Moonstone & Co.
A Brief Review of the Feldspar Group

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長石家族中包含月長石、天河石、暈彩黑色拉長石、拉長石等。本文作者對各種長石的成份作出描述，尤其對長石的三種主要原素: 鉀、鈉、鈣與各礦物作出檢測。

Jewellery of today often profits from the beauty of minerals of the feldspar group. As with many mineralogical names they are barely known among jewellery manufacturers and consumers, although they may know the gemmy varieties of the group, such as moonstone, amazonite, spectrolite or labradorite. The intention of this article is to present a picture of the feldspar group in respect of their representatives used as gemstones.

Feldspars are among the most frequently occurring silicate minerals in crystalline rocks such as granite or gneiss. They represent a common crystal structure that can be realised with a few variations, depending on the chemical constituents available during crystallisation. Basically there are three different major elements (K, Na, and Ca) that define important feldspar minerals: potassium (orthoclase), sodium (albite) and calcium (anorthite). When mineralogists analysed various feldspars they became aware that common feldspar was rarely pure in its composition, but was rather a potassium feldspar with some sodium, or a feldspar of intermediate composition with sodium and calcium. Thus mineralogists group them as "alkaline feldspars" (K, Na) and so called plagioclases (Na, Ca). Graphically this situation is often represented in a triangular diagram with corners indicating K, Na, and Ca composition (Fig. 1). Mixtures between the potassium and the calcium end members do not exist. Because of symmetry details related to the temperature history of the crystals many more varieties are known, but these are not relevant to gemmologists. The feldspar minerals occur with monoclinic and triclinic structure.

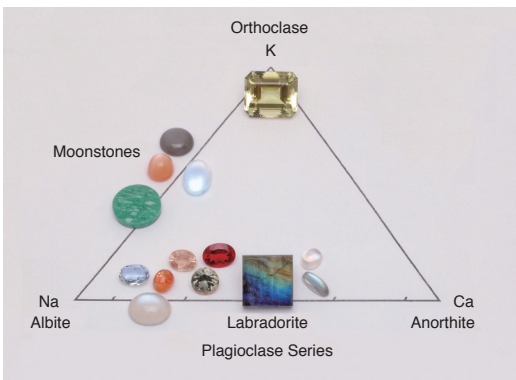

Fig. 1 A graphic display of the three extreme feldspar compositions and their naturally occurring intermediate mixtures is shown. Moonstones in different colours and amazonite are among the potassium feldspars. Sunstone, andesine labradorite and spectrolite are members of the plagioclase series. Photo © H.A. Hänni.

Among potassium feldspars with gemstone potential there is a yellow orthoclase (or sanidine) $KAlSi_3O_8$ from Madagascar that may be encountered as a faceted gemstone. Other potassium feldspars (microcline) are often white or pastel coloured and appear as moonstones. When white they may show the same bluish sheen effect as the classical moonstone. Other moonstones, especially those from India, are often coloured grey, orange, greenish or pinkish due to minute coloured guest minerals dispersed in the host. Some of these moonstones may also display the cat's eye effect, a single shining line that plays across the surface of a cabochon. In less frequent cases two such lines are crossed, forming a star moonstone. The reason for the moonstone sheen effect is a precipitation of tiny flakes of albite feldspar in the microcline matrix ($KAlSi_3O_8$), arranged along crystal structure directions.

Originally moonstones with the single bluish sheen were found only in Sri Lanka. More recently there has been a new occurrence of moonstone (peristerite) in Tanzania. Due to their composition moonstones have an average refractive index of 1.52 and a specific gravity of 2.57, both values being on the low side compared to other gemstones. Also the hardness of 6 is at the lower end of what is needed for daily wear. Cleavage may represent a problem when feldspars are knocked; a stone may split with a flat plane rather than a conchoidal fracture, as would many other minerals.

Another highly esteemed potassium feldspar is the blue-green amazonite. A non-transparent stone, it often contains white seams and is commonly cut into cabochons or used as beads for necklaces.

Fig. 2 An amazonite crystal and two cabochon-cut samples of this material that are green in colour due to traces of lead and water. Photo © H.A. Hänni.

The plagioclase group contains a number of other much esteemed gemstones such as aventurine sunstone and spectrolite. Plagioclases exist from high sodium to high calcium minerals. Mineralogists speak of a solid solution between the end members albite (Na) and anorthite (Ca). A number of intermediate minerals are defined with increasing replacement of Na by Ca. The middle point of the series is known as labradorite, its refractive index and specific gravity fall just between the values for albite and anorthite, namely 1.56 and 2.70. The calcium component raises the constants considerably from albite to anorthite.

The best-known plagioclase feldspar is probably spectrolite, a dark variety of labradorite. Labradorite is very often formed in an extremely fine lamellar array that gives rise to rainbow colours. These physically explainable interference colours are best seen against a dark background.

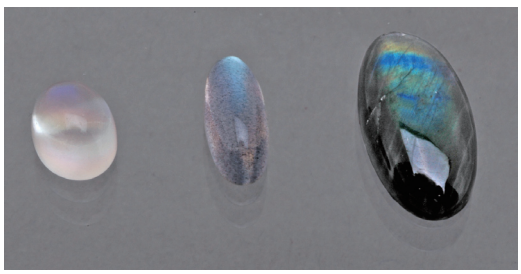

Fig. 3 Three labradorites with increasing amounts of black ore minerals. The large cabochon on the right is also called spectrolite because it shows the spectral colours best. Photo © H.A. Hänni.

A similar phenomenon occurs with black opal that may show the play of colour best on a dark body colour. The dark background in spectrolite is provided by tiny black inclusions of ore minerals. Feldspars with a labradorite composition occur in two different crystalline types: as transparent single crystals and as lamellar layered types. The single crystals may appear in a number of different colours such as red, green and yellow and are found in volcanic rocks. The layered varieties that show rainbow colours either have a white body colour, or a dark one, depending on the number of ore inclusions.

The solid solution series of plagioclase is characterised by members with increasing Na/Ca substitution. There is no natural border between the members, and only a precise chemical analysis can demonstrate whether a stone is still an andesine or has already become a labradorite! The borders are arbitrarily defined with a progression of 20% substitution. The minerals are albite, oligiclase, andesine, labradorite, bytownite and anorthite.

An often disputed topic is the origin of red facetted Andesine/Labradorite. For some years the stone was said to come from the Congo. Only cut material was encountered, never rough, and there was no report of a mine. Recently the same material was said to be of Chinese origin, but no precise locality has been indicated. The most problematic issue is the red colour that is said to be the result of a clever treatment. Research is in progress, and a future report will hopefully unveil the mystery.

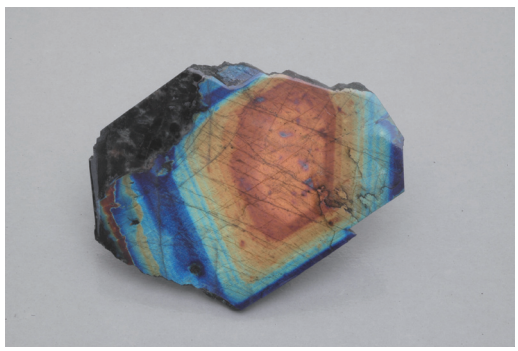

Fig. 4 A slice of spectrolite from Finland, that is a labradorite with interference colours and a high number of tiny black magnetite inclusions. Photo © H.A. Hänni.

All stones in these pictures are taken from Prof. H.A. Hänni's Gemstone Collection.

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