Granite_21 macro : How does it work?

by
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General introduction to granites

Granites are classified as intrusive, or plutonic, igneous rocks[1]. Slow cooling of plutonic magma beneath the surface of the Earth results in macroscopic assemblages of juxtaposed and closely packed minerals that show different forms, colours, sizes, and compositions. In contrast, volcanic glasses such as obsidian, are the amorphous product of rapidly cooling volcanic igneous rocks which solidify before crystallization can occur.

The overal colour of granites (white, pink, or grey) is controlled by the relative proportion of each mineral, which facilitates the optical classification of a given rock sample. Sometimes, particularly large crystals (phenocrysts[2], often plagioclase[3]) are present and can help with the identification.

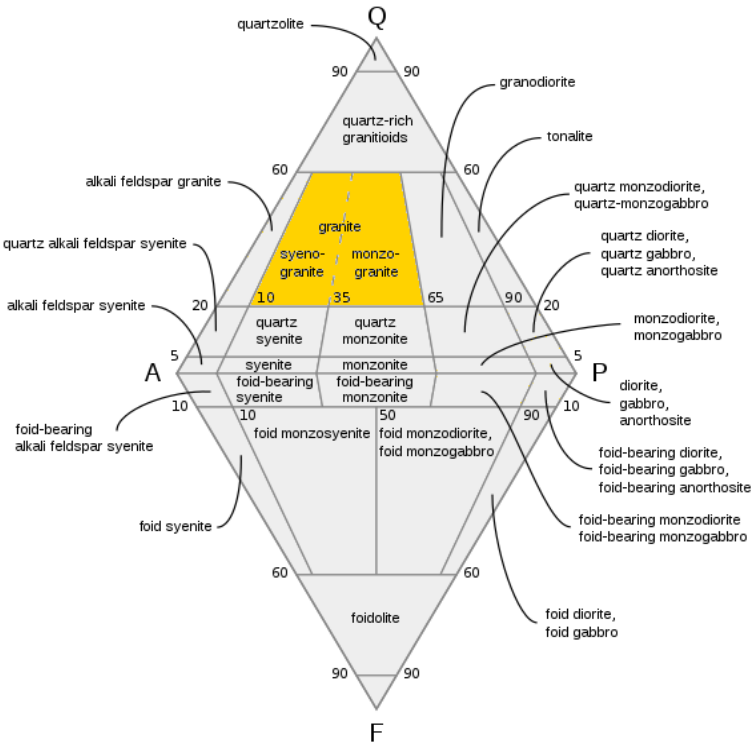


Fig. 1: QAPF diagram with granite field highlighted in yellow (after Kent G. Budge).

Figure 1 shows a QAPF diagram (Quartz, Alkali feldspar, Plagioclase, Feldspathoids, also known as a Streckeisen diagram) which is used by the scientific community for the classification of igneous rocks. More information on this can be found here[4] and for granites in general, here[5].

The modelling of granites: maps and masks

To simulate a real world granite in POV-Ray, we make use of a colour map (representing the different minerals/colours of the granite as basis for its pigment) and a colour mask (i.e. a *colour_map*-based *pigment_pattern* used within the granite texture) which controls the distribution of those same minerals/colours. Necessarily, there is a close relationship between maps and masks as mineral/colour boundaries within a particular granite must correspond to their mask boundaries. The

(1) https://www.usgs.gov/faqs/what-are-igneous-rocks?qt-news_science_products=0#qt-news_science_products
(2) https://en.wikipedia.org/wiki/Phenocryst
(3) https://en.wikipedia.org/wiki/Plagioclase
(4) https://en.wikipedia.org/wiki/QAPF_diagram
(5) https://en.wikipedia.org/wiki/Granite

final texture is pretty complex as additional differential scaling perturbs the final aspect of the texture. In the following paragraphs we shall explain how this is achieved by the macro, illustrated by comprehensive examples and diagrams. To make things easier to understand, the different parts of the macro are described separately.

Granite pigment creation

Sections 1 through 3 of the macro concerns the creation of granite pigments (Fig. 2). The input to this part of the macro - independently from the different parameters which will be described later - consists of three different colour map arrays (prefixed with A_) for each granite type file:

A_Granite_map1: describing the different minerals/colours;

A_Granite_map2: describing the veins crossing the granites (discussed separately below);

A_Granite_mask: describing the (spatial) distribution of the different minerals/colours.

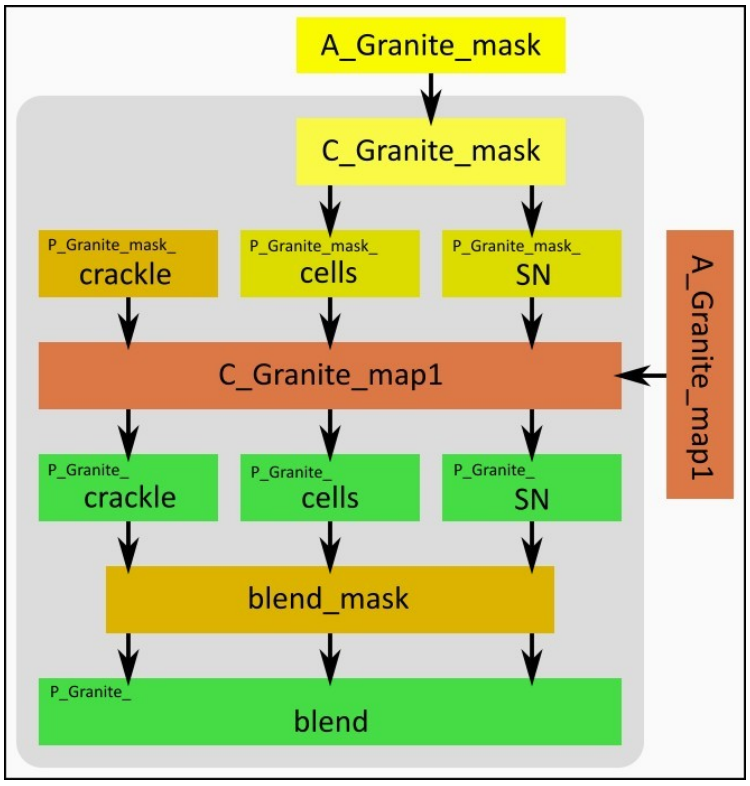


Fig. 2: Pigment generation (sections 1 to 3).

