant in making up a granitoid, essentially silica, potash ± soda.*

Several members of the Working Group proposed to abolish the term. However, it has been used since 1955 and designates a process demonstrated in several well-studied areas, for example, the granulites of the Ivrea Zone and Calabria.

Feldspathisation: *Formation of feldspar, due to metasomatism.*

Metablastesis: *Preferred crystallisation and growth in size of a mineral or a group of minerals by metamorphic (including metasomatic) processes.*

‘Preferred’ is used to emphasise the fact that certain minerals grow to larger sizes than others.

Metamorphic differentiation: *Mechanical redistribution of minerals by species and/or segregation of chemical components during metamorphism to form an inhomogeneous structure of two or more species within a rock body.*

The wording: ‘to form an inhomogeneous structure.’ was chosen because redistribution may also result in forming a more homogeneous body. Particular attention was given to the distinction of ‘redistribution’ of solid minerals and ‘segregation’ of chemical components, transported in solution.

Ultrametamorphism: *Metamorphism under the extreme upper range of temperatures and pressures as a result of which rocks suffer complete or almost complete in situ melting.*

Ptygmatic folding: Originally defined by Sederholm(1907) to describe contorted and folded granitic veins which characteristically occur in migmatites. The term is now used more widely to describe a form of folding where single isolated layers of relatively high competence material are enclosed in a matrix of lower competence and strongly shortened (see, Ramsay & Huber, 1983).

Concluding remarks

The members of the Study Group feel that the terms presented above are useful and even necessary, including rather new ones like 'mesosome'. They believe that the terms defined above are the minimum required to describe and classify common natural phenomena and well-known processes associated with migmatites. Additional information on the category and source of the terms is contained in the glossary. Various other terms related to migmatites which were considered unnecessary by the Study Group are also given in the main glossary and the glossary lists.

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