

Mount St Helens Volcanic Ash

By David Guarente and Dr. Eriks M Puris

Overview:

To see if the samples of volcanic ash recovered from Mt. St. Helens immediately after the blast give some definitive clues as to how the quality of the different ash samples compare based on certain determined criteria.

Purpose/ Goal:

To determine if the grain size, surface texture, and distance of ash found from the volcanic explosion site at Mount St. Helens, has a correlation in creating the conditions necessary to the evolution of a planet and its ability to generate new life.

Samples Used:

These 21 plus samples have been compiled in the PCC Sylvania SEM lab from previously collected samples out in the field after the 1980 Mt. St. Helens volcanic eruptions. Also, two wet samples from previous ash used at two separate distances.

Research Question:

“Can it be determined that different types of ash recovered, sampled and analyzed can affect different areas in the production of life-giving nutrients, based on the distance away from the Mount St. Helens volcano that each has been deposited?”

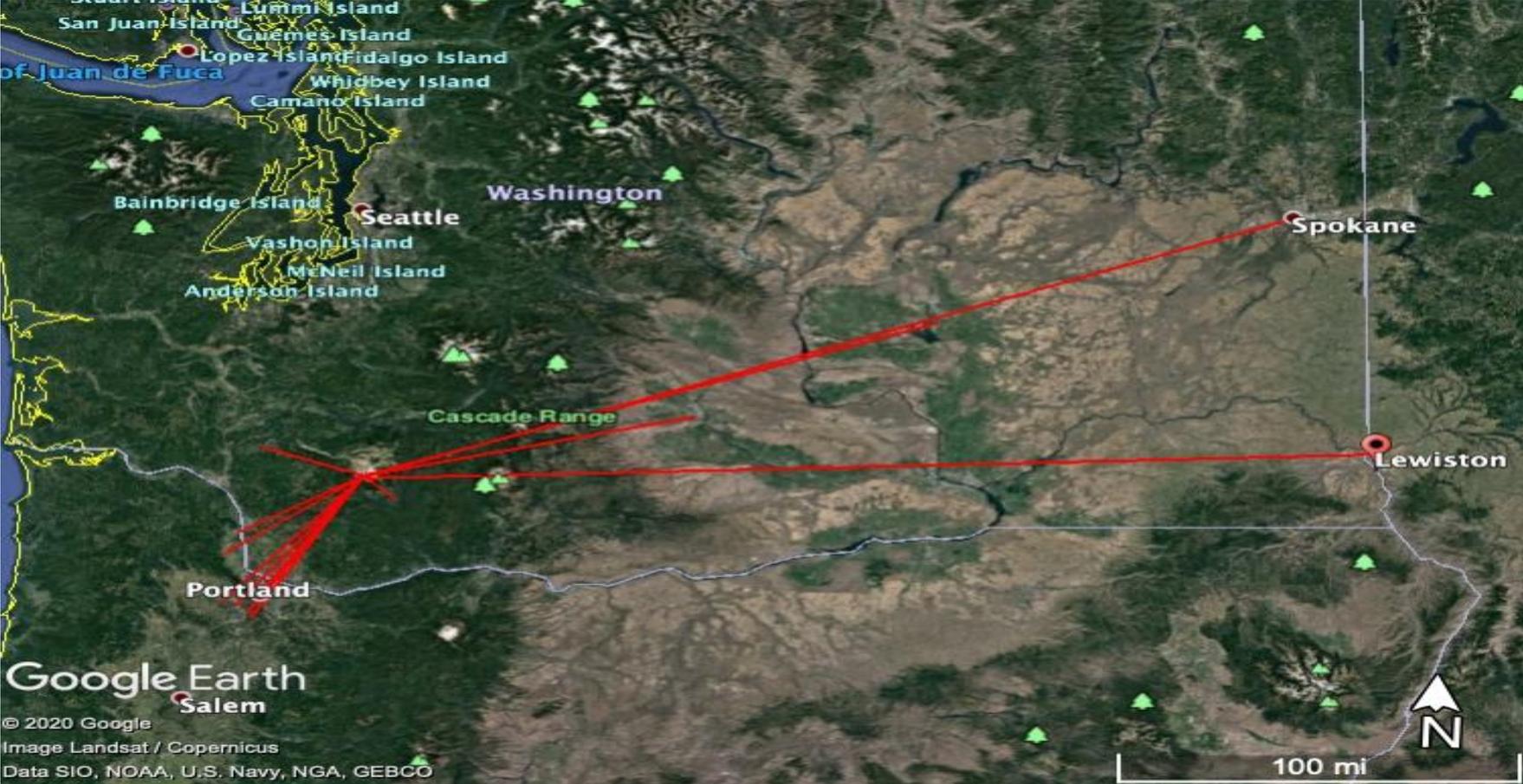
Analysis Categories:

This analysis also includes quantity, differences in chemical composition, texture, grain size, as well as in thickness, mass, volume, based on the aerial distribution.

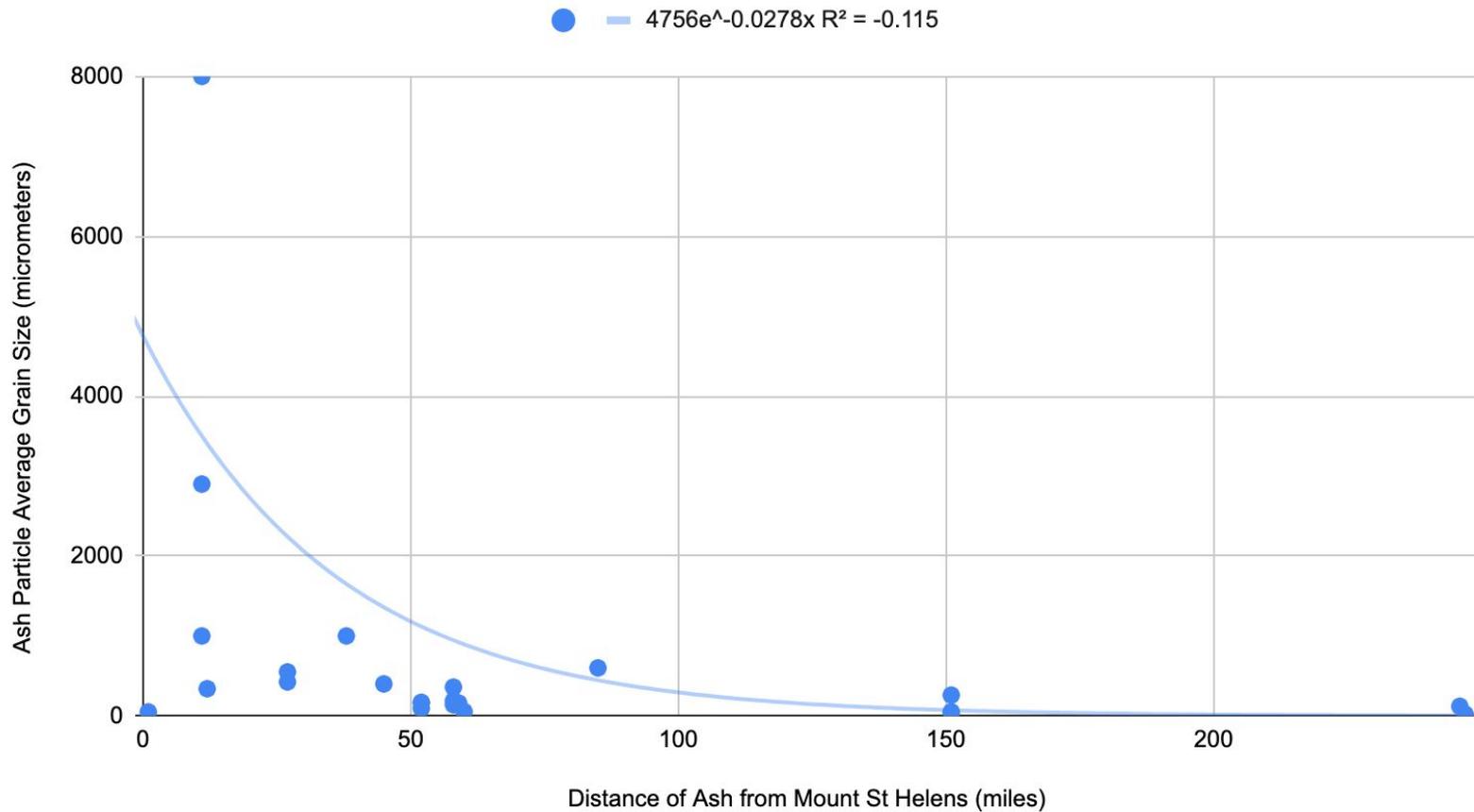
Mount St Helens Landsat Infrared Image



Map of the Volcanic Ash Locations



Distance from Mount St Helens vs Ash Particle Average Grain Size



Grain Samples Size Variations (by Distance)

1 mile- 1 mile west of the base of the Mount St Helens volcano {50 *um*}

11 miles- Cougar, WA {1000 *um*, 2,900 *um* (crystal-rich)}

27 miles- Toutle, WA {425 *um* (dry)/ 550 *um* (wet)}

Approx 55 miles- Metro Area in and around Portland, OR {170 *um*, 190 *um*, 95 *um*, 160 *um*, 54 *um*, 140 *um*, 360 *um*, 160 *um*}

85 miles- Yakima, WA {600 *um*}

153 miles- Moses Lake, WA {42 *um*, 51 *um* (dry)/ 260 *um* (wet)}

246 miles- Spokane, WA/ Lewiston, ID {120 *um*/ 22 *um*}

Table 1: GRAIN SAMPLES SIZE VARIATIONS (BY DISTANCE):

Distance from source	Location	Grain size	Grain Sorting	Grain type	Date	Sample #
1 mile	Base of Mount St. Helens, WA	50 μm	Mixed, poorly sorted	Fine, darker colored	4/12/1980	2
11 miles	Cougar, WA	2900 μm	Very large, mixed, poorly sorted	Small, coarse, dark and light intermixed	7/1981	19
27 miles	Toutle, WA	425 μm	Fairly well sorted	Slightly coarse and darker colored	7/2/1980	17
55 miles	Portland, OR	170 μm	Mixed, poorly sorted	Somewhat fine, powder, gray-colored	6/12/1980	4
85 miles	Yakima, WA	600 μm	Well sorted	Small coarse grains, sand-like	5/18/1980	11
153 miles	Moses Lake, WA	51 μm	Mixed, fairly well sorted	Fine powder, light-colored	5/18/1980	10
246 miles	Lewiston, ID	22 μm	Well sorted	Fine, light-colored	5/18/2980	45

Dry vs. Wet Ash Samples Comparisons

Sample 10- Moses Lake, WA (153 miles from volcano) Dry ash- 51 um vs. Wet ash- 260 um

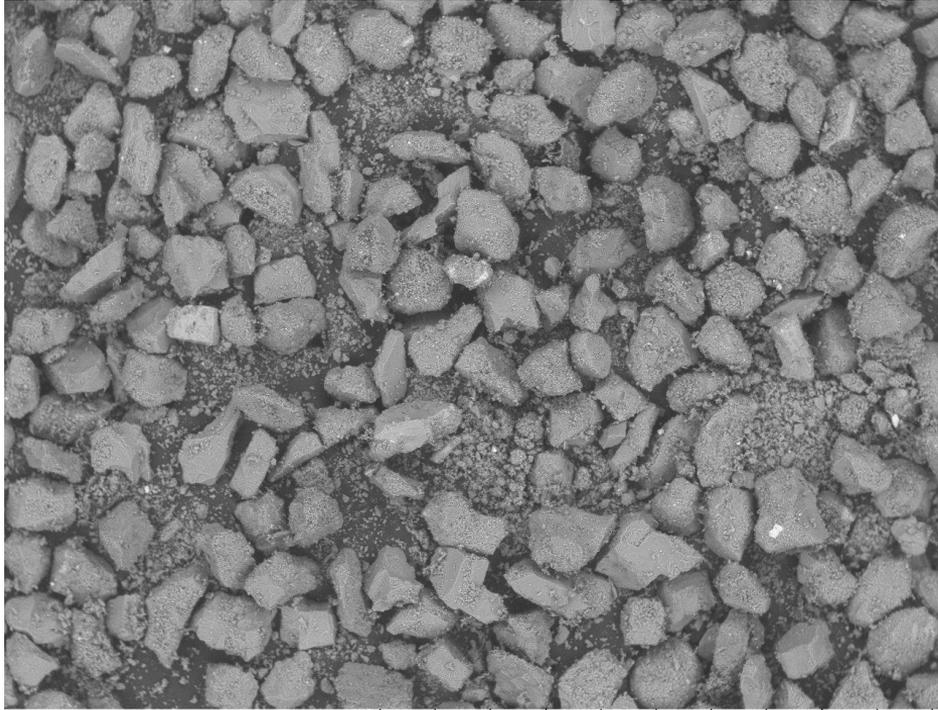
Sample 17- Toutle, WA (27 miles) Dry ash- 425 um vs. Wet ash- 550 um

In both cases, the size of the grains samples increased when exposed to water, regardless of distance. However, the finer-grained samples (at a larger distance) increased at a much greater rate when exposed to water than the larger, coarse-grained samples did.