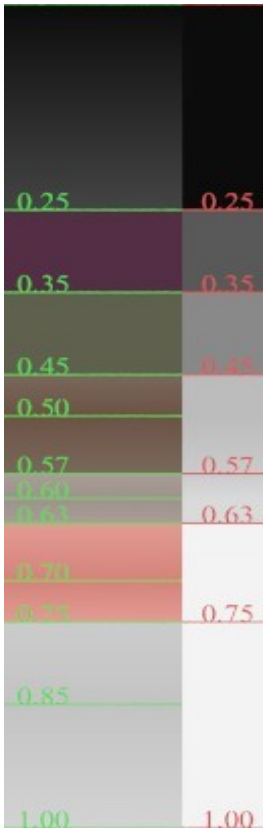
Examples are from the (default) Dakota Red Granite data (Table 1). Note that "not_0" used in the arrays represents a small value (1/265) which is small enough to render a completely black pixel, but which retains the ability to contribute to the multiplicative result of colour and intensity calculations resulting from strong illumination, radiosity, etc.).

Since granites consist of close-packed, discrete assemblages of minerals, this can be simulated by sharply-bounded groups of colours, with each group representing a different mineral (Table 1). The first array (A_Granite_map1) is read into the macro's *C_Granite_map1* colour map. The second array (A_Granite_mask) is read into the macro's *C_Granite_mask* colour map. This last colour_map controls one of the granite pigment patterns: cells or step noise (SN) while crackle uses its own colour_map (Fig. 2). A pigment is then generated by the combination of one of the pigment_patterns controlling the colour_map.

Note that the mask map does not necessarily have the same number of index values as the colour map, but the index values representing the *boundaries* between each mineral necessarily have identical values (Table 1).

Blend, the other internal pattern provided by the macro (*blend_mask*, Fig. 2) and developed originally by Tekno Frannansa (aka Tek) makes use of the generated pigments to provide a blended version of them. This can be very useful to simulate a weathered aspect of the granite for example.

```
#declare Map1_entries = 18;
#declare A_Granite_map1 =
array mixed [Map1_entries][2] {
 {0.00, <not_0, not_0, not_0>},
 {0.25, <0.059, 0.059, 0.059>},

 {0.25, <0.086, 0.027, 0.059>},
 {0.35, <0.086, 0.027, 0.059>},

 {0.35, <0.118, 0.118, 0.078>},
 {0.45, <0.118, 0.118, 0.078>},

 {0.45, <0.200, 0.137, 0.110>},
 {0.50, <0.150, 0.087, 0.060>},
 {0.57, <0.200, 0.137, 0.110>},

 {0.57, <0.400, 0.337, 0.310>},
 {0.60, <0.350, 0.287, 0.260>},
 {0.63, <0.400, 0.337, 0.310>},

 {0.63, <0.769, 0.329, 0.298>},
 {0.70, <0.669, 0.229, 0.198>},
 {0.75, <0.769, 0.329, 0.298>},

 {0.75, <0.600, 0.600, 0.600>},
 {0.85, <0.550, 0.550, 0.550>},
 {1.00, <0.650, 0.650, 0.650>}
}
```




```
#declare Mask_entries = 14;
#declare A_Granite_mask =
array mixed [Mask_entries][2] {
 {0.00, <not_0, not_0, not_0>},
 {0.25, <not_0, not_0, not_0>},

 {0.25, <0.100, 0.100, 0.100>},
 {0.35, <0.100, 0.100, 0.100>},

 {0.35, <0.250, 0.250, 0.250>},
 {0.45, <0.250, 0.250, 0.250>},

 {0.45, <0.500, 0.500, 0.500>},
 {0.57, <0.500, 0.500, 0.500>},

 {0.57, <0.600, 0.600, 0.600>},
 {0.63, <0.600, 0.600, 0.600>},

 {0.63, <0.700, 0.700, 0.700>},
 {0.75, <0.700, 0.700, 0.700>},

 {0.75, <0.900, 0.900, 0.900>},
 {1.00, <0.900, 0.900, 0.900>}
}
```

Table 1: Correspondance between the colour_map (column 1) and pigment_pattern (column 3) arrays. Visualisation of both arrays is shown in column 2.

As the granite mask is used as a pigment_pattern, changing the rgb-values of its colour_map changes the aspect of the granite pigment and, as explained later, the aspect of the granite texture. How pigment patterns work exactly is explained in the POV-Ray documentation[6]. The user is invited to experiment by making changes to the mask's colour_map when choosing the cells or the step noise pigment pattern (remember: the crackle pattern uses its own map!), for instance by reversing the rgb values in the list, and compare the rendered texture with the original one (Fig. 3). A very large number of different granites can thus be generated from a single basic concept. Do *not* change the colour_map entries in the A_Granite_mask array however, without also changing the corresponding entries in the A_Granite_mask1 array!

