Supplement 1 - image documentation

Transition from Stratigraphic to Disturbed ice

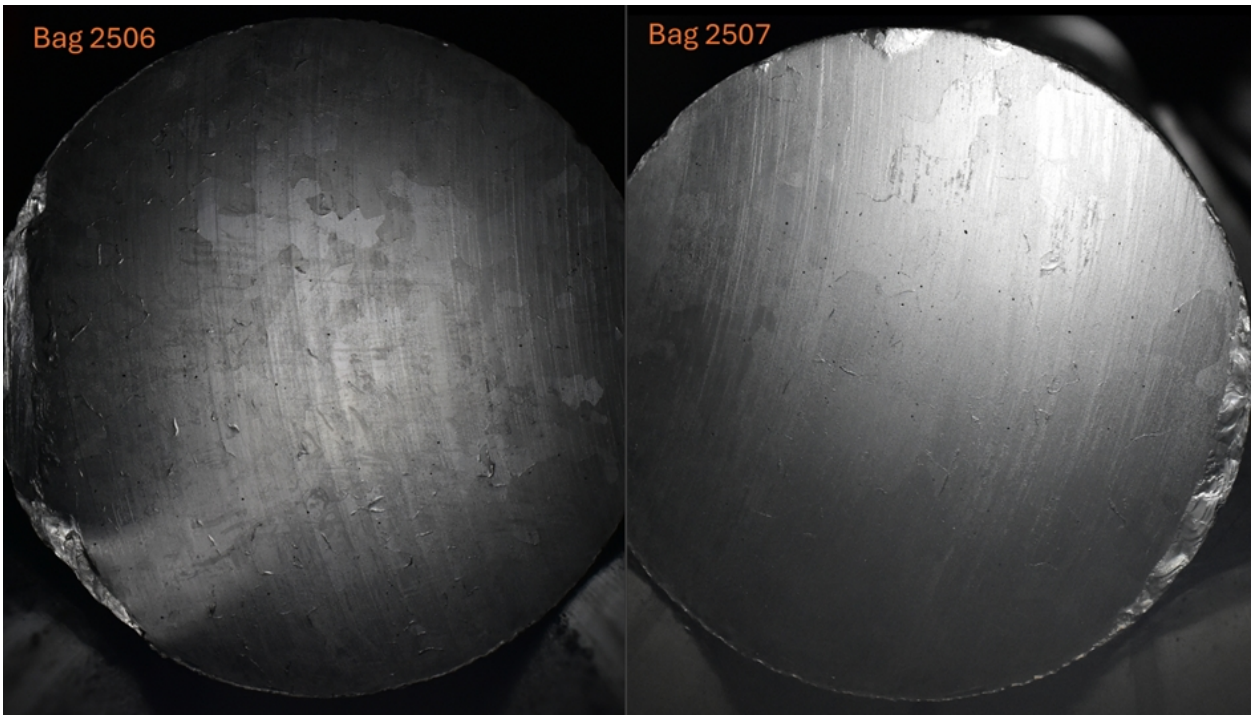


Figure S1_1: change of crystal boundaries. The ratio boundary to crystal area (or perimeter) decreases and crystals appear more rounded. Bag 2506 to 2507 marks the transition into the disturbed ice zone.