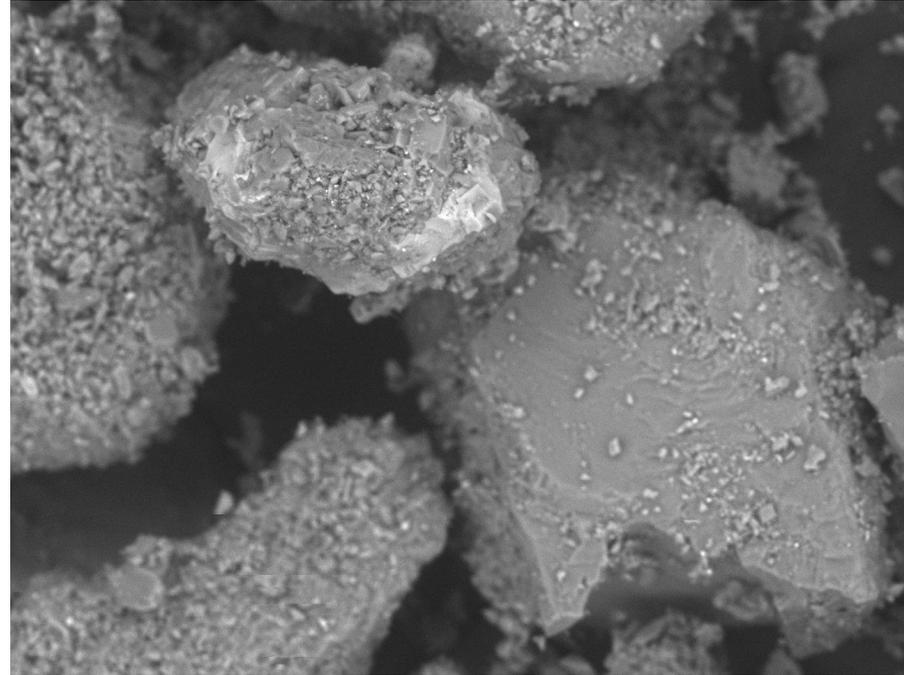
When the sample of ash had water added and analyzed again using the SEM, the fine ash had coagulated into larger grain sizes created a more cohesive group of combined ashes. This could serve as a foundation of nutrients for the enhancement of agriculture or the generation of life.

Sample 1- St Helens, OR

early April 1980

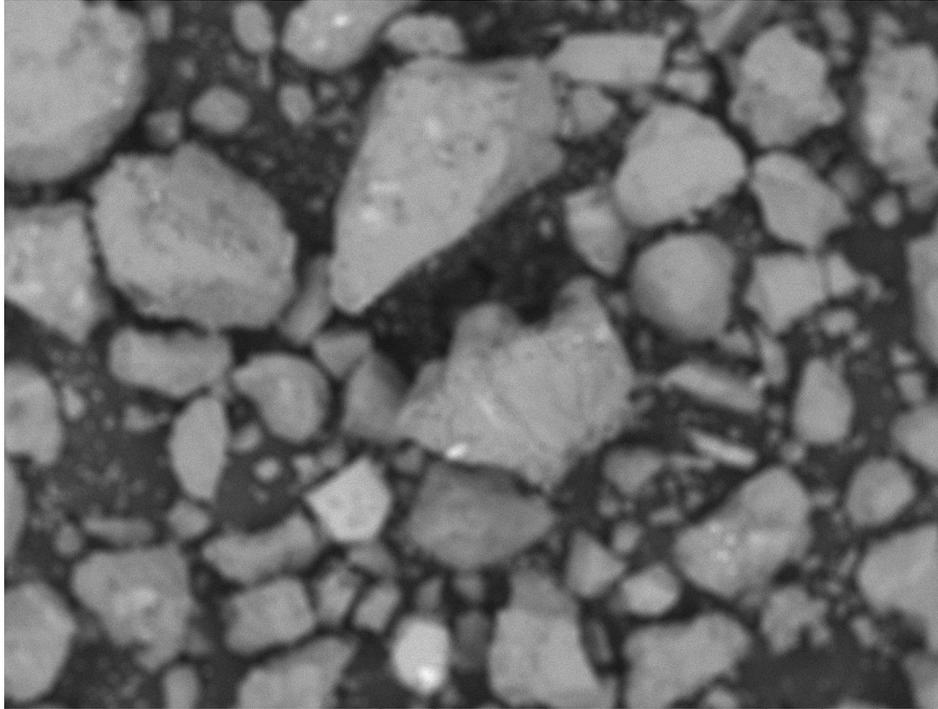


0549 2020/02/21 10:49 NL D4.5 x100 1 mm

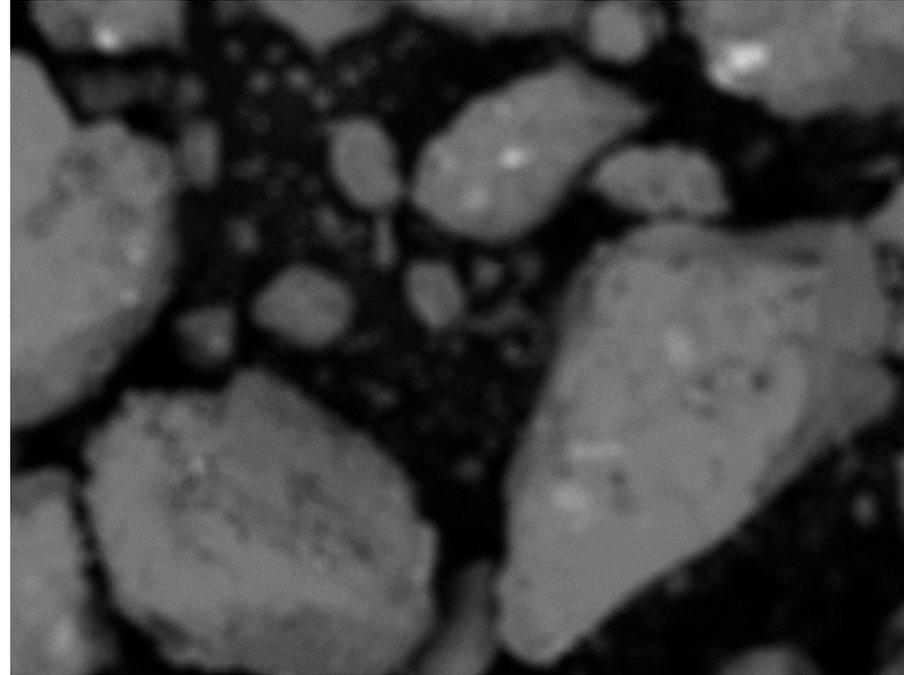


0550 2020/02/21 10:52 NL D4.5 x800 100 um

Sample 2- Mt St Helens volcano base 4/12/1980

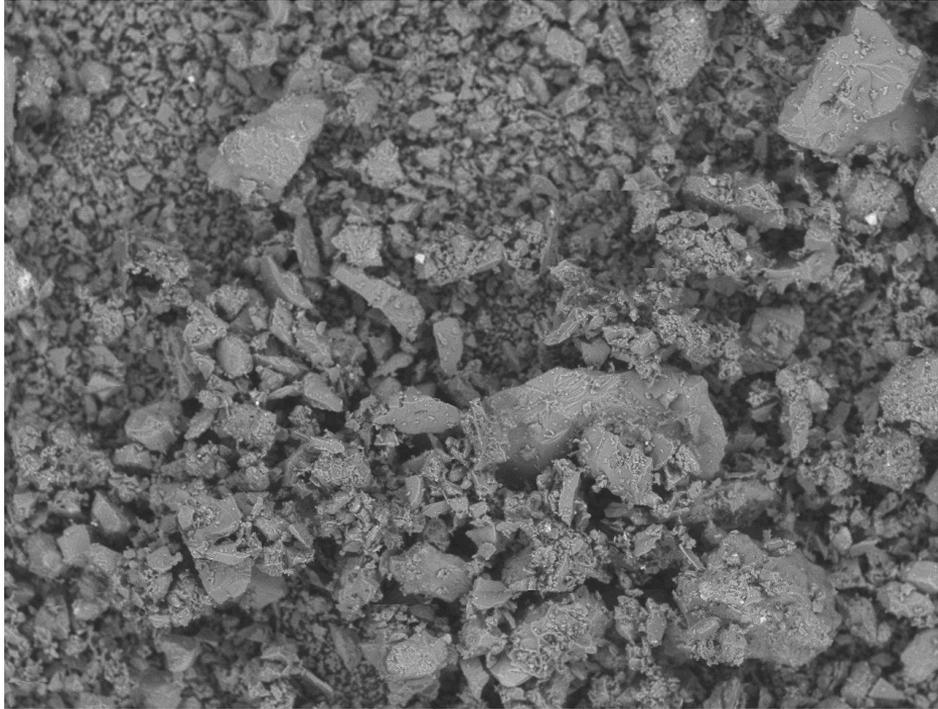


0551 2020/02/21 11:03 NL D3.6 x100 1 mm

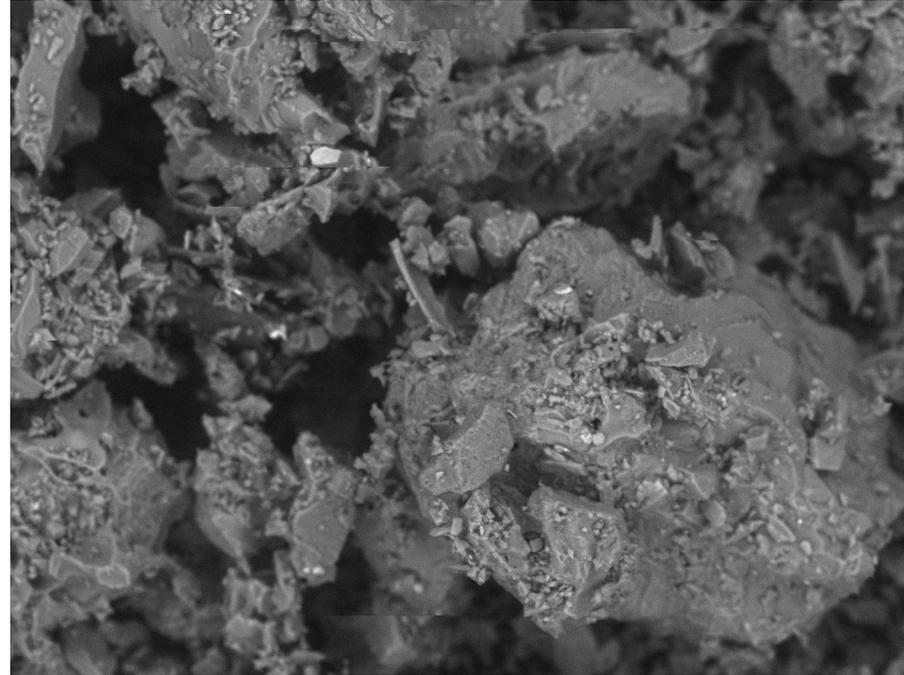


0552 2020/02/21 11:08 NL D3.7 x180 500 um

Sample 4- Portland, OR 6/12/1980

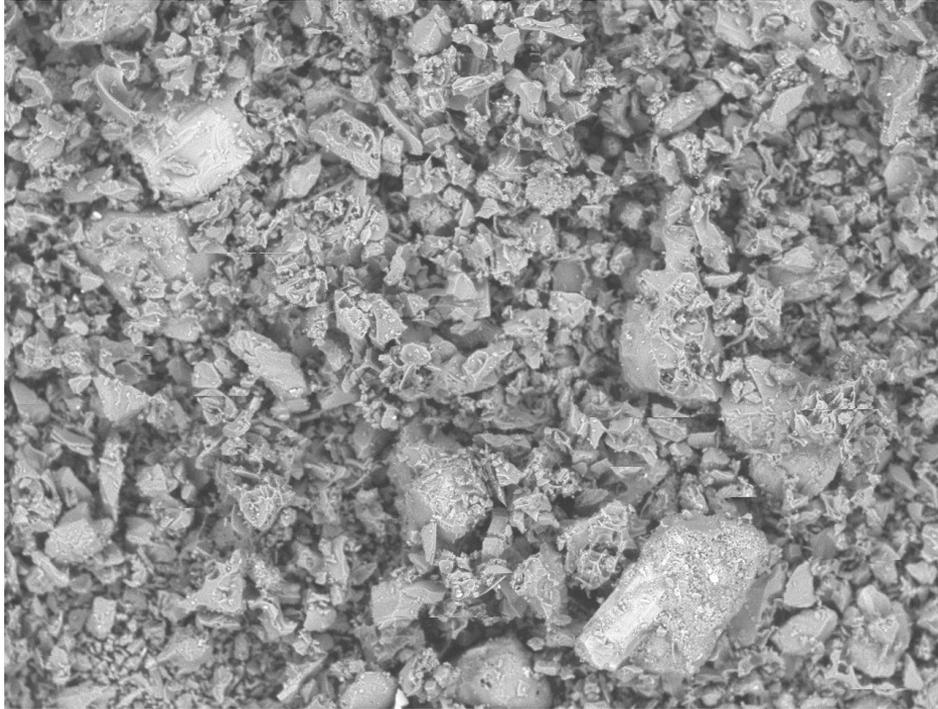


0553 2020/02/21 11:19 NL D4.9 x180 500 um



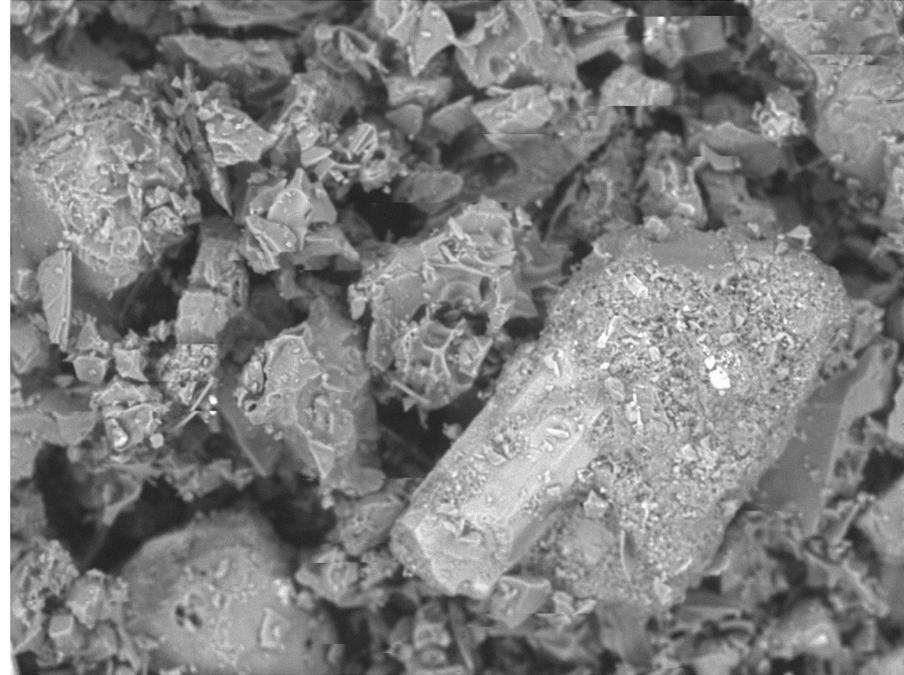
0554 2020/02/21 11:24 NL D4.9 x600 100 um