(6) https://wiki.povray.org/content/Reference:Pigment_Pattern

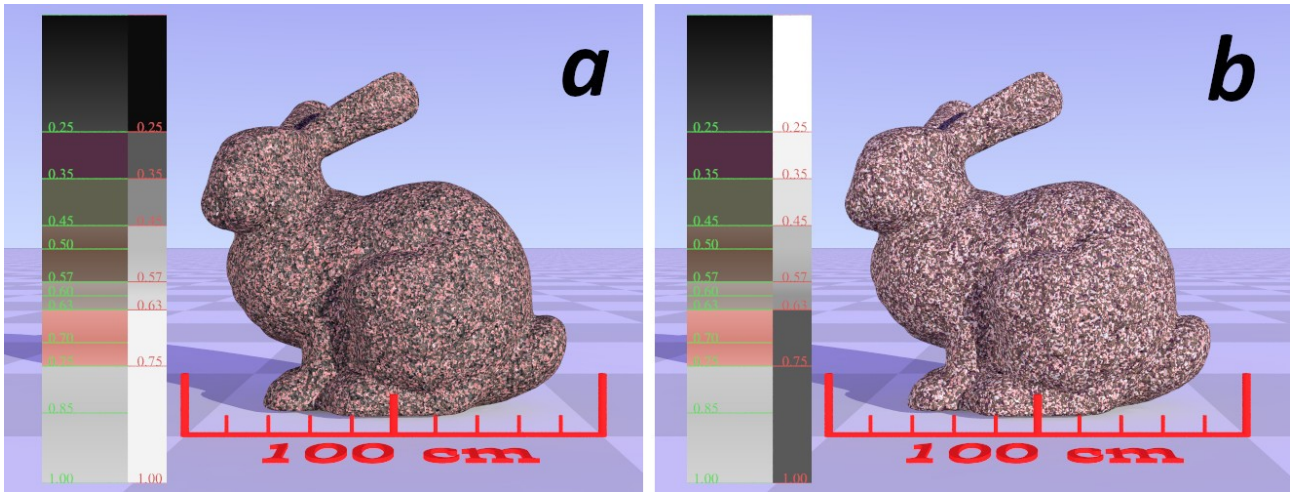


Fig. 3: Reversing the rgb colour map values of the A_Granite_mask array, changes the visual aspect of the final granite texture. (a) is the original array; (b) has the rgb values inverted.

A_Granite_map2, which controls the appearance of the (quartz) veins intersecting a given granite, is a mixed array with the following format:

```
#declare Map2_entries = 5;
#declare A_Granite_map2 =
array mixed [Map2_entries][3] {
  {0.000, <0.800, 0.800, 0.800>, 0.150},
  {0.005, <0.800, 0.800, 0.800>, 0.000},
  {0.010, <0.800, 0.800, 0.800>, 0.150},
  {0.011, <1.000, 1.000, 1.000>, 1.000},
  {1.000, <1.000, 1.000, 1.000>, 1.000}
}
```

This array describes the colour map of the quartz. It is a bit different from the minerals colour map in that it also contains filter and transmit information. Especially the filter information is highly experimental at this stage and may substantially change in the future. When enabled, a veins texture will be layered over the main granite texture. As this feature is still in an experimental phase, it is advised to not change anything to this array and copy it verbatim from one granite include file to the next. Things may change in the future though.

In section 4 of the macro, the data from this array are fed into the internal *C_Granite_map2* colour map, which in turn is the core of the *P_Granite_veins* pigment that employs a marble pattern.

Granite texture creation

In section 5 of the macro (Fig. 4), the texture generation, we employ the same pigment patterns used in section 3 (Fig. 2). However, they are implemented for a different reason, and in a different way. This time they control the distribution of the granite pigments at different scales throughout the granite texture . An array (*A_Granite_var*) serves as input for additional variations. It has the following format:

```
#declare Var_entries = 8;
#declare A_Granite_var =
array [Var_entries][3] {
  {0.20, 0.50, 0.15},
  {0.25, 1.00, 0.18},
  {0.35, 1.00, 0.18},
  {0.40, 0.50, 0.15},
  {0.60, 1.00, 0.15},
  {0.65, 0.50, 0.18},
  {0.75, 1.00, 0.18},
  {0.80, 0.50, 0.15}
}
```

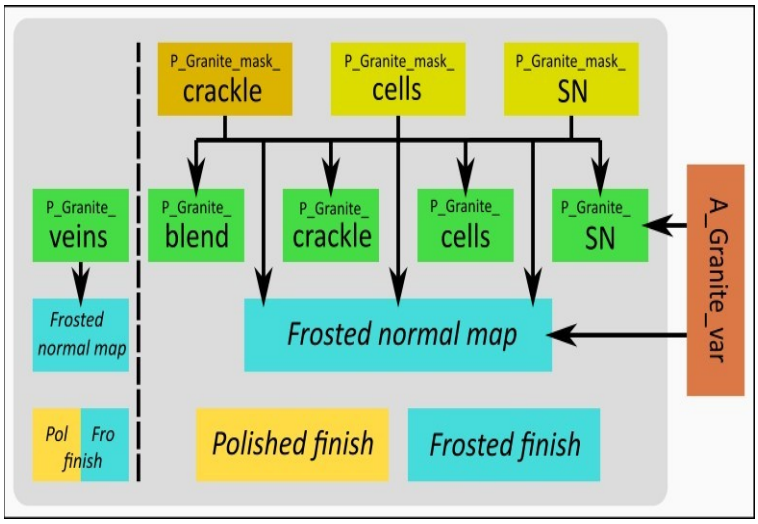


Fig 4: Texture generation (section 5).

Like in the arrays discussed previously, the first elements are the pigment or normal map entries. The second elements control the strength of the normal pattern (only frosted version of the granite) in the normal map. The third elements scale both the pigments in the pigment map, and the normal patterns in the normal map. The purpose of these last elements is to provide a visual size variation of the granite minerals in the texture. When experimenting with these scale values, be careful to keep the variations relatively small and close to each other. A larger variation rapidly becomes 'artificial' (fig. 5).