Crystal size from ice drill surface cuttings

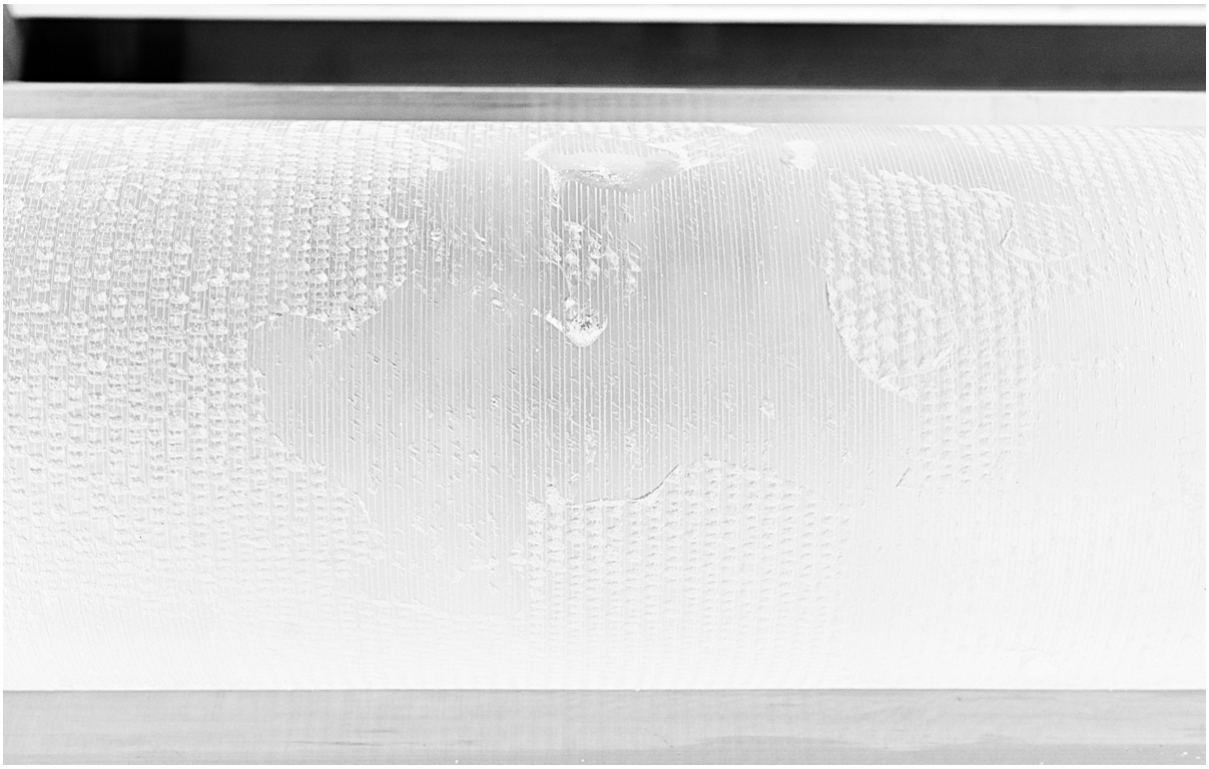


Figure S1_2: Bag 2586 shows characteristic cutter marks on the core surface caused by variable crystal orientation. The core diameter is 98 mm; the image width is ~200 mm.

Aggregates similar to the ones from the Dome C core

Figure S1_3: Aggregates similar to the ones from the Dome C core. Scale on the picture to the right.

Figure S1_4: Run #891, corresponds to bag 2796-D. Fig. 3, orange star - Sand and gravel.

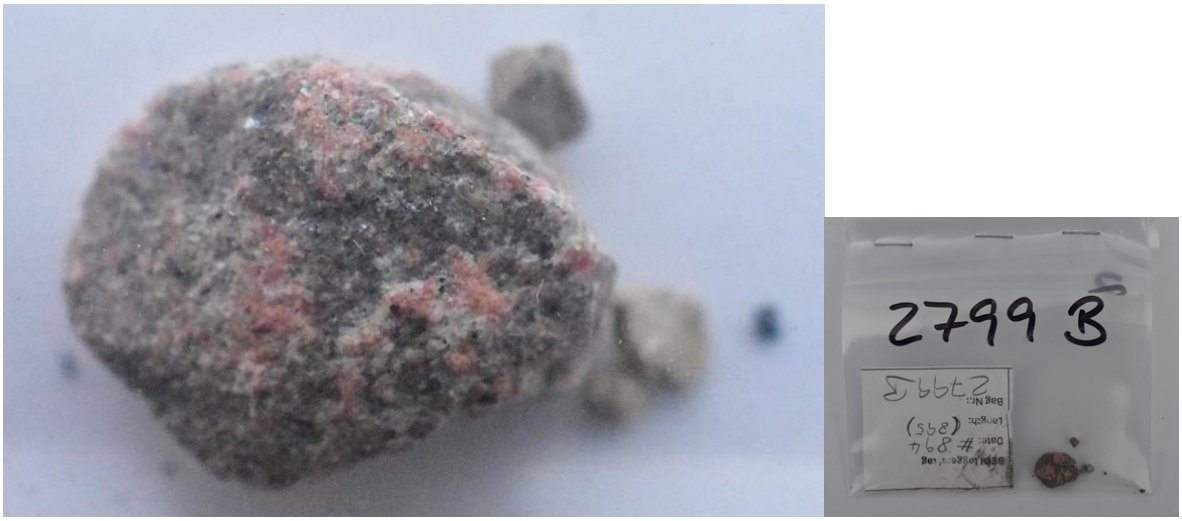


Figure S1_5: Run #895, bag 2799-B. Fig. 3, orange star - Granitic pebble of almost 2 cm diameter.