Sample 5- PCC Campus, Portland, OR 10/17/1980



0555

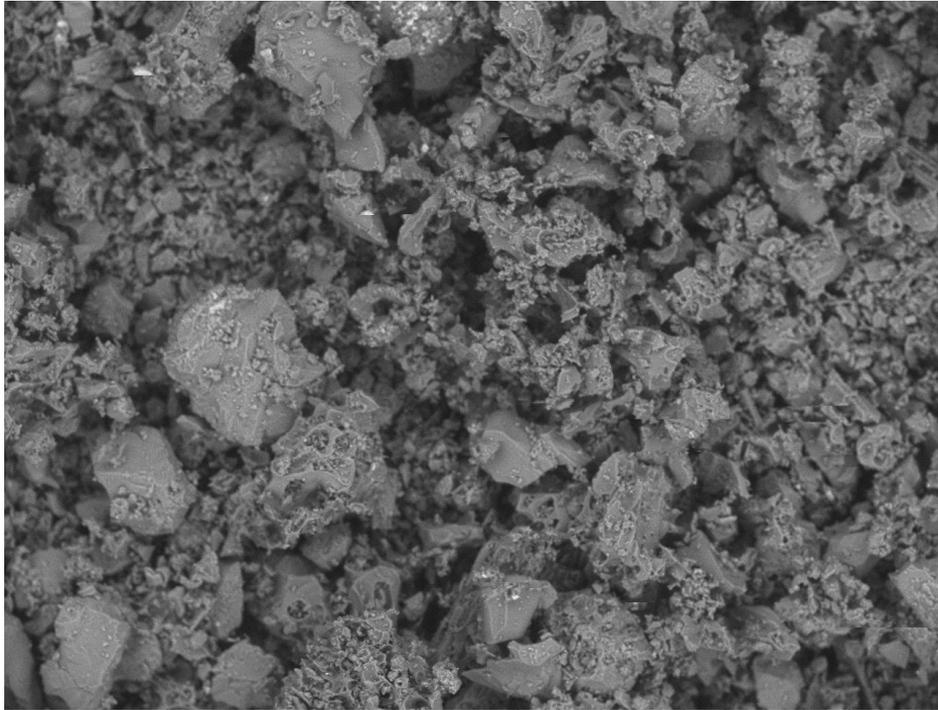
2020/02/21 11:34 NL D4.9 x200 500 um



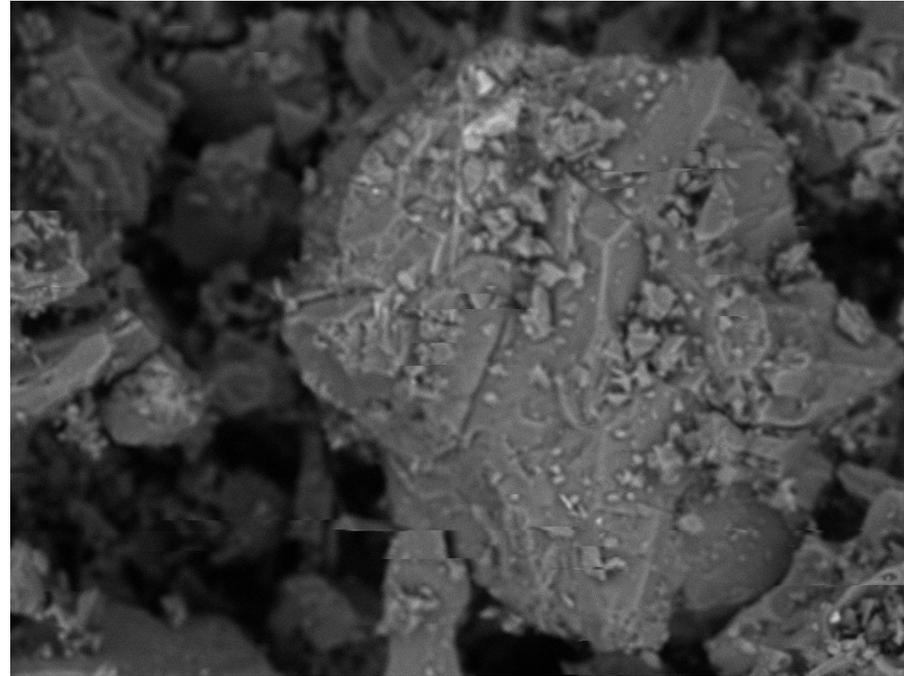
0556

2020/02/21 11:38 NL D4.9 x500 200 um

Sample 6- Spokane, WA 5/18/1980

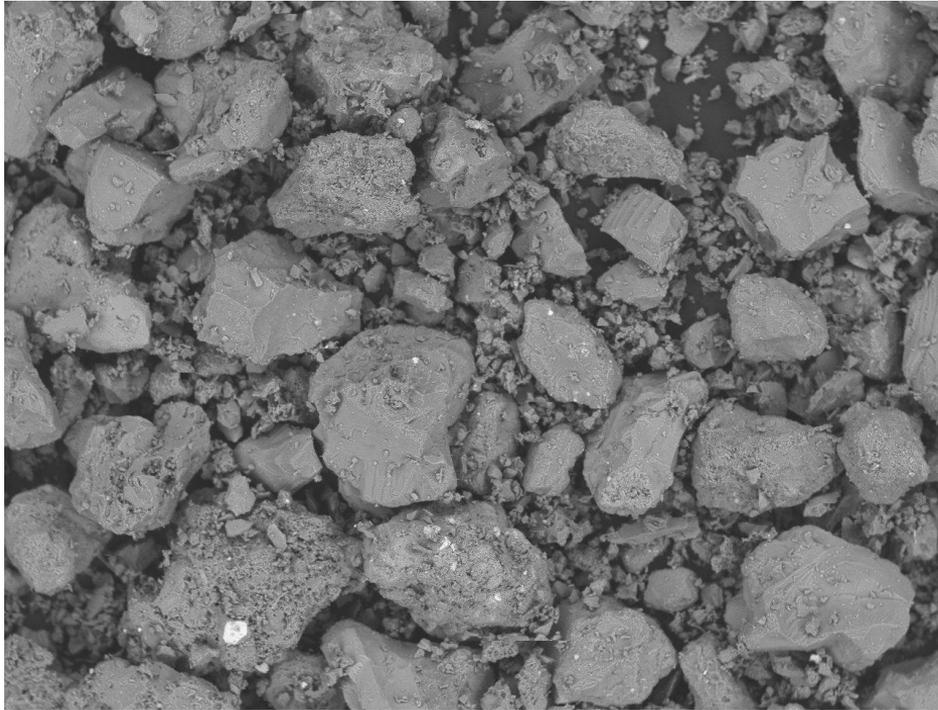


0557 2020/02/21 11:53 NL D5.0 x250 300 um

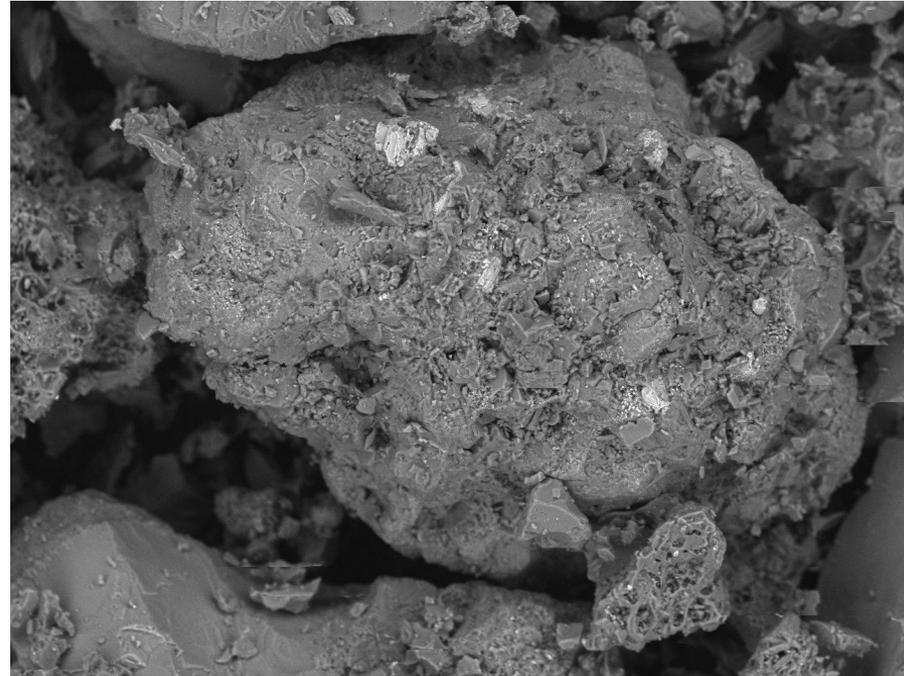


0558 2020/02/21 11:59 NL D5.0 x1.0k 100 um

Sample 8- Scappoose, OR 7/22/1980

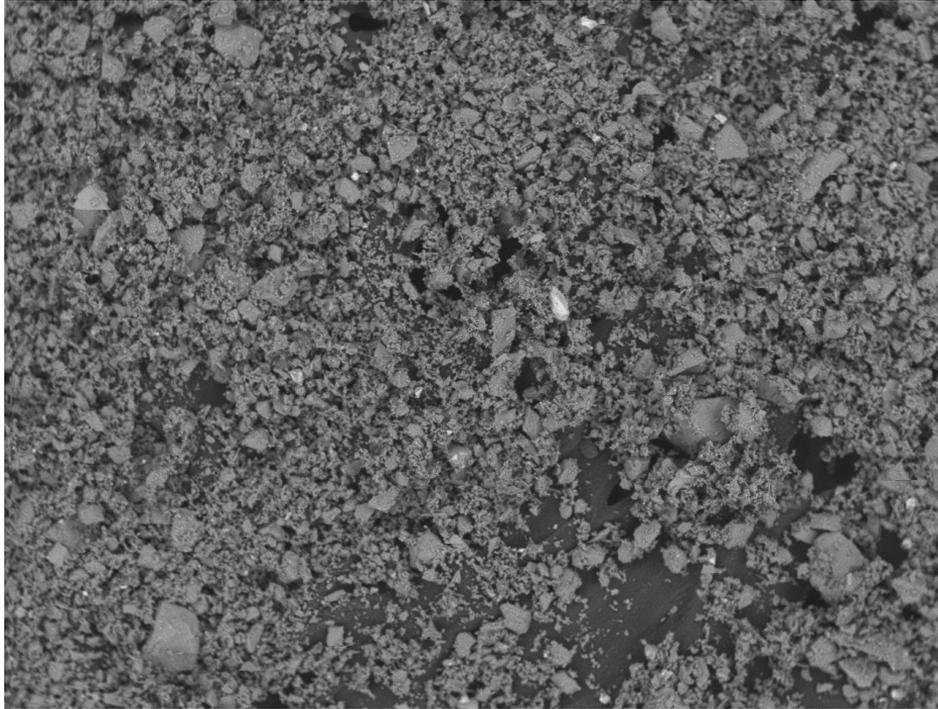


0509 2020/01/31 09:52 N D4.3 x100 1 mm

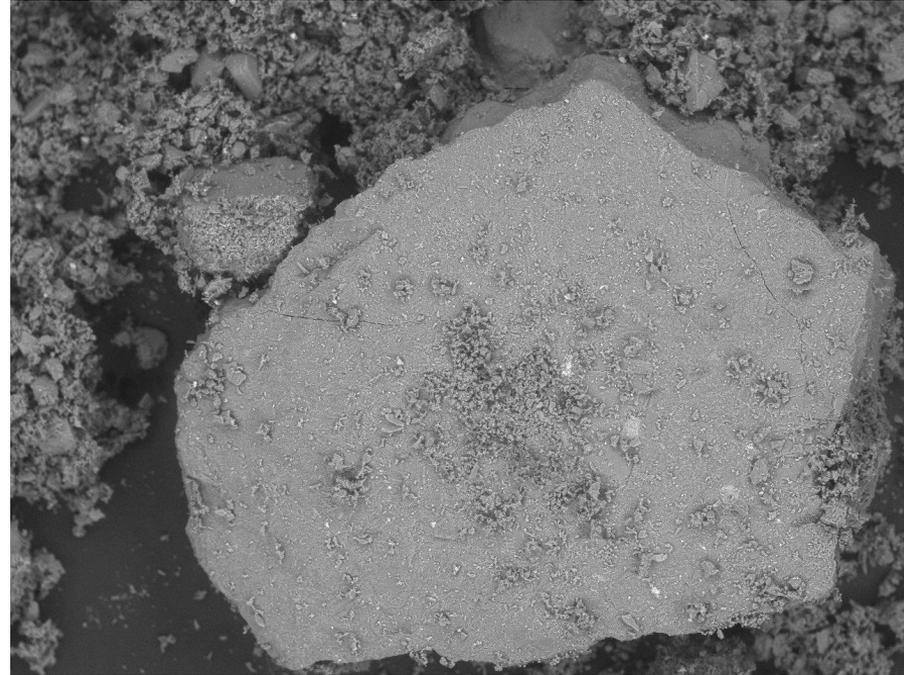


0510 2020/01/31 10:02 N D4.3 x400 200 um

Sample 9- Cougar, WA July 1981 (Vitreous Ash)