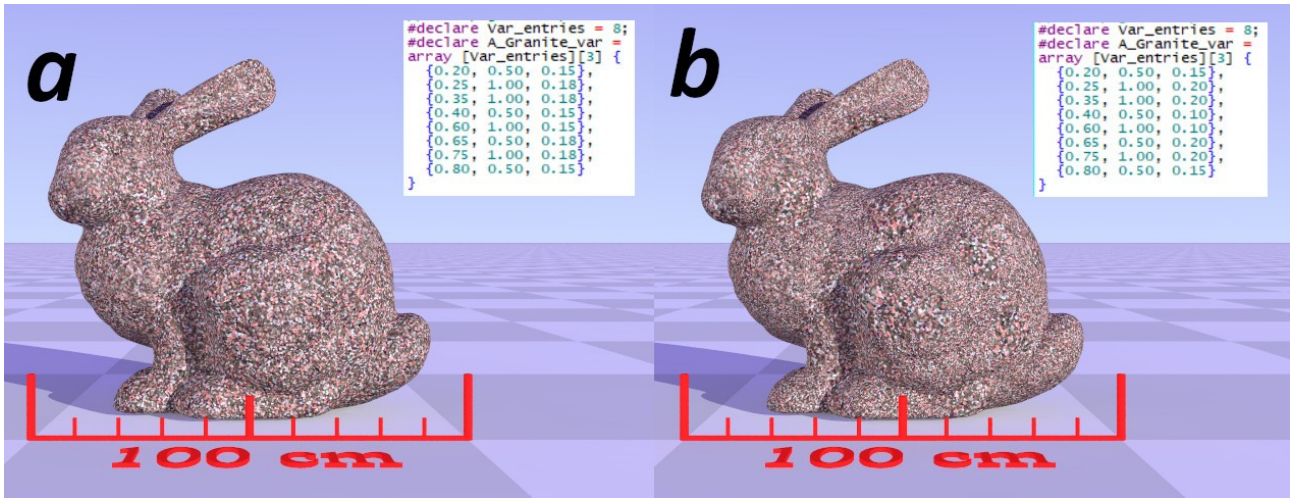


Fig. 5: Changing the scale value in the A_Granite_var array. (a) is the original array; (b) uses more extreme scale values.

Also in this section, different finish blocks are generated, corresponding to either the polished or the frosted versions of the granite, and whether or not the granite contains veins (layered texture). Finally, the normal block for the frosted version of the granite is generated.

The veins texture (Fig. 4) has its own finish blocks (polished or frosted) and a normal block where the normal map is controlled by the same pigment (*P_Granite_veins*) used in the pigment pattern.

Still experimental is the use of subsurface light transmission. The macro parameter *SubS* switches this on in this section's finish blocks. *[to be developed further]*

The granite textures have been structured and scaled in such a way that they correspond to a fairly fine-grained real-world granite. This means that applying this texture to an arbitrarily-sized object without any further scaling will show a real-world-scale granite texture. One POV-unit corresponds to 100 cm (fig. 3 and 5).

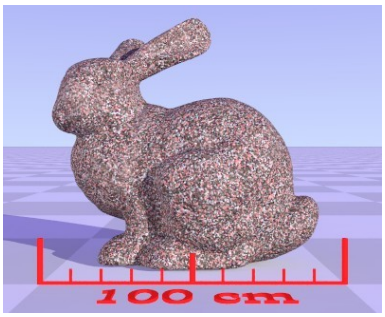
Granite material creation

In section 6 of the macro, everything is pulled together into the final material. An interior block is added with an ior value choosen as a good compromise for feldspars and quartz. Further development of the interior may include media to be combined with the subsurface light transport.

Still within the macro structure, the user can apply internal transformations to the texture. He may for instance want to rotate the texture (can be useful when using veins), translate it (also useful with veins enabled), or scale the complete texture up or down for particular reasons. The parameters *M_scale* (defaults to <1,1,1>), *M_rotat* (defaults to <0,0,0>), and *M_trans* (defaults to <0,0,0>) are provided as input parameters (see below).

Macro parameters and their use

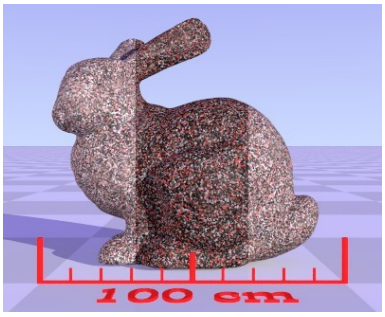
Required parameters



Granite_file

The include file that describes the granite through (user-defined) arrays and read into the macro.

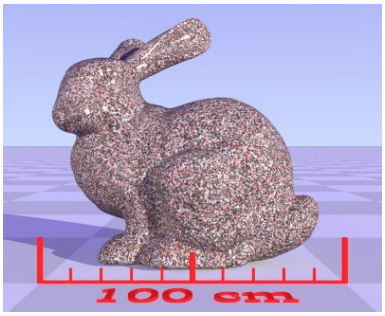
default: "DakotaRedGranite.inc"



CSC

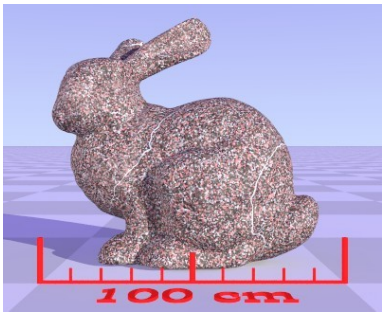
Colour Space Conversion: Assuming that the input colour vectors are defined as rgb, conversion to srgb is possible by using value 1 to convert directly to a "raw" srgb vector (middle on image), or 2 by using a conversion macro (right on image). Any other value just keeps the rgb vectors (left on image).

default: 2;



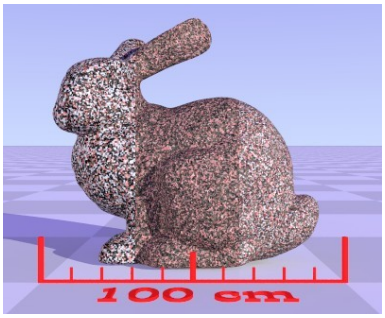
Pol
Switch to turn 'on' the polished version of the granite (left half of image). When 'off', the frosted version is rendered (right half of image).

default: off;



Type
Type switches the veins crossing the granite on/off (image is 'on'). Warning! This parameter is still in an experimental stage.

default: off;

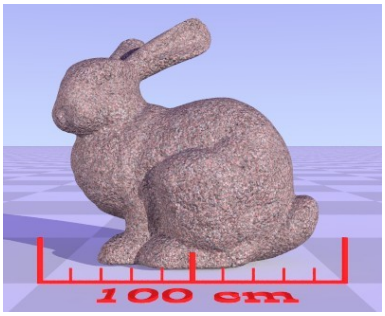


Pat1
Pat1 (pigment pattern at the pigment level) and Pat2 (pigment pattern at the texture level) are described here together. Three patterns are proposed: (1) cells; (2) step noise; (3) crackle solid. The Pat1 patterns are the fundamental building blocks of the granite at the pigment level, simulating the mineral assemblages.

default: 2;

Pat2
At the texture level, tthe Pat2 patterns are used to modulate the aspect of the granite. As such, they can be different from the Pat1 patterns (increasing the number of different possible granites). In the image, only three options are shown: Pat1=Pat2=1 (left); Pat1=Pat2=2 (centre); and Pat1=Pat2=3 (right).