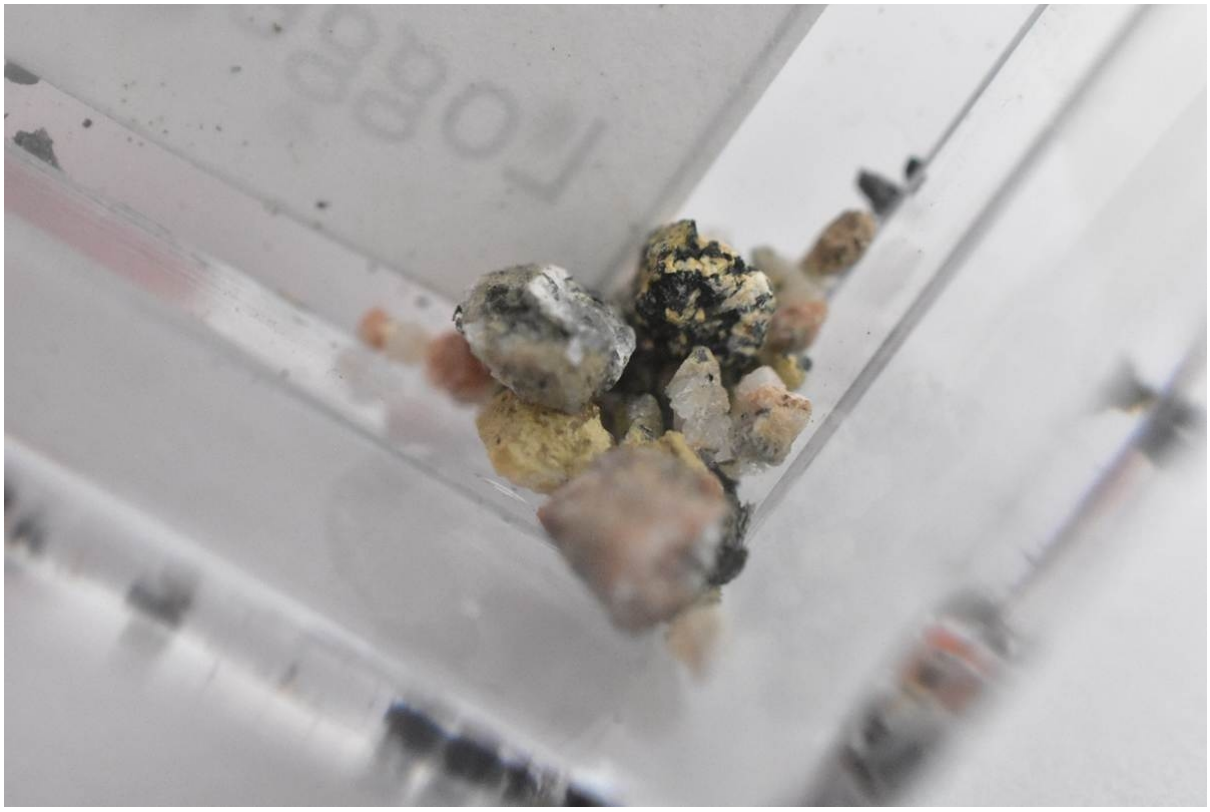


Figure S1_6: Run #896, corresponds to bag 2799-C and 2799-D. Fig. 3, orange star - Fine gravel.

Figure S1_7: Run #901 and #902, bag 2799-D, no core run. 79 cm above bedrock. Depth 2799.04m. Fig. 3, orange star - sand.

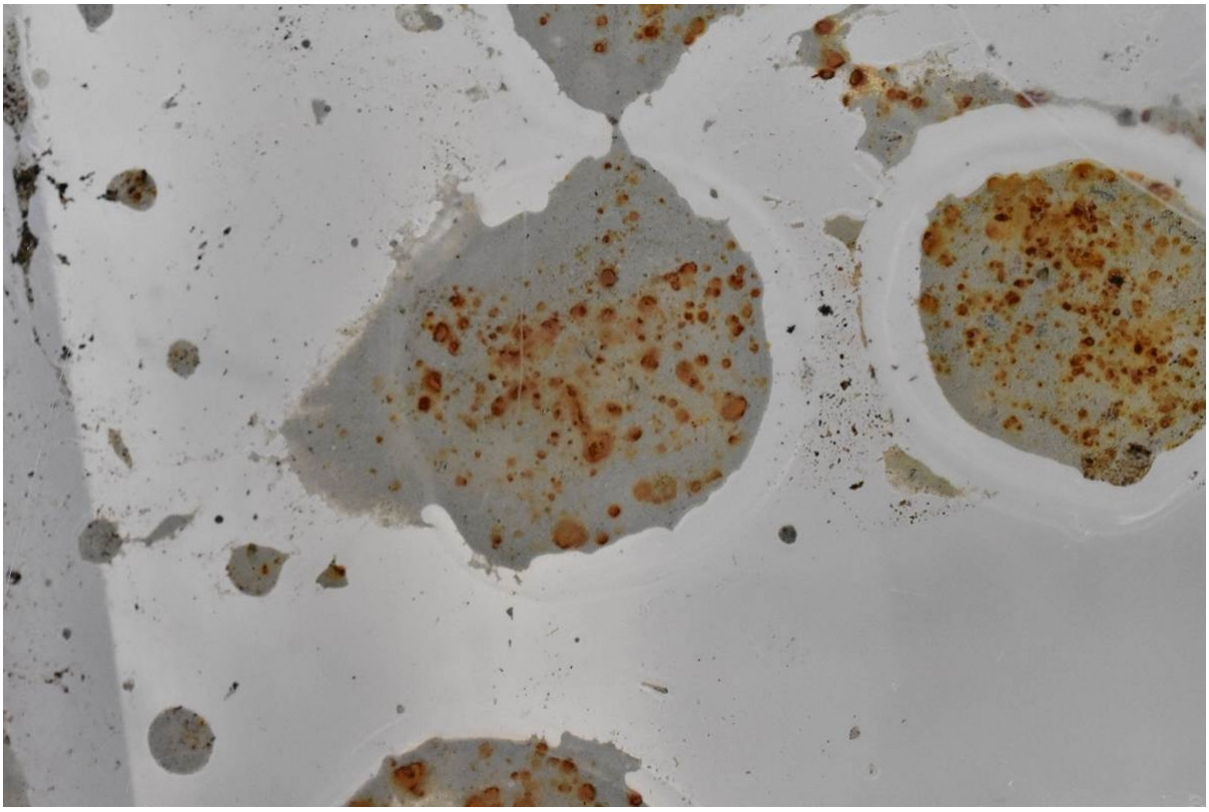


Figure S1_8: Run #905, depth 2799.85m. Material from the bottom of the ice sheet, no core run.