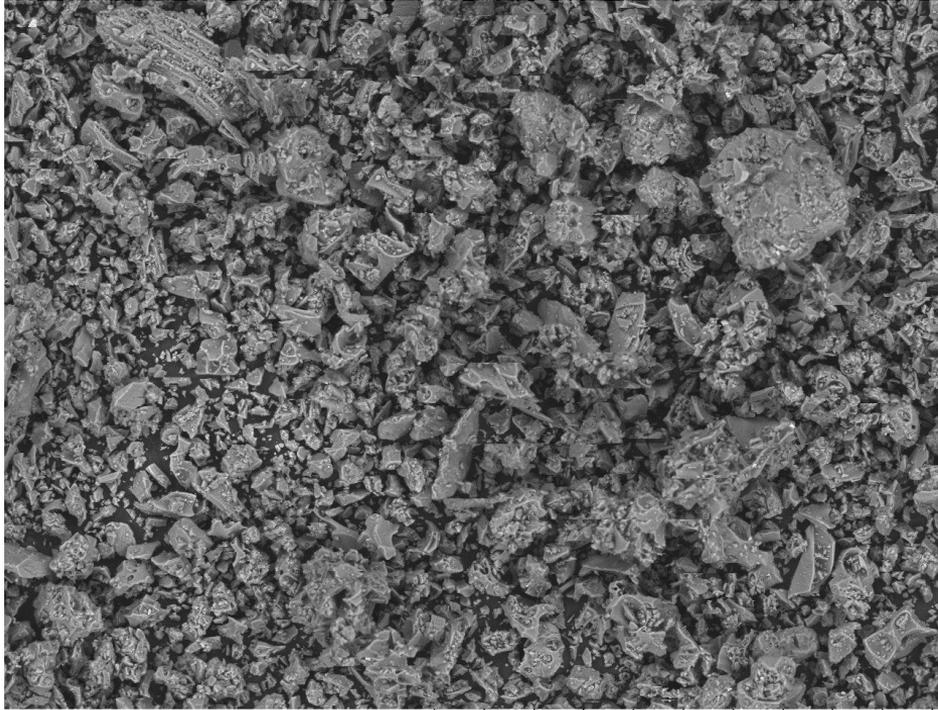


0511 2020/01/31 10:17 N D4.3 x100 1 mm

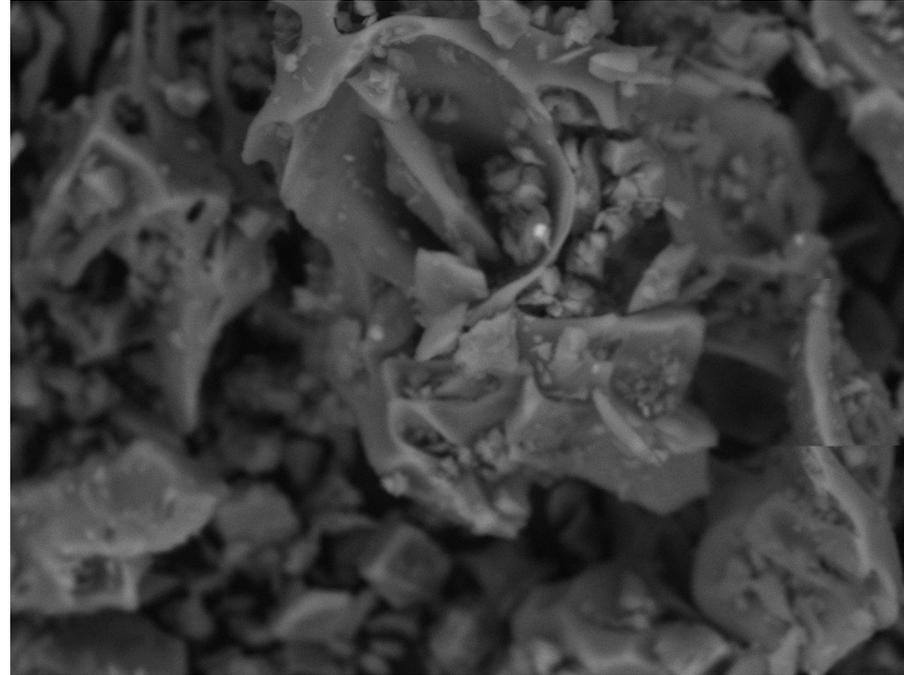


0560 2020/02/21 12:18 NL D4.9 x150 500 um

Sample 10- Moses Lake, WA 5/18/1980

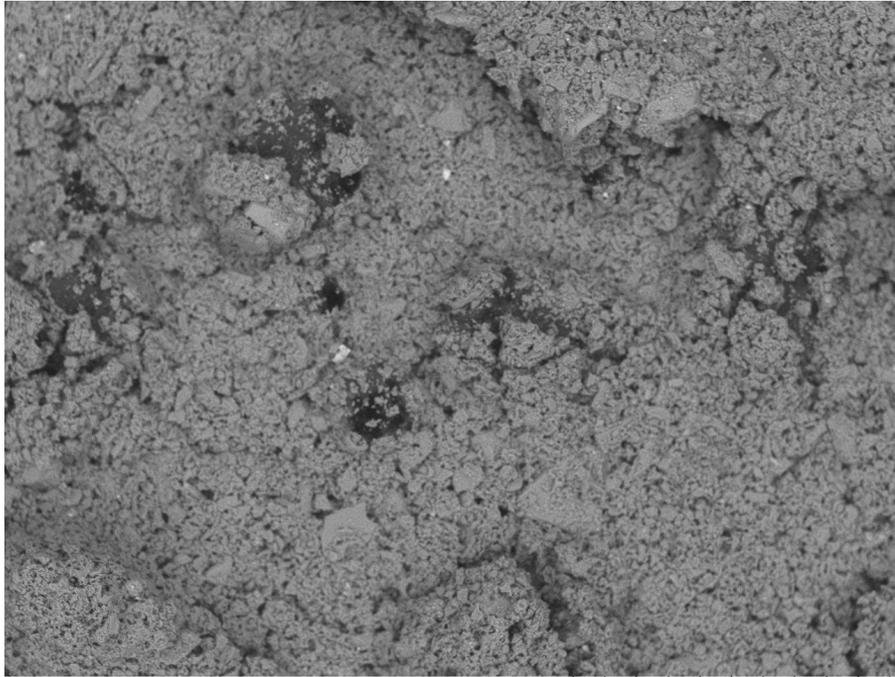


0513 2020/01/31 10:37 N D4.2 x300 300 um

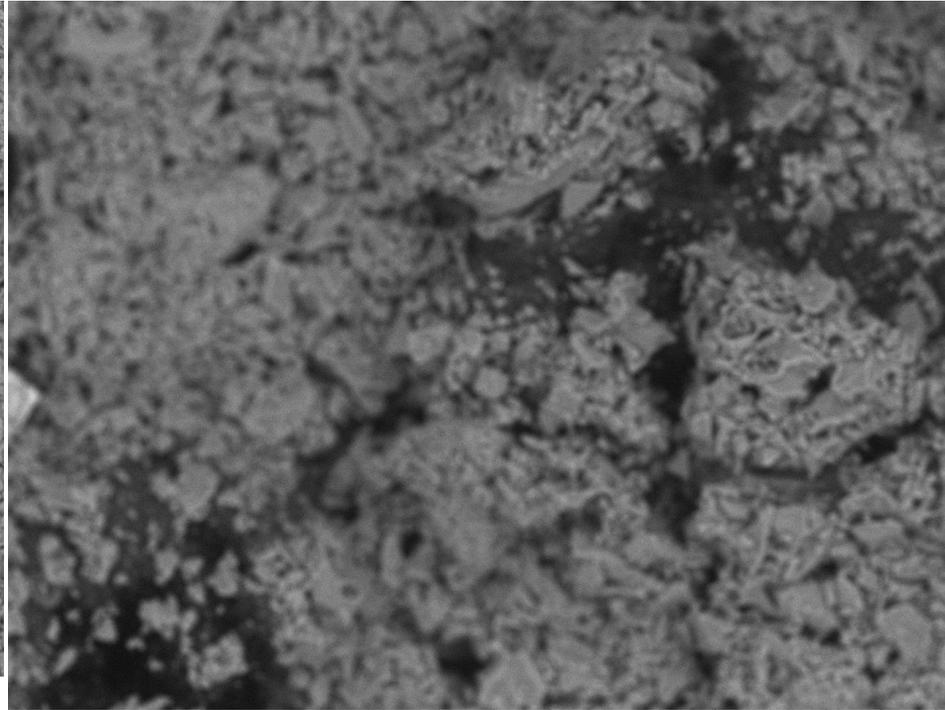


0514 2020/01/31 10:53 NL D4.2 x2.5k 30 um

Sample 10- One Month Later, in Water (Moses Lake)

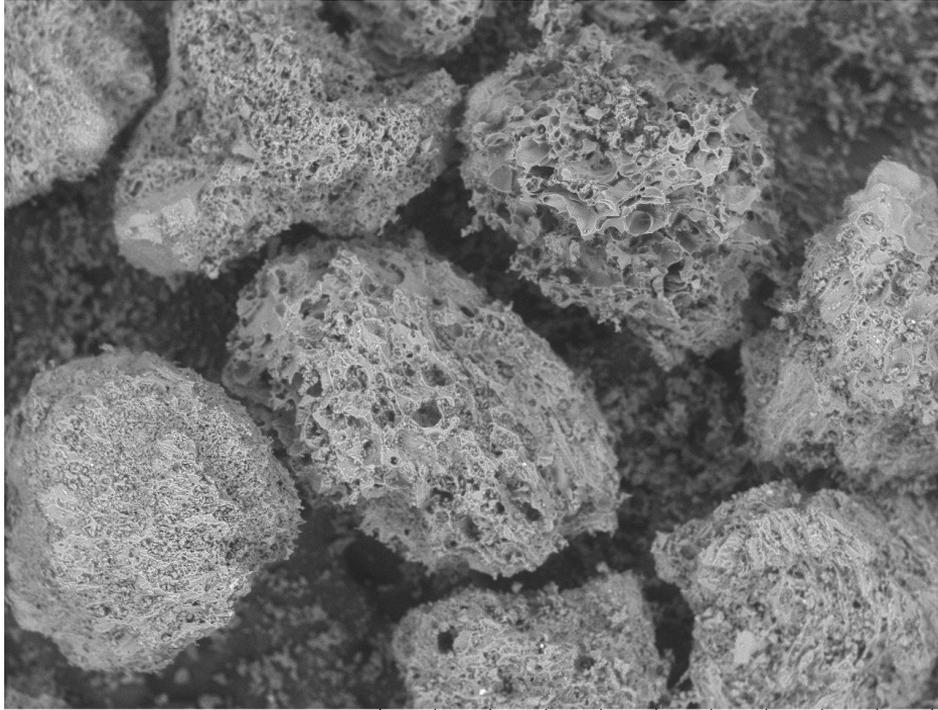


0566 2020/03/13 10:15 NL D4.7 x120 500 um



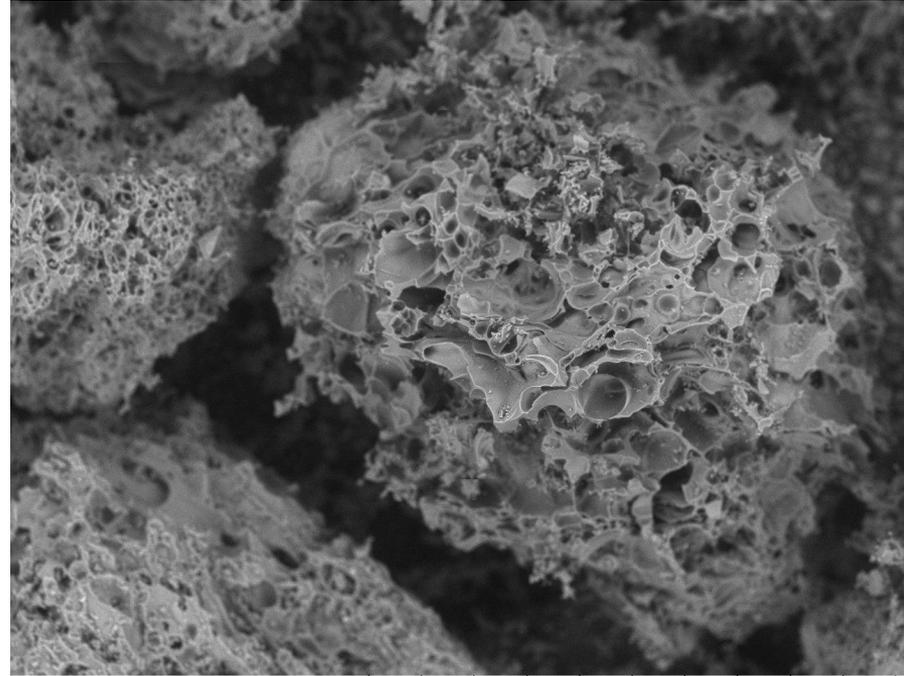
0567 2020/03/13 10:18 NL D4.8 x500 200 um