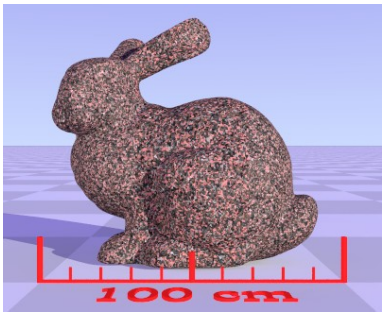
default: 3;



Blend
By switching Blend 'on', the granite pigments are 'blended' using the internal blended cells pattern macro by Tekno Frannansa. This simulates a weathered granite. See also the BC_Blur parameter below.

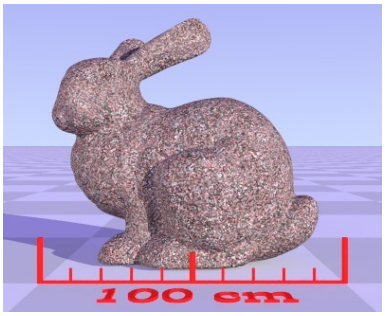
default: off;

Optional parameters



SN_Start; SN_End; SN_Turb
The step noise pattern can be controlled by these three parameters. The two first set to the same value (0-1) the pattern corresponds to the cells pattern. With SN_Start = 0 and SN_End = 1, the pattern comes as close as it can get to f_noise3d(). SN_Turb controls the warp turbulence of the pattern. It is best to leave these parameters alone. An example is given here with default SN_Start and SN_End at left, SN_Start=SN_End=0.2 in the middle, and SN_Start=0 and SN_End=1 at right.

SN_Start default: 0.2;
SN_End default: 0.8;
SN_Turb default: 0.325;



BC_Blur
This parameter controls the amount of blurring used in the blended cells macro. The example uses a value of 0.5; compare with the default 'Blend' example above.

default: 2;

Optional transformations of the material

M_scale; M_rotat; M_trans
The end material can be scaled, rotated, and translated, at will. Scaling in particular will break the relationship with real world granite dimensions however. Rotation and translation can be of help when veins are enabled.

M_scale default: <1.0, 1.0, 1.0>;
M_rotat default: <0.0, 0.0, 0.0>;
M_trans default: <0.0, 0.0, 0.0>;

Subsurface light transport (experimental parameters)

SubS
This feature is still experimental and may change in the future. The default translucency value is based on the Dakota Red granite.

default: off;

Translucency
default: <0.669, 0.229, 0.198>*1;

Colophon

In January 1996, Daniel Mecklenburg Jr., aka Code Warrior, posted in https://groups.google.com/g/comp.graphics.rendering.raytracing/c/OH1eY_l2WxI the first known version of the original set of code for POV-Ray that lies at the basis of the present macro. Somehow, this set of code found its way into early include files developed at the time by different users. It is probable that one of us (TdeG) found the set late in the nineteen nineties or early in the twenty first century. Nothing really important happened after then until the early months of 2021. The Granite_21 macro is the result.

July 2021

Annex 1: Dakota Red Granite

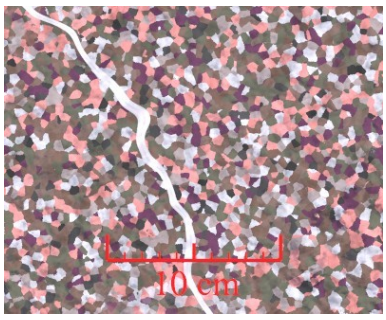
```
#declare Map1_entries = 18;
#declare A_Granite_map1 =
array mixed [Map1_entries][2] {
  {0.00, <not_0, not_0, not_0>},
  {0.25, <0.059, 0.059, 0.059>},
  {0.25, <0.086, 0.027, 0.059>},
  {0.35, <0.086, 0.027, 0.059>},
  {0.35, <0.118, 0.118, 0.078>},
  {0.45, <0.118, 0.118, 0.078>},
  {0.45, <0.200, 0.137, 0.110>},
  {0.50, <0.150, 0.087, 0.060>},
  {0.57, <0.200, 0.137, 0.110>},
  {0.57, <0.400, 0.337, 0.310>},
  {0.60, <0.350, 0.287, 0.260>},
  {0.63, <0.400, 0.337, 0.310>},
  {0.63, <0.769, 0.329, 0.298>},
  {0.70, <0.669, 0.229, 0.198>},
  {0.75, <0.769, 0.329, 0.298>},
  {0.75, <0.600, 0.600, 0.600>},
  {0.85, <0.550, 0.550, 0.550>},
  {1.00, <0.650, 0.650, 0.650>}
}
```


```
#declare Mask_entries = 14;
#declare A_Granite_mask =
array mixed [Mask_entries][2] {
  {0.00, <not_0, not_0, not_0>},
  {0.25, <not_0, not_0, not_0>},
  {0.25, <0.100, 0.100, 0.100>},
  {0.35, <0.100, 0.100, 0.100>},
  {0.35, <0.250, 0.250, 0.250>},
  {0.45, <0.250, 0.250, 0.250>},
  {0.45, <0.500, 0.500, 0.500>},
  {0.57, <0.500, 0.500, 0.500>},
  {0.57, <0.600, 0.600, 0.600>},
  {0.63, <0.600, 0.600, 0.600>},
  {0.63, <0.700, 0.700, 0.700>},
  {0.75, <0.700, 0.700, 0.700>},
  {0.75, <0.900, 0.900, 0.900>},
  {1.00, <0.900, 0.900, 0.900>}
}
```

```
#declare Map2_entries = 5;
#declare A_Granite_map2 =
array mixed [Map2_entries][4] {
  {0.000, <0.800, 0.800, 0.800>, 0.050, 0.150},
  {0.005, <0.800, 0.800, 0.800>, 0.001, 0.000},
  {0.010, <0.800, 0.800, 0.800>, 0.050, 0.150},
  {0.011, <1.000, 1.000, 1.000>, 0.000, 1.000},
  {1.000, <1.000, 1.000, 1.000>, 0.000, 1.000}
}
```