Initial rock identification by visual inspection

Figure S1_9: Rocks collected from various depths of the debris-rich ice zone. High resolution image used for initial analysis of subglacial lithology. Red boxes are of typical granite composition, blue K-feldspar rich or pure feldspar, pyroxene, mica, and green samples with over 50% quartz.

Text and additional inspection by: https://mycleverai.com/rock-identifier

This revealed the same results as inspection by eye.

Based on the visual characteristics, these appear to be fragments of **granite**. Granite is a common **igneous rock** composed primarily of the minerals **quartz**, **feldspar** (specifically potassium feldspar and plagioclase feldspar), and **mica** (biotite and/or muscovite). The individual grains visible in the samples suggest this phaneritic texture, where the crystals are large enough to be seen with the naked eye. The speckled appearance with varying colours (grey, white, black, and some hints of pink or reddish hues which could indicate the presence of potassium feldspar) is characteristic of granite.

Figure S1_10: From figure S5, labelled as "sample 0".

Based on the image, the rock appears to be a type of **granite**. Specifically, the pinkish mineral within the granite is likely **orthoclase feldspar**. The darker mineral is likely **biotite mica** or **hornblende**, and the lighter, granular mineral is likely **quartz**.

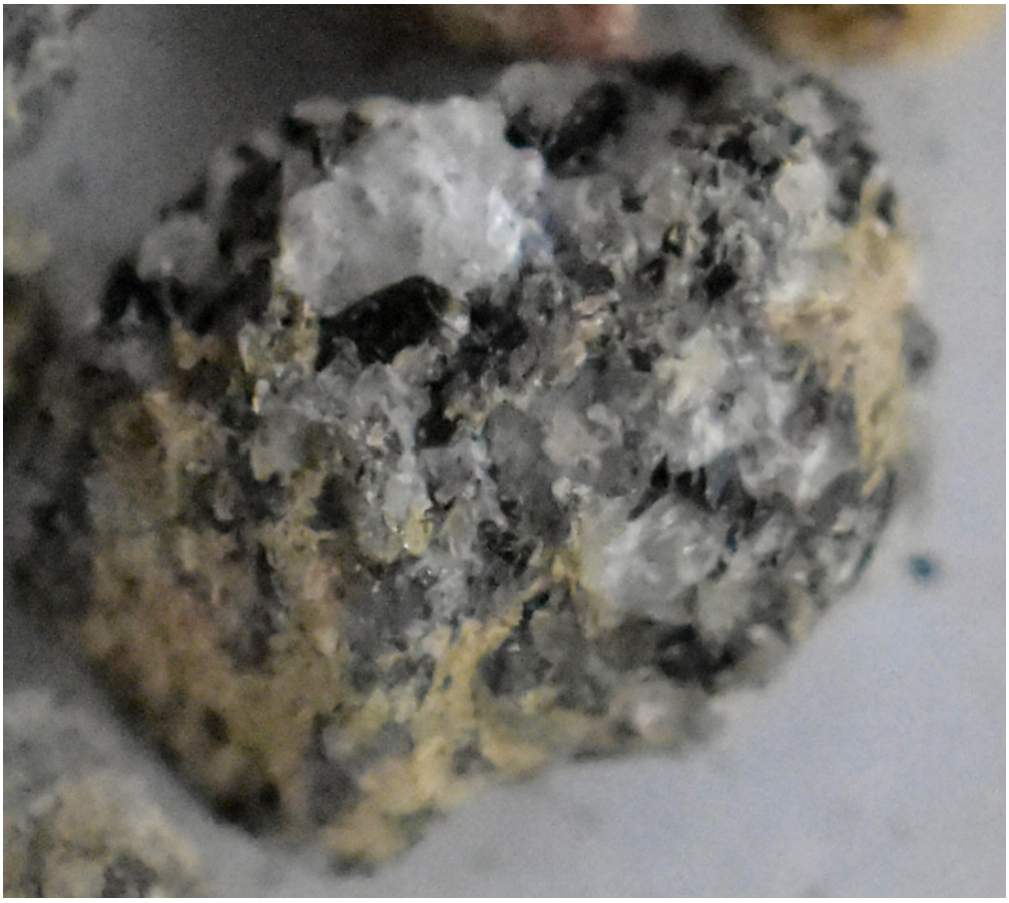


Figure S1_11: Labelled “1” in figure S9.