Sample 11- Yakima, WA 5/18/1980



0515

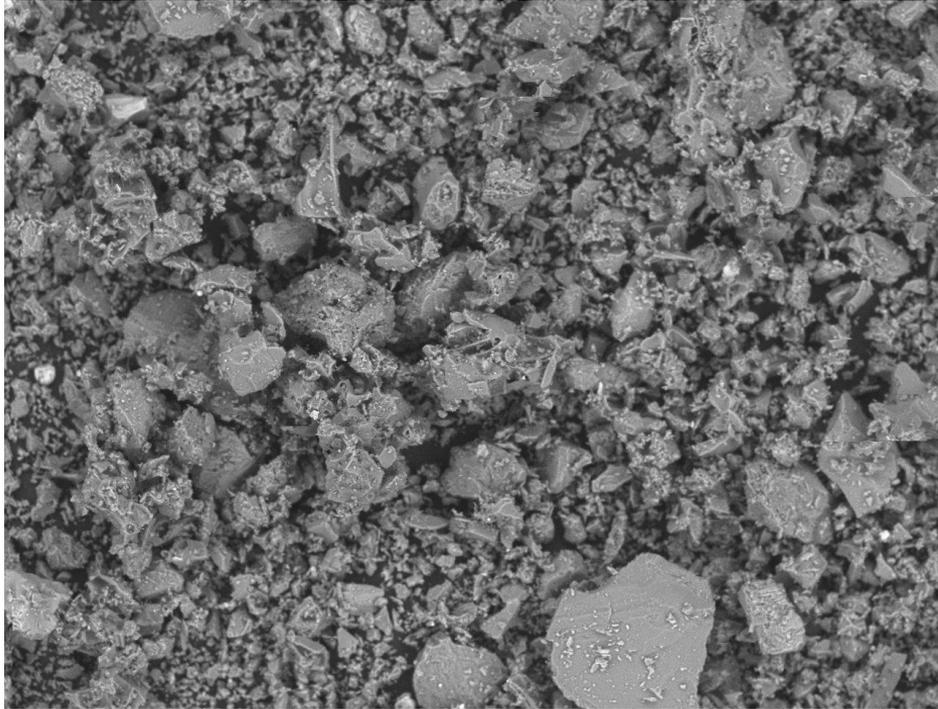
2020/01/31 11:03 NL D4.0 x100 1 mm



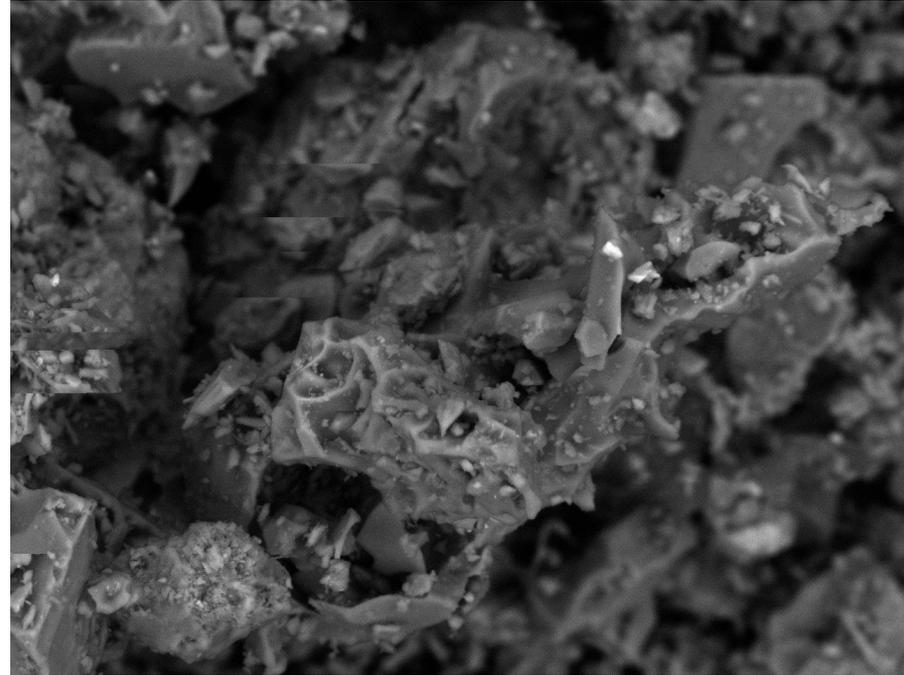
0516

2020/01/31 11:08 NL D4.0 x200 500 um

Sample 14- SW Portland, OR 5/25/1980

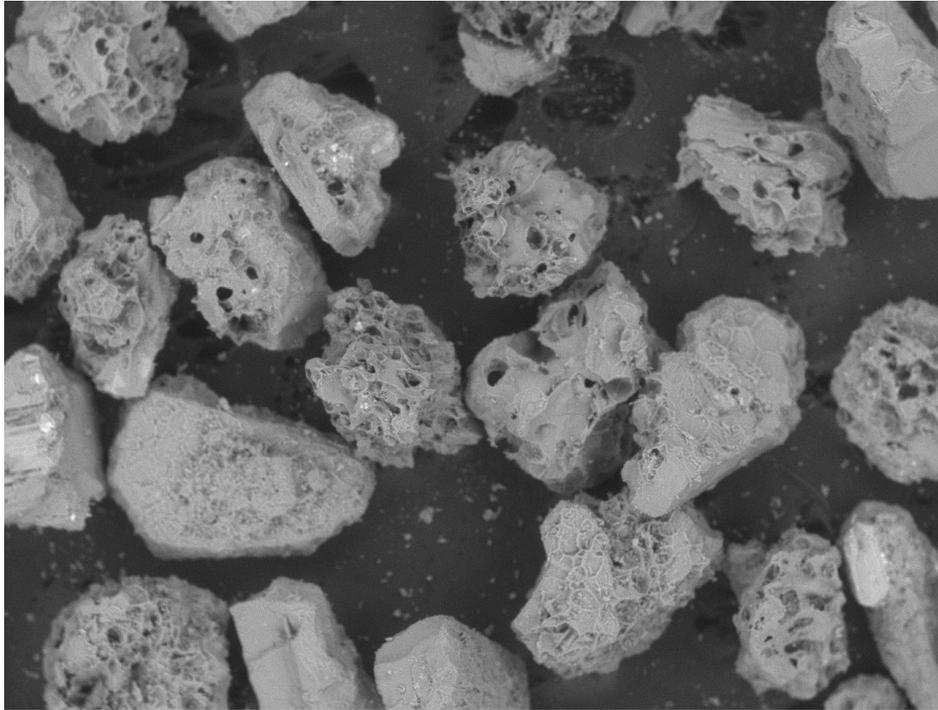


0517 2020/01/31 11:19 NL D4.4 x300 300 um

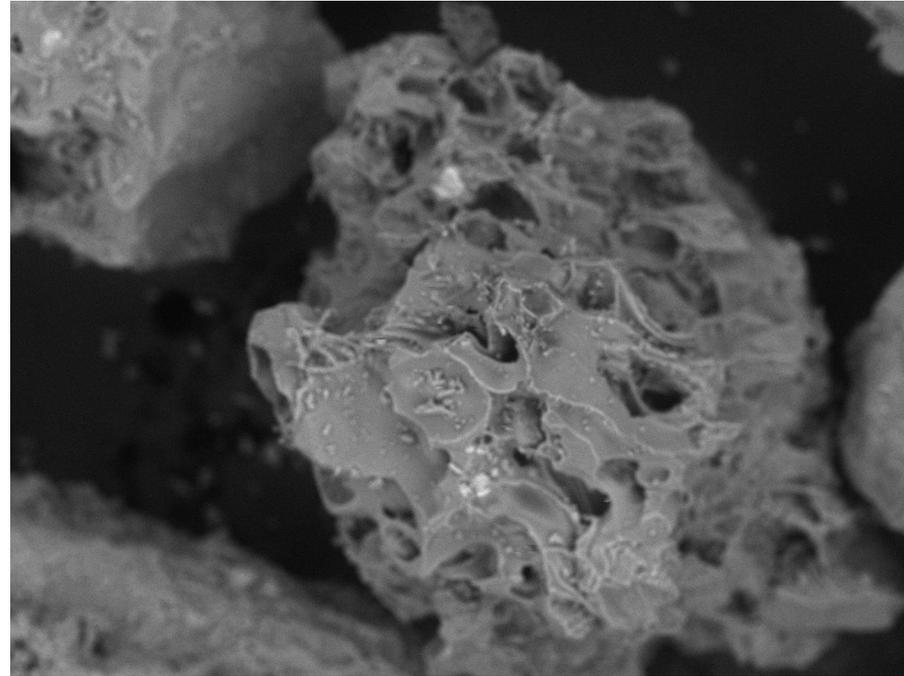


0518 2020/01/31 11:31 NL D4.4 x1.5k 50 um

Sample 16- Swift Reservoir, WA 3/19 to 20/1982

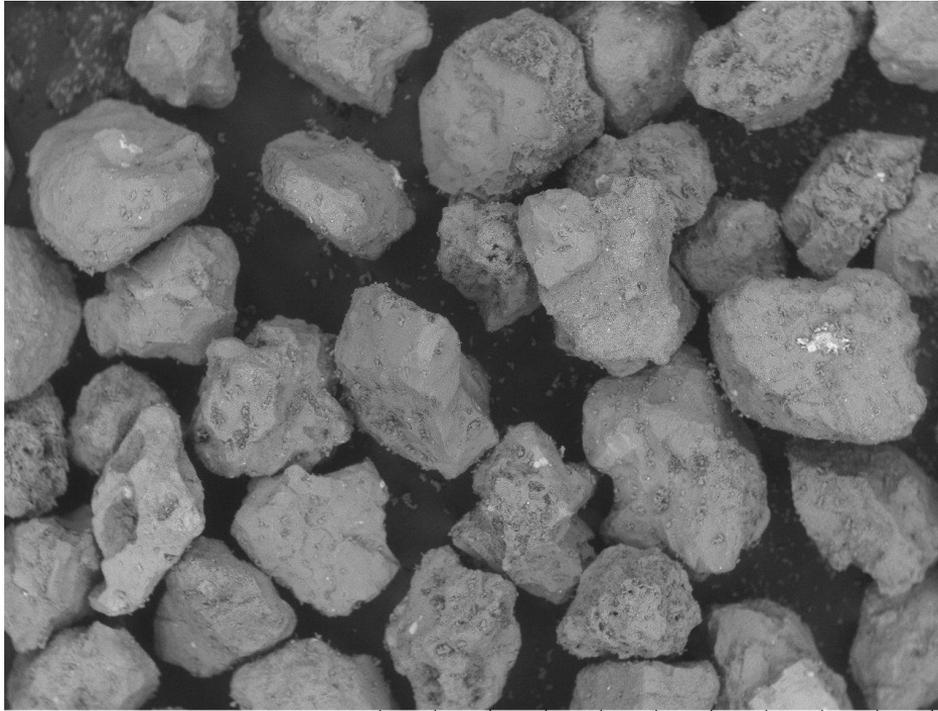


0519 2020/01/31 11:42 NL D4.0 x100 1 mm

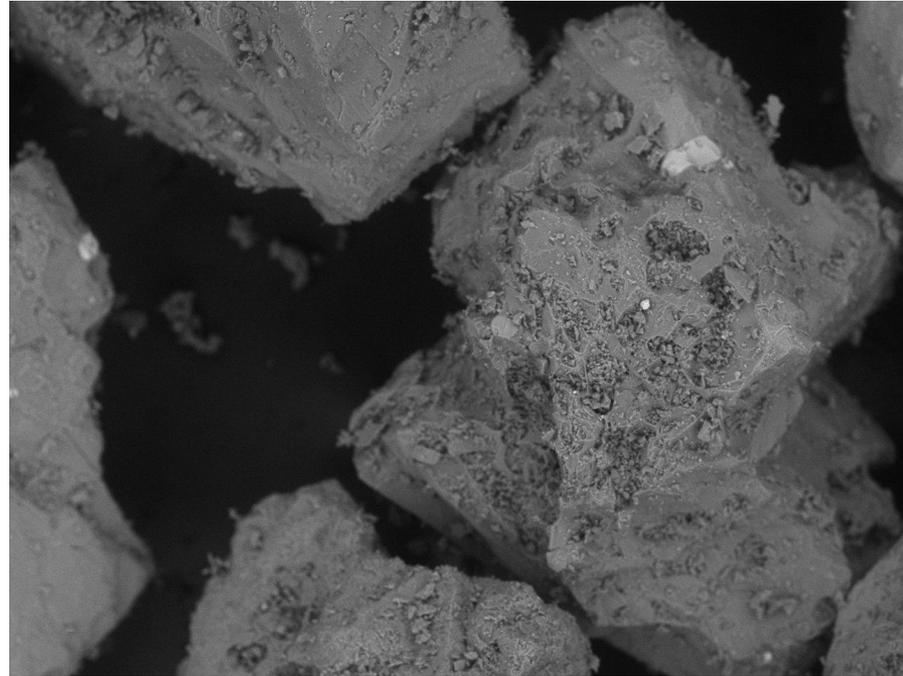


0520 2020/01/31 11:48 NL D4.1 x400 200 um

Sample 17- Toutle, WA 7/2/1980

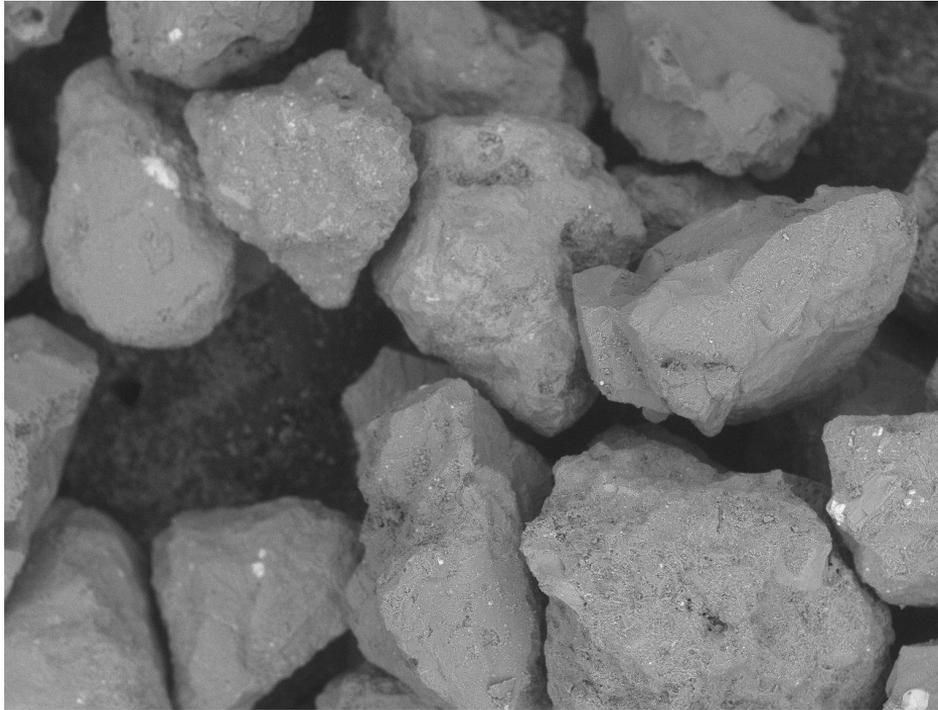


0521 2020/01/31 11:58 NL D4.7 x50 2 mm



0522 2020/01/31 12:04 NL D4.8 x200 500 um

Sample 17- One Month Later, in Water (Toutle, WA)