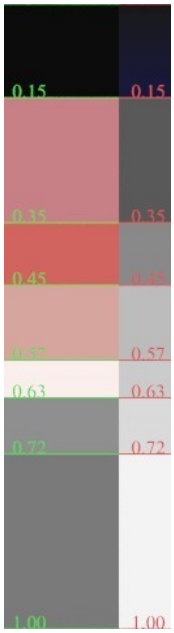
```
#declare Var_entries = 8;
#declare A_Granite_var =
array [Var_entries][3] {
  {0.20, 0.50, 0.15},
  {0.25, 1.00, 0.18},
  {0.35, 1.00, 0.18},
  {0.40, 0.50, 0.15},
  {0.60, 1.00, 0.15},
  {0.65, 0.50, 0.18},
  {0.75, 1.00, 0.18},
  {0.80, 0.50, 0.15}
}
```

```
#declare Translucency =
<0.669, 0.229, 0.198>*1;
```



Annex 2: North American Pink Granite

```
#declare Map1_entries = 14;
#declare A_Granite_map1 =
array mixed [Map1_entries][2] {
  {0.00, <not_0, not_0, not_0>},
  {0.15, <not_0, not_0, not_0>},
  {0.15, <0.576, 0.435*0.50, 0.482*0.50>},
  {0.35, <0.576, 0.435*0.50, 0.482*0.50>},
  {0.35, <0.635, 0.506*0.25, 0.455*0.25>},
  {0.45, <0.635, 0.506*0.25, 0.455*0.25>},
  {0.45, <0.675, 0.506*0.75, 0.455*0.75>},
  {0.57, <0.675, 0.506*0.75, 0.455*0.75>},
  {0.57, <0.961, 0.863, 0.843>},
  {0.63, <0.961, 0.863, 0.843>},
  {0.63, <0.275, 0.275, 0.275>},
  {0.72, <0.275, 0.275, 0.275>},
  {0.72, <0.196, 0.196, 0.196>},
  {1.00, <0.196, 0.196, 0.196>}
}
```

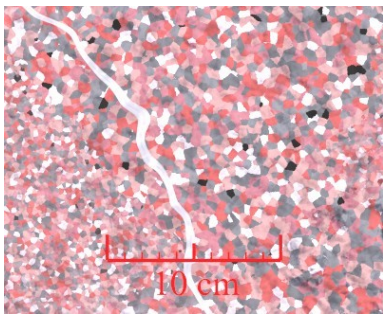



```
#declare Mask_entries = 14;
#declare A_Granite_mask =
array mixed [Mask_entries][2] {
  {0.00, <0.010, 0.010, 0.010>},
  {0.15, <0.010, 0.010, 0.0510>},
  {0.15, <0.100, 0.100, 0.100>},
  {0.35, <0.100, 0.100, 0.100>},
  {0.35, <0.250, 0.250, 0.250>},
  {0.45, <0.250, 0.250, 0.250>},
  {0.45, <0.500, 0.500, 0.500>},
  {0.57, <0.500, 0.500, 0.500>},
  {0.57, <0.600, 0.600, 0.600>},
  {0.63, <0.600, 0.600, 0.600>},
  {0.63, <0.700, 0.700, 0.700>},
  {0.72, <0.700, 0.700, 0.700>},
  {0.72, <0.900, 0.900, 0.900>},
  {1.00, <0.900, 0.900, 0.900>}
}
```

```
#declare Map2_entries = 5;
#declare A_Granite_map2 =
array mixed [Map2_entries][4] {
  {0.000, <0.800, 0.800, 0.800>, 0.050, 0.150},
  {0.005, <0.800, 0.800, 0.800>, 0.001, 0.000},
  {0.010, <0.800, 0.800, 0.800>, 0.050, 0.150},
  {0.011, <1.000, 1.000, 1.000>, 0.000, 1.000},
  {1.000, <1.000, 1.000, 1.000>, 0.000, 1.000}
}
```

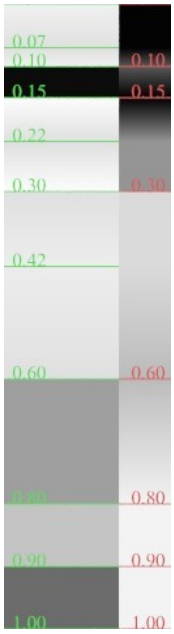
```
#declare Var_entries = 8;
#declare A_Granite_var =
array [Var_entries][3] {
  {0.20, 0.50, 0.15},
  {0.25, 1.00, 0.18},
  {0.35, 1.00, 0.18},
  {0.40, 0.50, 0.10},
  {0.60, 1.00, 0.15},
  {0.65, 0.50, 0.18},
  {0.75, 1.00, 0.18},
  {0.80, 0.50, 0.15}
}
```

```
#declare Translucency =
<0.669, 0.229, 0.198>*1;
```



Annex 3: Southern Gray Granite

```
#declare Map1_entries = 17;
#declare A_Granite_map1 =
array mixed [Map1_entries][2] {
  {0.00, <0.880, 0.880, 0.880>},
  {0.07, <0.745, 0.745, 0.745>},
  {0.10, <0.880, 0.880, 0.880>},
  {0.10, <not_0, not_0, not_0>},
  {0.15, <not_0, not_0, not_0>},
  {0.15, <0.980, 0.980, 0.980>},
  {0.22, <0.745, 0.745, 0.745>},
  {0.30, <0.980, 0.980, 0.980>},
  {0.30, <0.745, 0.745, 0.745>},
  {0.42, <0.845, 0.845, 0.845>},
  {0.60, <0.745, 0.745, 0.745>},
  {0.60, <0.345, 0.345, 0.345>},
  {0.80, <0.345, 0.345, 0.345>},
  {0.80, <0.549, 0.549, 0.549>},
  {0.90, <0.549, 0.549, 0.549>},
  {0.90, <0.149, 0.149, 0.149>},
  {1.00, <0.149, 0.149, 0.149>}
}
```