Based on the visual characteristics, this appears to be a **granitic rock** or **granite**.

The texture suggests an aggregate of interlocking mineral crystals. The visible minerals appear to be:

- **Feldspar**: Likely some form of plagioclase and/or alkali feldspar, contributing to the lighter, often somewhat opaque or translucent crystalline areas. The yellowish patches could also be weathered feldspar.
- **Quartz**: The glassy, clear to translucent, irregular grains are likely quartz.
- **Mica**: Darker, flaky minerals, possibly biotite, are visible as darker specks within the rock.

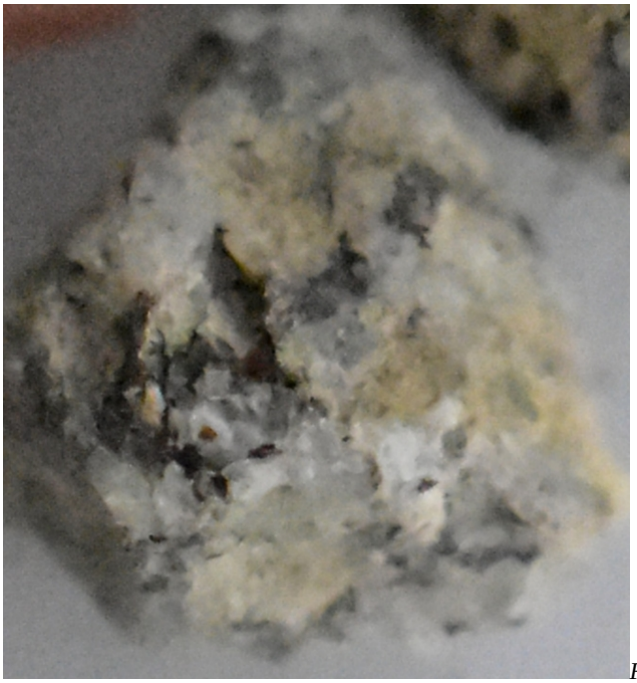


Figure S1_12: Labelled "2" in figure S9

Based on the image, this rock appears to be **granite**. It displays a coarse-grained, interlocking texture with visible crystals of different minerals. The predominant colours suggest the presence of:

- **Feldspar** (likely potassium feldspar and plagioclase feldspar), which would contribute to the white and sometimes pinkish-yellowish hues.
- **Quartz**, which would typically appear as glassy or milky white crystals.
- **Mica** (like biotite or muscovite), which would form the darker, flaky or granular specks.

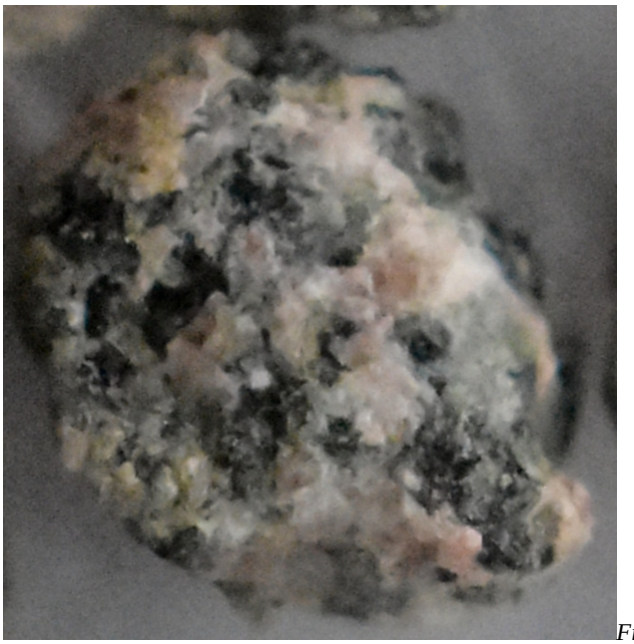


Figure S1_13: Labelled "3" in figure S9

Based on the visual evidence, this appears to be a rock with a granular texture, composed of several distinct minerals. The prominent colours are white, pinkish-tan, and dark gray/black.

The white mineral is likely **feldspar**, possibly orthoclase or plagioclase. The pinkish-tan mineral could also be a variety of **feldspar**, such as microcline or perthite. The dark gray/black mineral is likely **biotite mica** or **hornblende**, common mafic minerals found in igneous rocks.

Considering the combination of these minerals, the rock is likely a **granite**. Within granite, the specific minerals can vary, but the overall appearance strongly suggests this igneous rock type.