0568

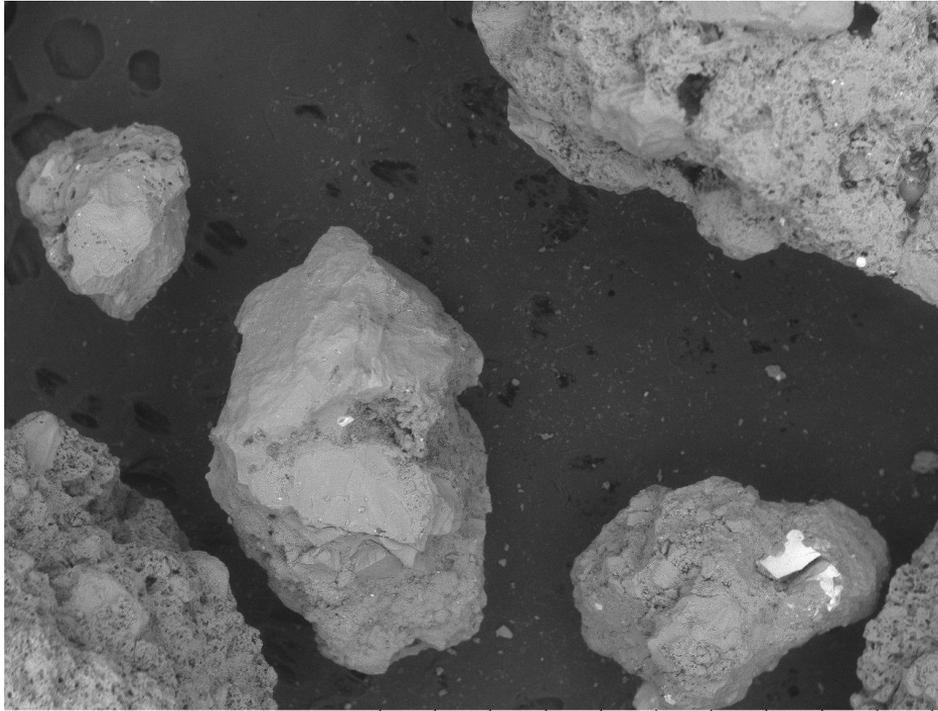
2020/03/13 10:34 NL D4.5 x100 1 mm



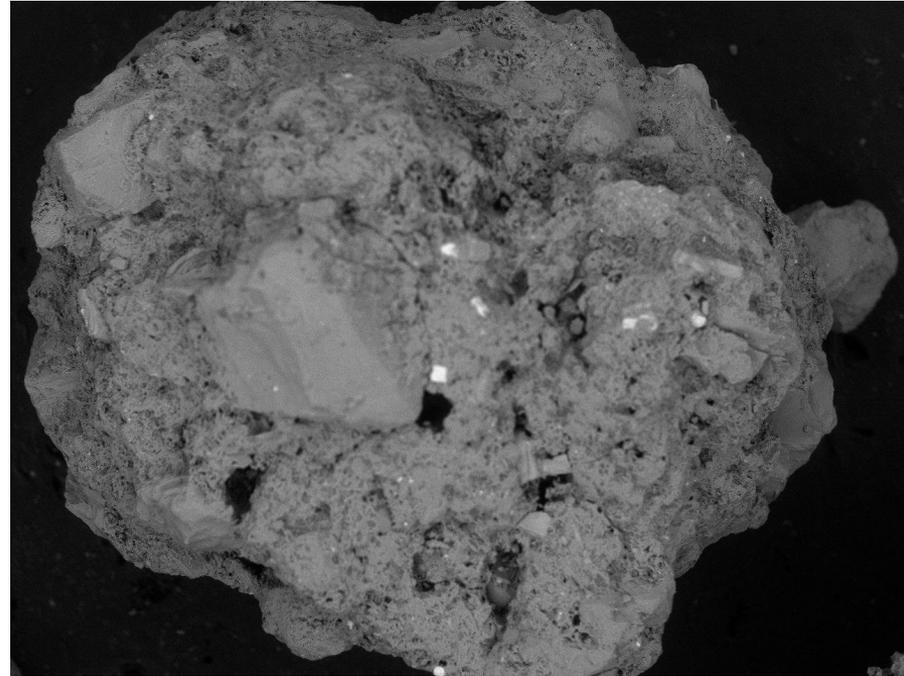
0569

2020/03/13 10:38 NL D4.5 x200 500 um

Sample 19- Cougar, WA July 1981 (Crystal-rich Ash)

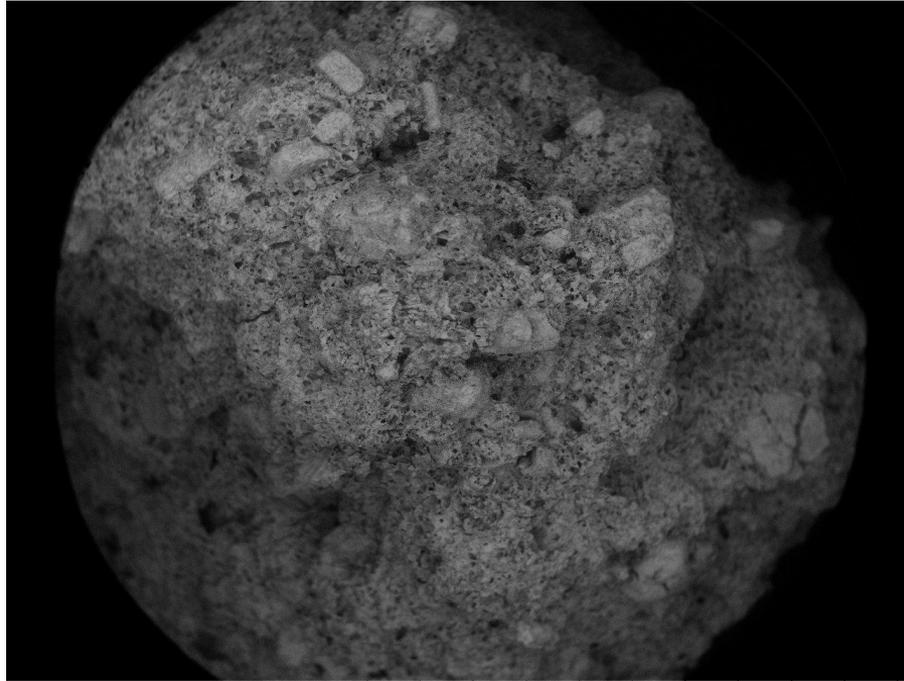


0523 2020/01/31 12:16 NL D5.4 x50 2 mm



0524 2020/01/31 12:22 NL D5.2 x60 1 mm

Sample 21- Cougar, WA 7/18/1981 (Pumice Lapilli)

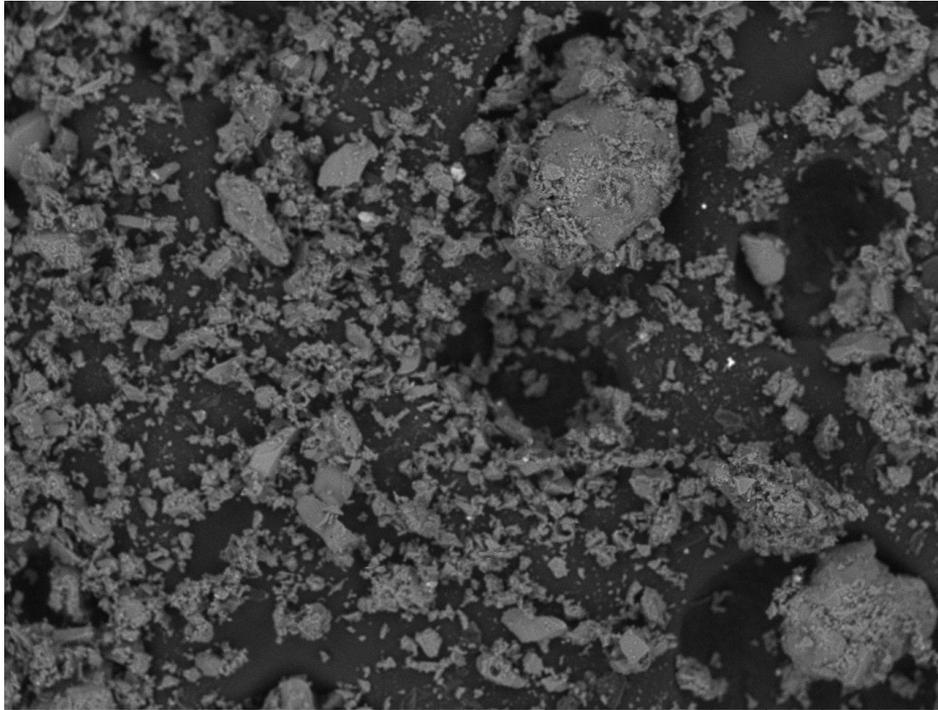


0525 2020/01/31 12:37 F L D5.2 x25 4 mm



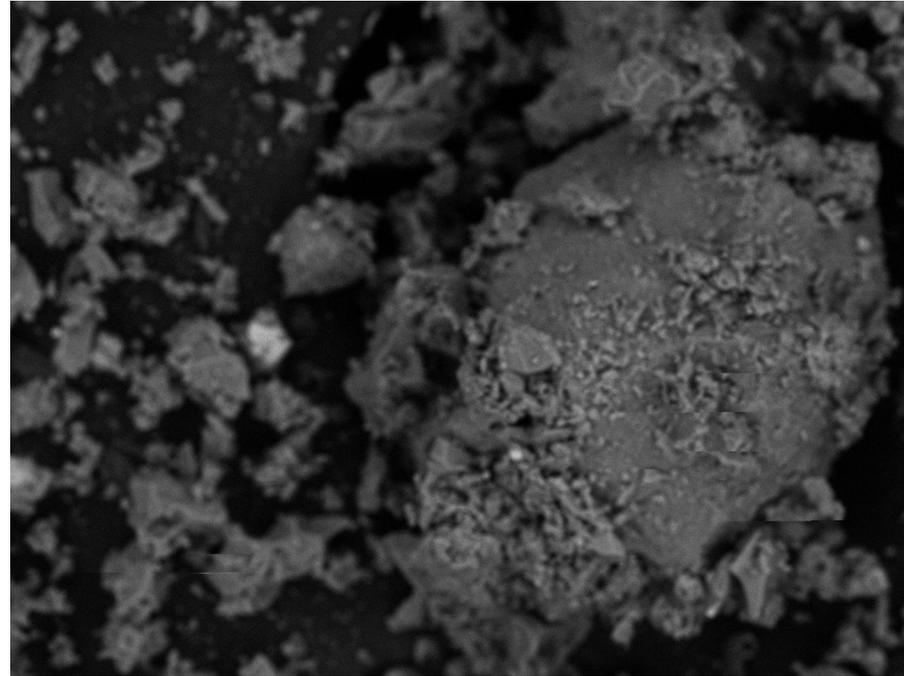
0526 2020/01/31 12:40 F L D5.0 x100 1 mm