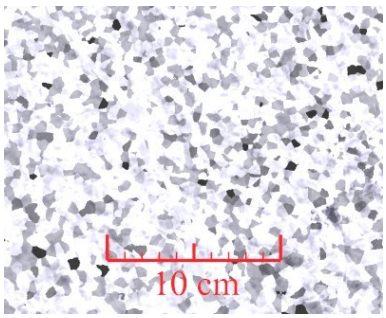



```
#declare Mask_entries = 14;
#declare A_Granite_mask =
array mixed [Mask_entries][2] {
  {0.00, <0.001, 0.001, 0.001>},
  {0.10, <0.001, 0.001, 0.001>},
  {0.10, <0.100, 0.100, 0.100>},
  {0.15, <0.100, 0.100, 0.100>},
  {0.15, <0.001, 0.001, 0.001>},
  {0.30, <0.001, 0.001, 0.001>},
  {0.30, <0.300, 0.300, 0.300>},
  {0.60, <0.300, 0.300, 0.300>},
  {0.60, <0.700, 0.700, 0.700>},
  {0.80, <0.700, 0.700, 0.700>},
  {0.80, <0.500, 0.500, 0.500>},
  {0.90, <0.500, 0.500, 0.500>},
  {0.90, <0.900, 0.900, 0.900>},
  {1.00, <0.900, 0.900, 0.900>}
}
```

```
#declare Map2_entries = 5;
#declare A_Granite_map2 =
array mixed [Map2_entries][4] {
  {0.000, <0.800, 0.800, 0.800>, 0.050, 0.150},
  {0.005, <0.800, 0.800, 0.800>, 0.001, 0.000},
  {0.010, <0.800, 0.800, 0.800>, 0.050, 0.150},
  {0.011, <1.000, 1.000, 1.000>, 0.000, 1.000},
  {1.000, <1.000, 1.000, 1.000>, 0.000, 1.000}
}
```

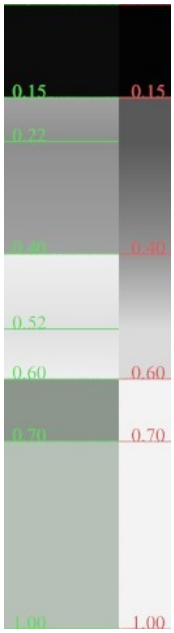
```
#declare Var_entries = 8;
#declare A_Granite_var =
array [Var_entries][3] {
  {0.20, 0.50, 0.15},
  {0.25, 1.00, 0.20},
  {0.35, 1.00, 0.20},
  {0.40, 0.50, 0.18},
  {0.60, 1.00, 0.18},
  {0.65, 0.50, 0.20},
  {0.75, 1.00, 0.20},
  {0.80, 0.50, 0.15}
}
```

```
#declare Translucency =
<0.745, 0.745, 0.745>*1;
```



Annex 4: Medium Barre Gray Granite

```
#declare Map1_entries = 12;
#declare A_Granite_map1 =
array mixed [Map1_entries][2] {
  {0.00, <not_0, not_0, not_0>},
  {0.15, <not_0, not_0, not_0>},
  {0.15, <0.356, 0.356, 0.356>},
  {0.22, <0.271, 0.271, 0.271>},
  {0.40, <0.356, 0.356, 0.356>},
  {0.40, <0.863, 0.863, 0.863>},
  {0.52, <0.745, 0.745, 0.745>},
  {0.60, <0.863, 0.863, 0.863>},
  {0.60, <0.267, 0.306, 0.267>},
  {0.70, <0.267, 0.306, 0.267>},
  {0.70, <0.471, 0.529, 0.471>},
  {1.00, <0.471, 0.529, 0.471>}
}
```

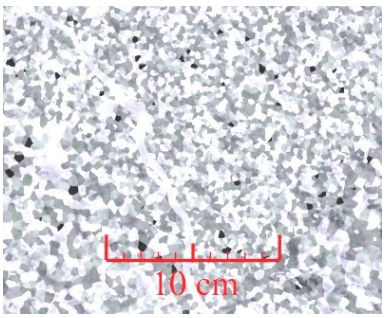



```
#declare Mask_entries = 10;
#declare A_Granite_mask =
array mixed [Mask_entries][2] {
  {0.00, <0.001, 0.001, 0.001>},
  {0.15, <0.001, 0.001, 0.001>},
  {0.15, <0.100, 0.100, 0.100>},
  {0.40, <0.100, 0.100, 0.100>},
  {0.40, <0.300, 0.300, 0.300>},
  {0.60, <0.300, 0.300, 0.300>},
  {0.60, <0.700, 0.700, 0.700>},
  {0.70, <0.700, 0.700, 0.700>},
  {0.70, <0.900, 0.900, 0.900>},
  {1.00, <0.900, 0.900, 0.900>}
}
```

```
#declare Map2_entries = 5;
#declare A_Granite_map2 =
array mixed [Map2_entries][4] {
  {0.000, <0.800, 0.800, 0.800>, 0.050, 0.150},
  {0.005, <0.800, 0.800, 0.800>, 0.001, 0.000},
  {0.010, <0.800, 0.800, 0.800>, 0.050, 0.150},
  {0.011, <1.000, 1.000, 1.000>, 0.000, 1.000},
  {1.000, <1.000, 1.000, 1.000>, 0.000, 1.000}
}
```

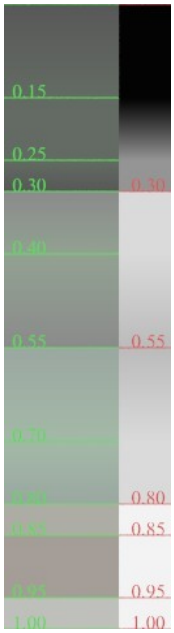
```
#declare Var_entries = 8;
#declare A_Granite_var =
array [Var_entries][3] {
  {0.20, 0.50, 0.10},
  {0.25, 1.00, 0.18},
  {0.35, 1.00, 0.18},
  {0.40, 0.50, 0.15},
  {0.60, 1.00, 0.15},
  {0.65, 0.50, 0.12},
  {0.75, 1.00, 0.12},
  {0.80, 0.50, 0.10}
}
```

```
#declare Translucency =
<0.471, 0.529, 0.471>*1;
```