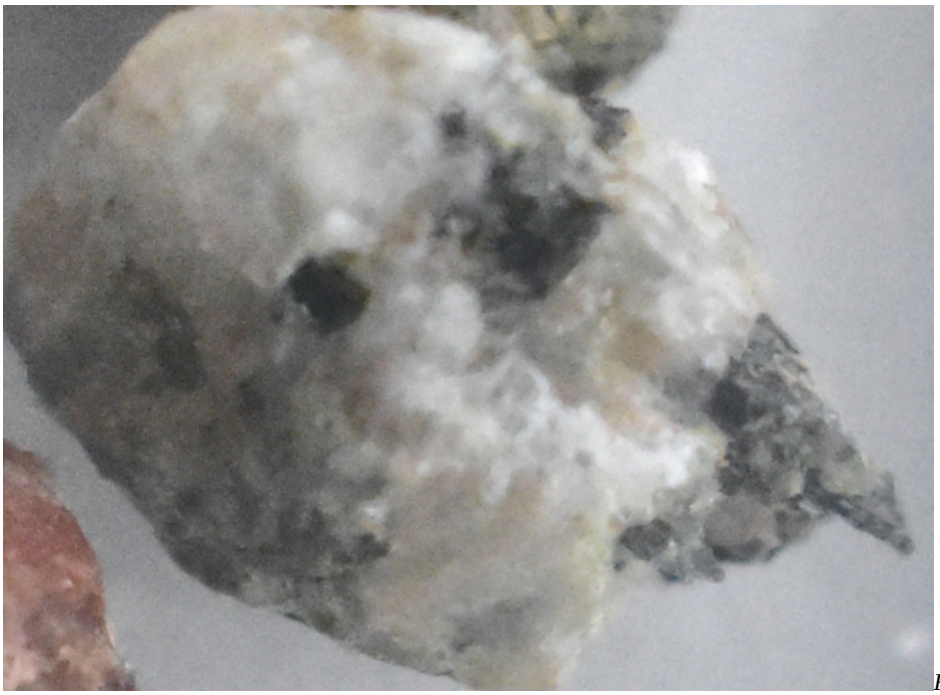


Figure S1_14: Labelled "4" in figure S9

Based on the image, this appears to be a **feldspar** mineral, likely **plagioclase**, as part of a **granitic rock**.

The lighter, dominant mineral with a somewhat dull luster is characteristic of feldspar. The darker, granular areas could be other minerals commonly found in granite, such as **quartz** or **mica**, and the scattered dark specks might be **biotite** mica or other mafic minerals. Without further information or clearer detail on crystal structure, specific identification beyond plagioclase feldspar within a granitic context is difficult.

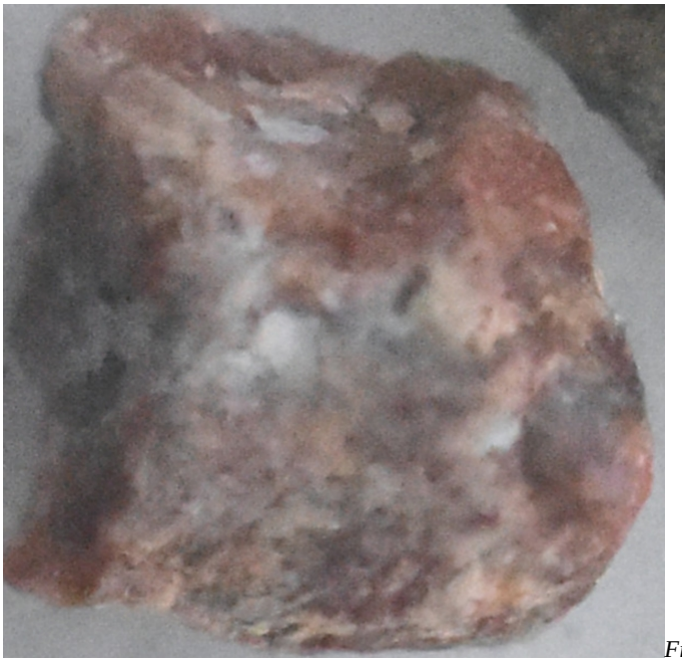


Figure S1_15: Labelled “5” in figure S9

Based on the visual characteristics in the provided images, this appears to be a sample of **granite**.

Granite is an igneous rock composed primarily of quartz, feldspar, and mica. The colouring in the image, with its pinkish-brown and white components, is consistent with the typical appearance of granite where the feldspar and quartz are dominant.