Sample 25- Portland, OR 5/25/1980



0527

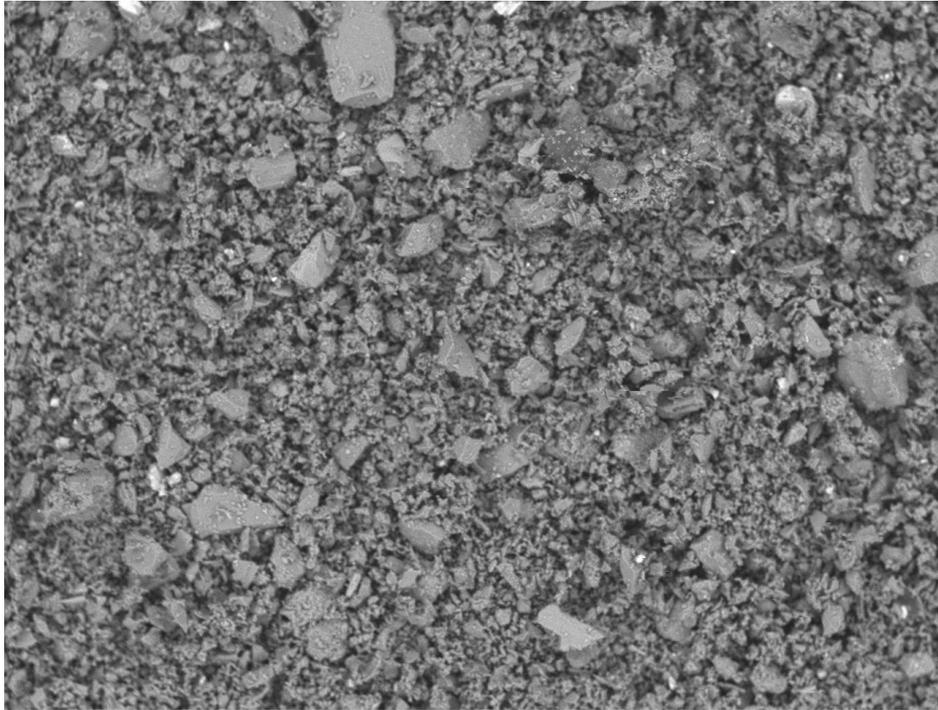
2020/01/31 12:52 NL D4.8 x200 500 um



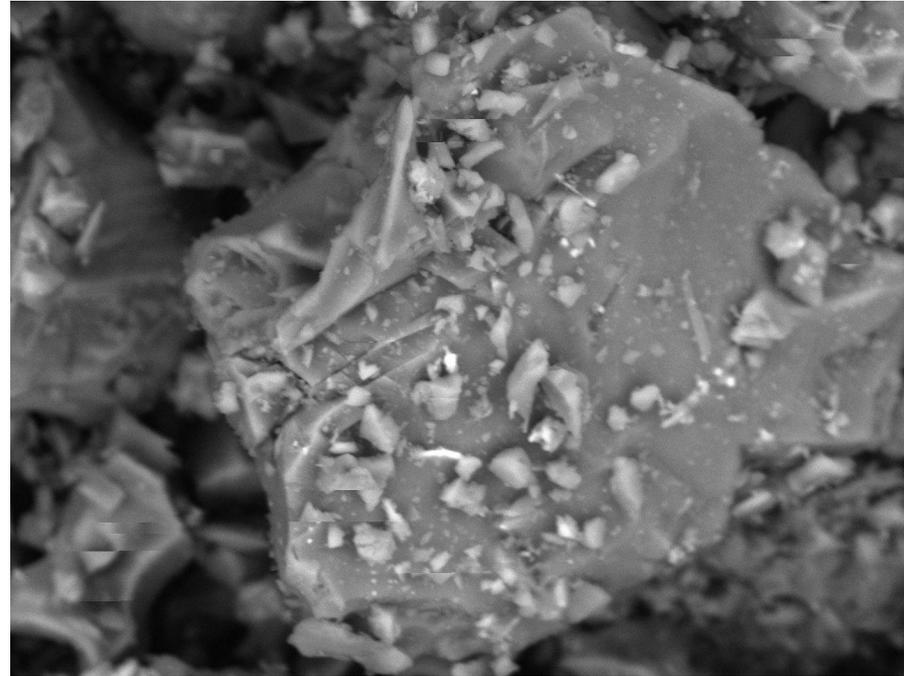
0528

2020/01/31 12:58 NL D4.8 x600 100 um

Sample 28- Aloha, OR 6/12/1980 (Silicated ash)

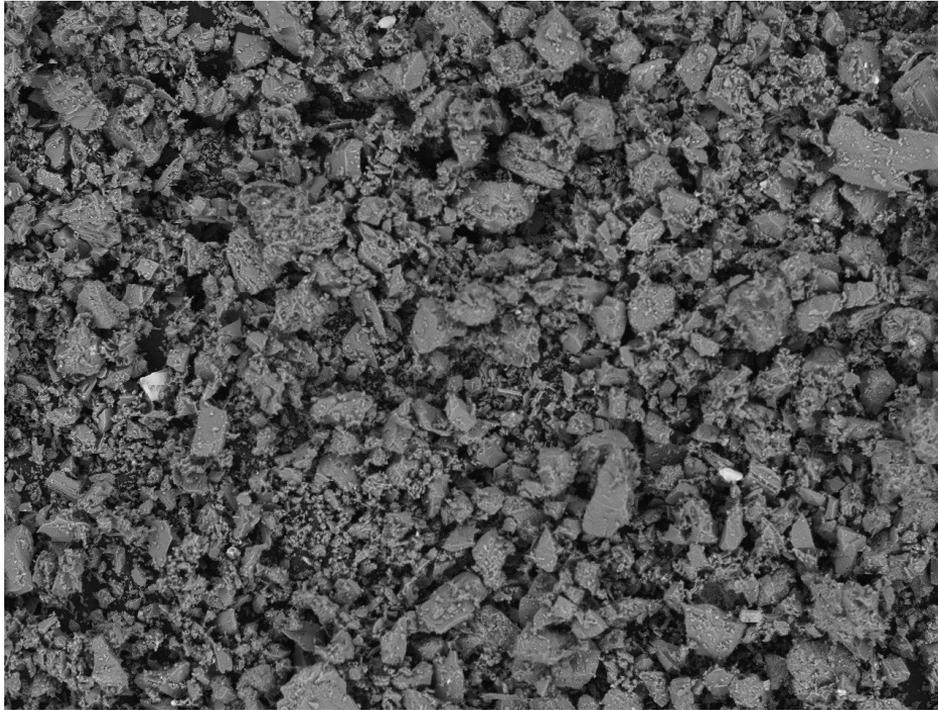


0529 2020/02/14 09:56 N D4.6 x150 500 um

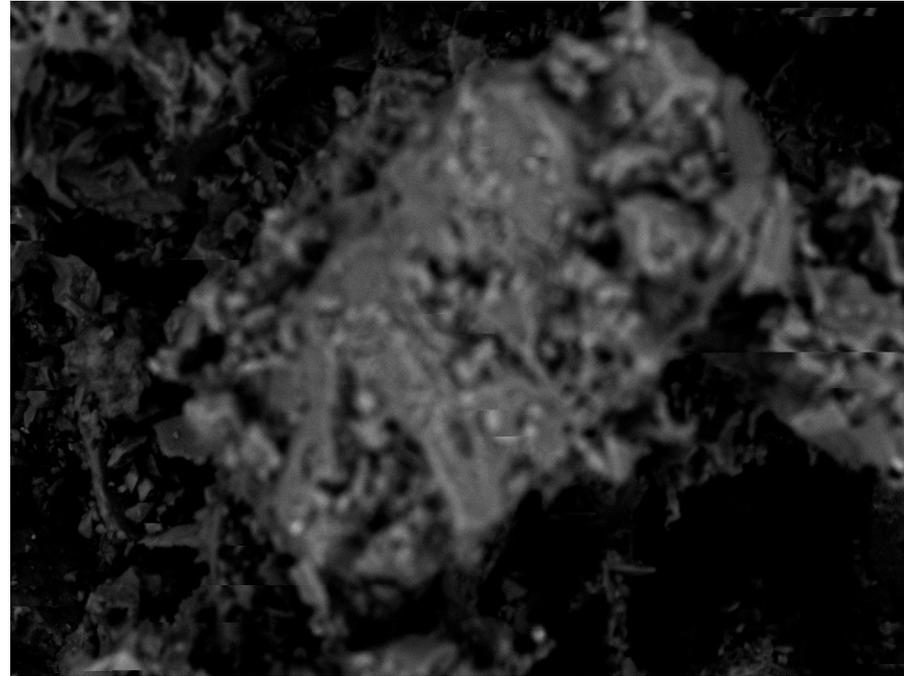


0530 2020/02/14 10:03 N D4.8 x2.5k 30 um

Sample 30- Beaverton, OR (part 1) 5/25/1980

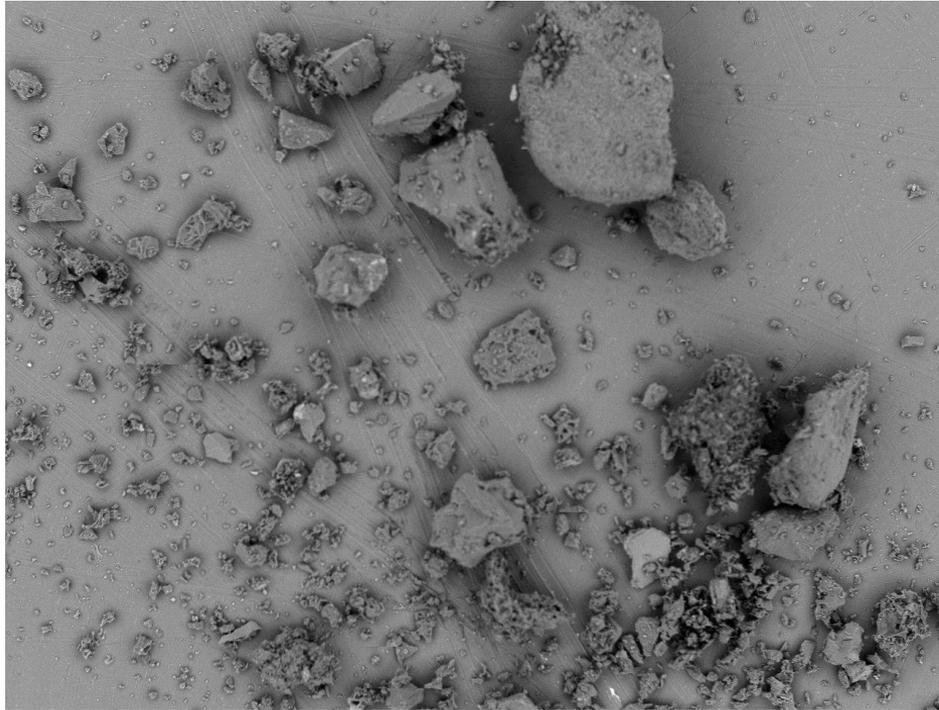


0531 2020/02/14 10:16 N D3.6 x150 500 um



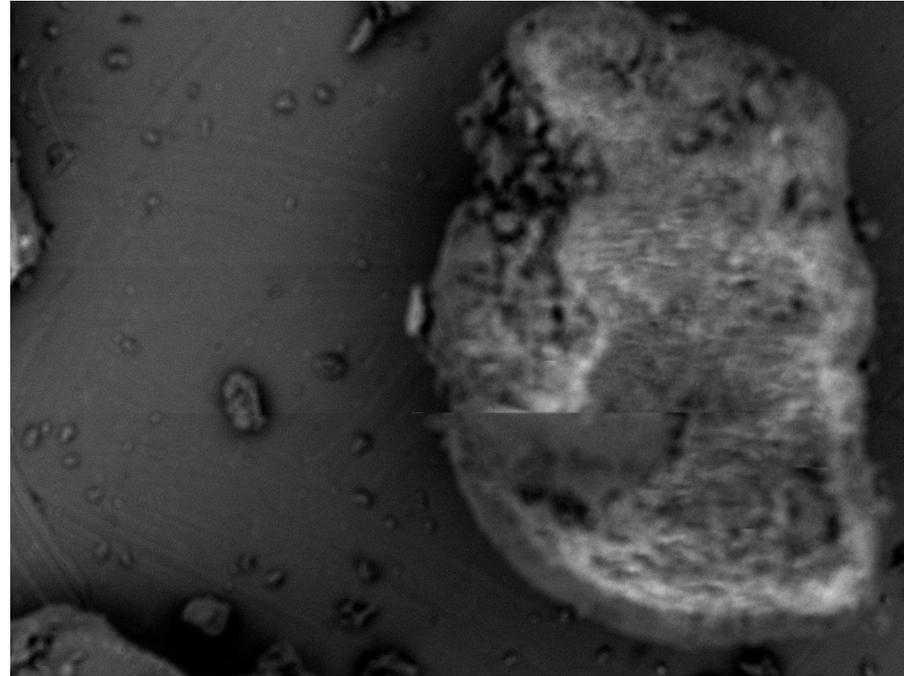
0532 2020/02/14 10:48 N D3.5 x1.0k 100 um