Annex 5: Saint-André Green Granite

```
#declare Map1_entries = 16;
#declare A_Granite_map1 =
array mixed [Map1_entries][2] {
  {0.00, <0.098, 0.098, 0.098>},
  {0.15, <0.128, 0.148, 0.128>},
  {0.25, <0.128, 0.148, 0.128>},
  {0.30, <0.098, 0.098, 0.098>},
  {0.30, <0.259, 0.259, 0.259>},
  {0.40, <0.289, 0.359, 0.289>},
  {0.55, <0.259, 0.259, 0.259>},
  {0.55, <0.329, 0.388, 0.357>},
  {0.70, <0.369, 0.488, 0.387>},
  {0.80, <0.329, 0.388, 0.357>},
  {0.80, <0.420, 0.420, 0.376>},
  {0.85, <0.420, 0.420, 0.376>},
  {0.85, <0.376, 0.337, 0.310>},
  {0.95, <0.376, 0.337, 0.310>},
  {0.95, <0.518, 0.529, 0.498>},
  {1.00, <0.518, 0.529, 0.498>}
}
```

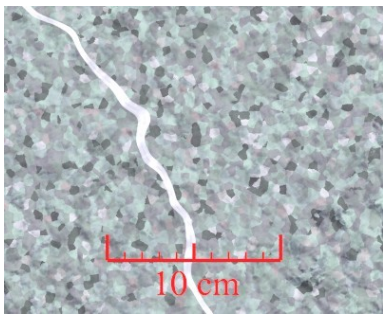



```
#declare Mask_entries = 12;
#declare A_Granite_mask =
array mixed [Mask_entries][2] {
  {0.00, <0.001, 0.001, 0.001>},
  {0.30, <0.001, 0.001, 0.001>},
  {0.30, <0.300, 0.300, 0.300>},
  {0.55, <0.300, 0.300, 0.300>},
  {0.55, <0.700, 0.700, 0.700>},
  {0.80, <0.700, 0.700, 0.700>},
  {0.80, <0.500, 0.500, 0.500>},
  {0.85, <0.500, 0.500, 0.500>},
  {0.85, <0.700, 0.700, 0.700>},
  {0.95, <0.700, 0.700, 0.700>},
  {0.95, <0.900, 0.900, 0.900>},
  {1.00, <0.900, 0.900, 0.900>}
}
```

```
#declare Map2_entries = 5;
#declare A_Granite_map2 =
array mixed [Map2_entries][4] {
  {0.000, <0.800, 0.800, 0.800>, 0.050, 0.150},
  {0.005, <0.800, 0.800, 0.800>, 0.001, 0.000},
  {0.010, <0.800, 0.800, 0.800>, 0.050, 0.150},
  {0.011, <1.000, 1.000, 1.000>, 0.000, 1.000},
  {1.000, <1.000, 1.000, 1.000>, 0.000, 1.000}
}
```

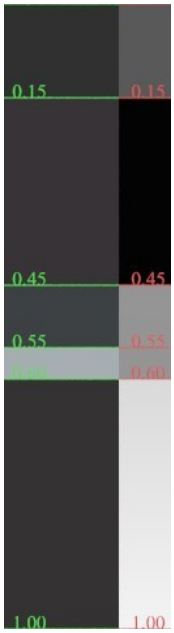
```
#declare Var_entries = 8;
#declare A_Granite_var =
array [Var_entries][3] {
  {0.20, 0.50, 0.15},
  {0.25, 1.00, 0.18},
  {0.35, 1.00, 0.18},
  {0.40, 0.50, 0.15},
  {0.60, 1.00, 0.15},
  {0.65, 0.50, 0.18},
  {0.75, 1.00, 0.18},
  {0.80, 0.50, 0.15}
}
```

```
#declare Translucency =
<0.518, 0.529, 0.498>*1;
```



Annex 6: Impala Black Granite

```
#declare Map1_entries = 10;
#declare A_Granite_map1 =
array mixed [Map1_entries][2] {
  {0.00, <0.298, 0.298, 0.298>*0.1},
  {0.15, <0.298, 0.298, 0.298>*0.1},
  {0.15, <0.376, 0.337, 0.369>*0.1},
  {0.45, <0.376, 0.337, 0.369>*0.1},
  {0.45, <0.486, 0.529, 0.557>*0.1},
  {0.55, <0.486, 0.529, 0.557>*0.1},
  {0.55, <0.486, 0.529, 0.557>*0.8},
  {0.60, <0.486, 0.529, 0.557>*0.8},
  {0.60, <0.357, 0.318, 0.329>*0.1},
  {1.00, <0.357, 0.318, 0.329>*0.1}
}
```




```
#declare Mask_entries = 10;
#declare A_Granite_mask =
array mixed [Mask_entries][2] {
  {0.00, <0.100, 0.100, 0.100>},
  {0.15, <0.100, 0.100, 0.100>},
  {0.15, <0.001, 0.001, 0.001>},
  {0.45, <0.001, 0.001, 0.001>},
  {0.45, <0.300, 0.300, 0.300>},
  {0.55, <0.300, 0.300, 0.300>},
  {0.55, <0.300, 0.300, 0.300>},
  {0.60, <0.300, 0.300, 0.300>},
  {0.60, <0.700, 0.700, 0.700>},
  {1.00, <0.900, 0.900, 0.900>}
}
```

```
#declare Map2_entries = 5;
#declare A_Granite_map2 =
array mixed [Map2_entries][4] {
  {0.000, <0.800, 0.800, 0.800>, 0.050, 0.150},
  {0.005, <0.800, 0.800, 0.800>, 0.001, 0.000},
  {0.010, <0.800, 0.800, 0.800>, 0.050, 0.150},
  {0.011, <1.000, 1.000, 1.000>, 0.000, 1.000},
  {1.000, <1.000, 1.000, 1.000>, 0.000, 1.000}
}
```

```
#declare Var_entries = 8;
#declare A_Granite_var =
array [Var_entries][3] {
  {0.20, 0.50, 0.15},
  {0.25, 1.00, 0.16},
  {0.35, 1.00, 0.16},
  {0.40, 0.50, 0.15},
  {0.60, 1.00, 0.15},
  {0.65, 0.50, 0.16},
  {0.75, 1.00, 0.16},
  {0.80, 0.50, 0.15}
}
```

```
#declare Translucency =
<0.486, 0.529, 0.557>*0.8
```