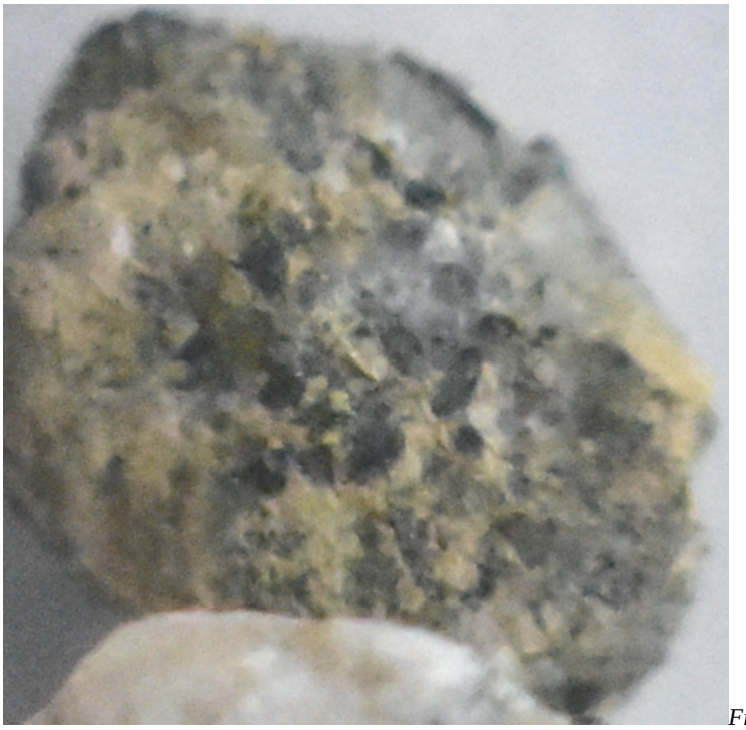


Figure S1_16: Labelled “6” in figure S9

Based on the provided image, it is difficult to definitively identify the specific mineral species due to the low resolution and lack of detail. However, the rock appears to be an aggregate of various minerals. The greenish-yellowish hues combined with darker gray or black inclusions suggest a

composition that could include minerals like epidote, chlorite, or perhaps some amphibole group minerals. The lighter matrix might be quartz or feldspar.

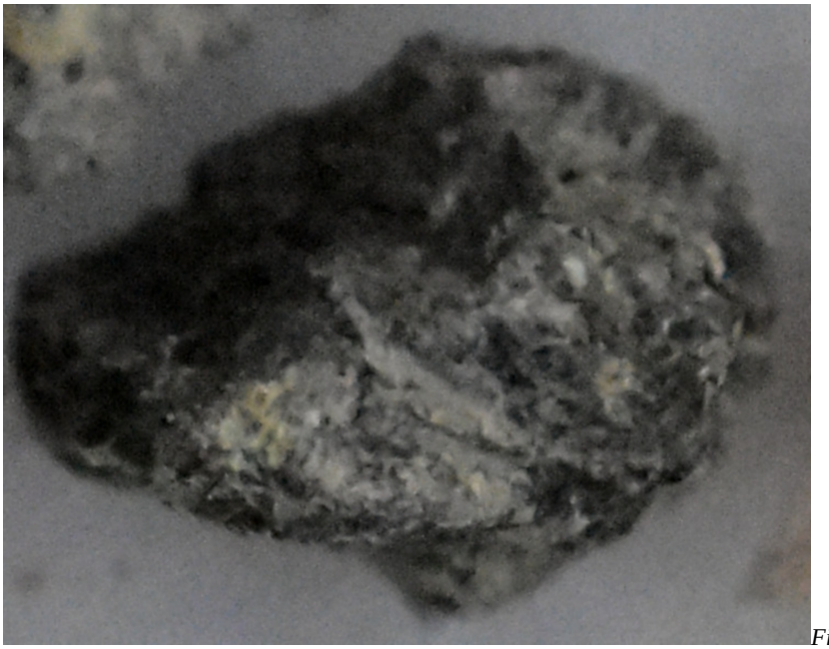


Figure S1_17: Labelled "7" in figure S9

Based on the image, it appears to be a piece of **basalt**.

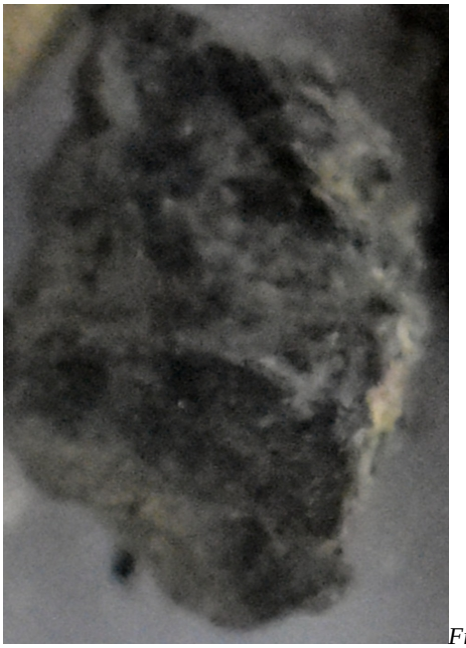
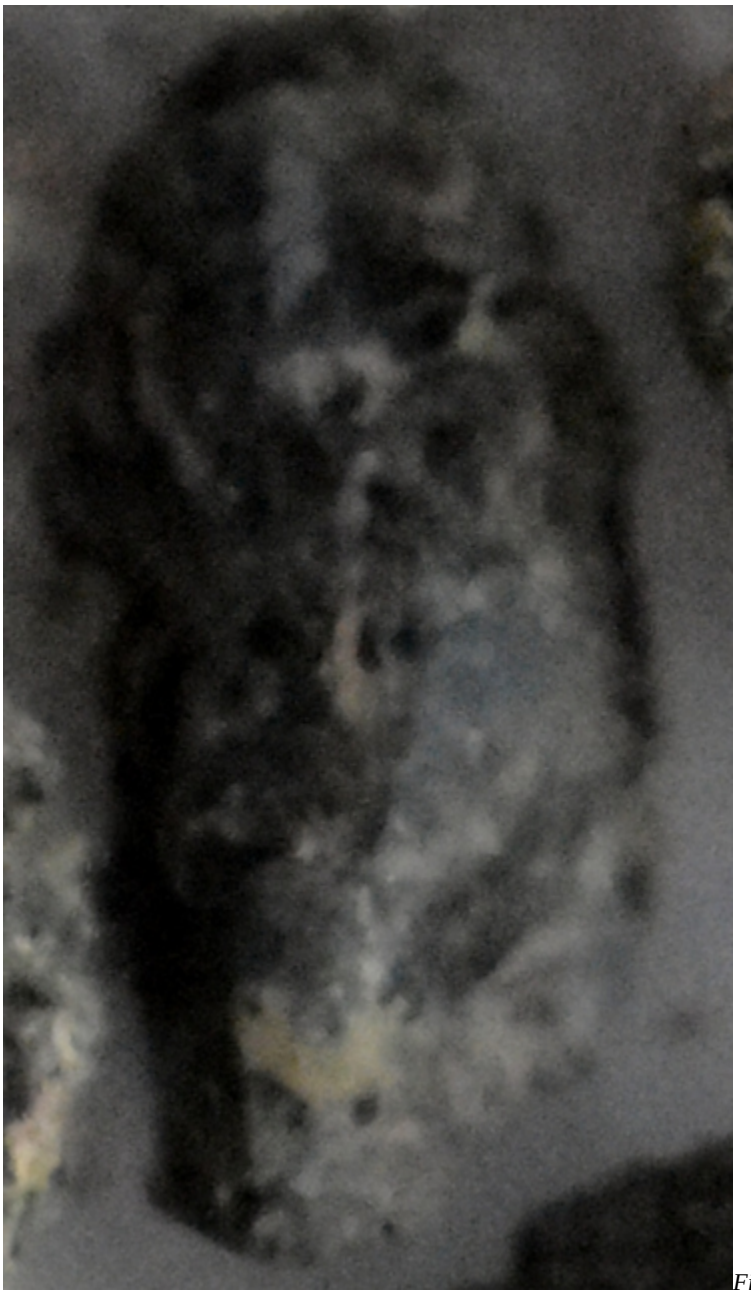


Figure S1_18: Labelled "8" in figure S9

Based on the visual information, it is difficult to definitively identify the rock or mineral. The image is blurry and lacks clear crystalline structures or distinct colour variations that would allow for precise identification.

644 However, the general appearance suggests it could be a **rock** composed of various minerals,
645 possibly **igneous or metamorphic** in origin, given the somewhat granular and variegated texture.
646 It's hard to identify a specific mineral species from this image alone.

647



648 *Figure S1_19: Labelled “9” in figure S9*

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Figure S1_20: Labelled "10" in figure S9

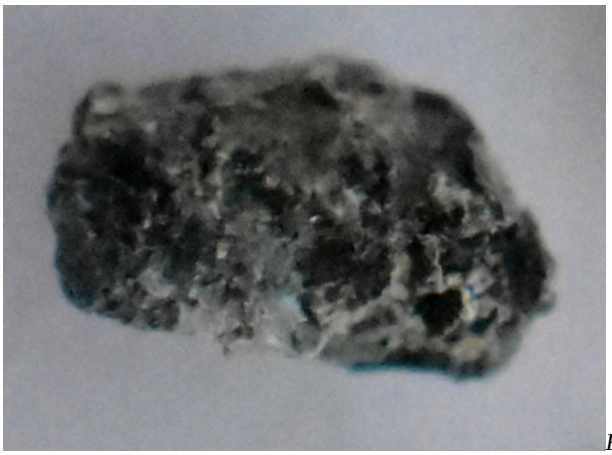

Figure S1_21: Labelled "11" in figure S9

Based on the visual characteristics, this appears to be a fragment of a **chondrite meteorite**, likely a **carbonaceous chondrite**.

Figure S1_22: Sample from figure S6

*Based on the appearance in the image, the mineral is likely **Quartz**.*

Specifically, it appears to be **Milky Quartz**. Milky quartz is the most common variety of quartz, characterised by its white, cloudy, or milky appearance. This cloudiness is often due to the presence of microscopic inclusions of gas, liquid, or other minerals trapped within the crystal structure during its formation. The overall translucent to opaque nature and the crystalline form visible in the image are consistent with milky quartz.

Figure S1_23: Sample from figure S6

Based on the image, this appears to be a fragment of a rock, likely igneous, with visible crystals of different minerals. The speckled appearance with dark, light, and yellowish components suggests it could be a granite or a similar feldspar-rich rock containing mafic minerals.

Without further testing or a clearer view of crystal habits, it's difficult to pinpoint a specific mineral species with absolute certainty. However, the light-coloured mineral is likely a **Feldspar**, possibly **Orthoclase** or **Plagioclase** due to its common occurrence in such rocks. The dark mineral could be **Biotite** (a dark mica) or **Amphibole** (like hornblende). The yellowish tint might indicate some weathering or a specific composition within the feldspar group, perhaps involving potassium feldspar with some staining.