Sample 31- Beaverton, OR (part 2) 6/12/1980



0533

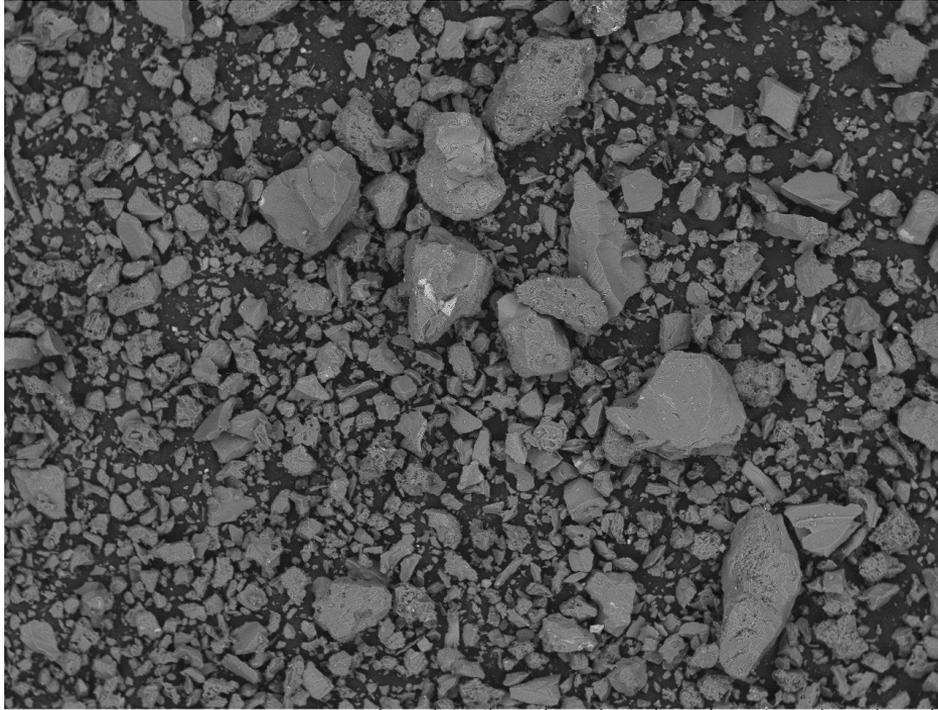
2020/02/14 11:00 N D3.6 x80 1 mm



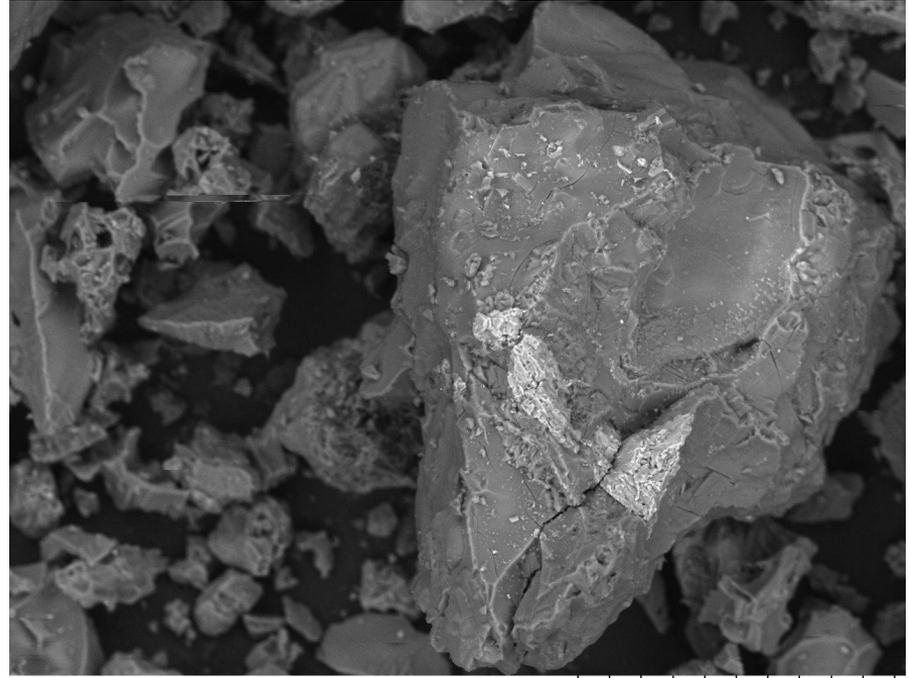
0534

2020/02/14 11:11 N D3.6 x250 300 um

Sample 33-Lake Grove, OR(Lake Oswego) 10/10/80

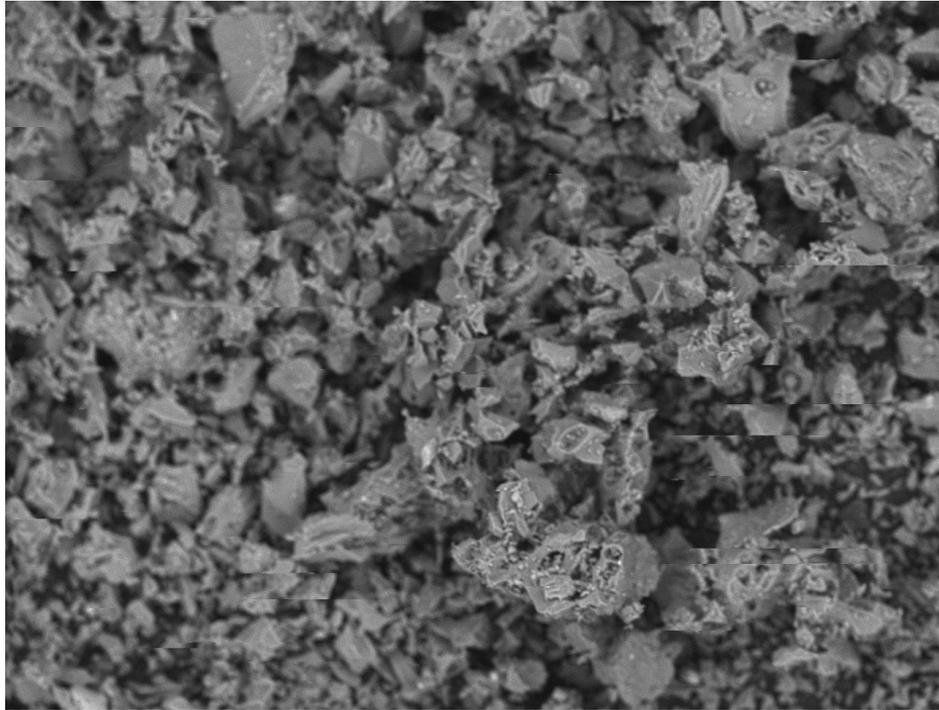


0535 2020/02/14 11:24 N D4.8 x100 1 mm

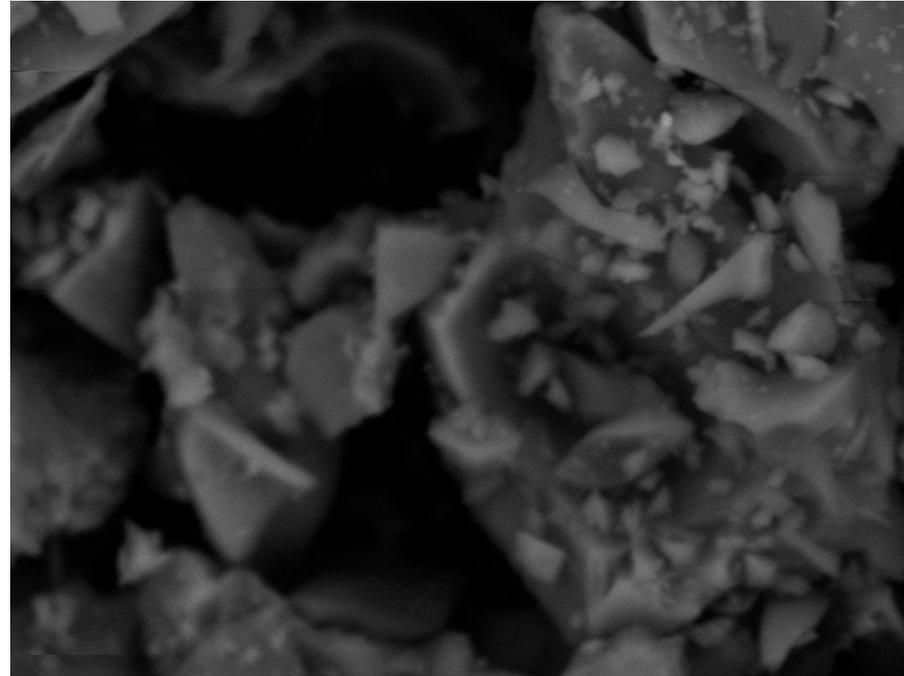


0536 2020/02/14 11:27 N D4.8 x600 100 um

Sample 45- Lewiston, ID 5/18/1980

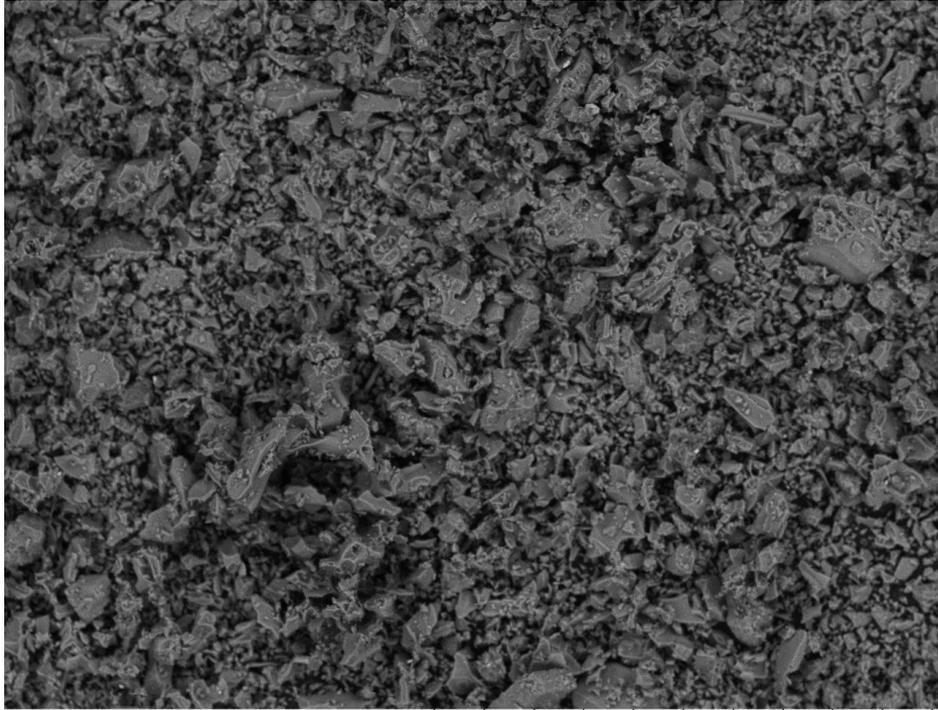


0537 2020/02/14 11:40 N D4.9 x300 300 um

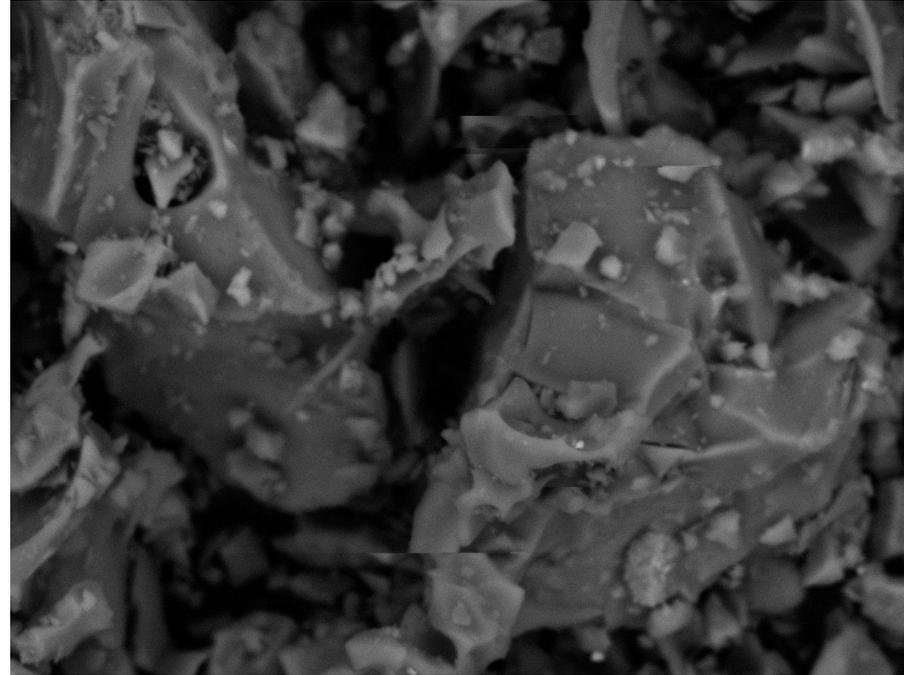


0538 2020/02/14 12:07 NL D5.1 x4.0k 20 um

Sample 46- Moses Lake, WA 5/18/1980



0539 2020/02/14 12:20 NL D5.1 x300 300 um

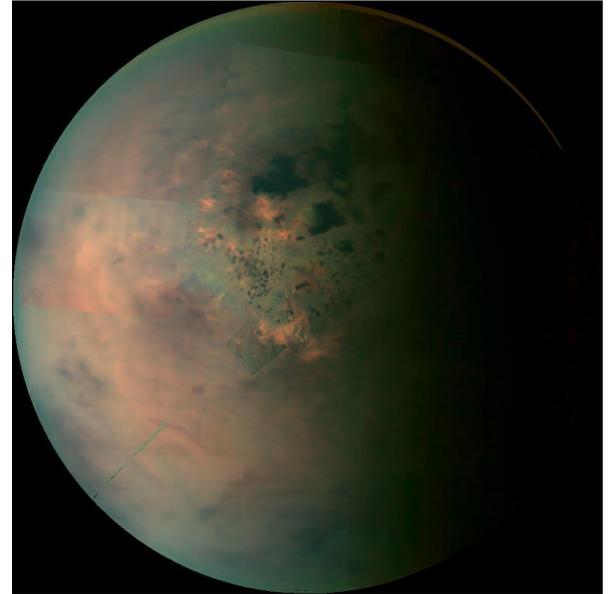
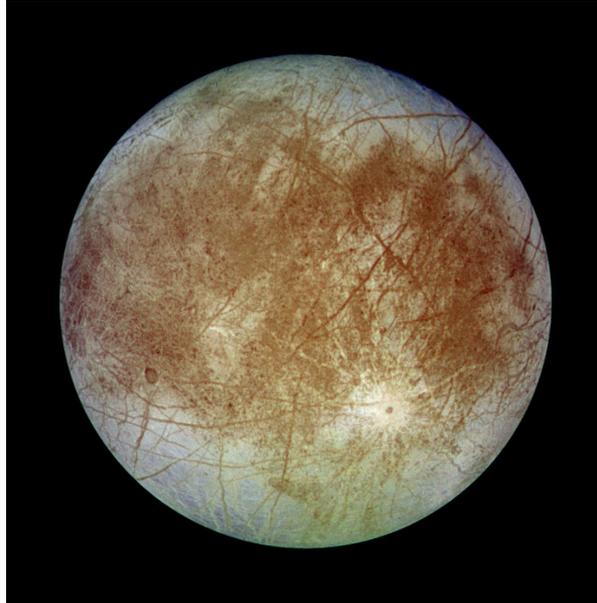


0540 2020/02/14 12:24 NL D5.2 x2.5k 30 um

The effect of fine-grained volcanic ash on soil

Agricultural regions in close proximity to volcanic arcs allow for very fertile soils to be sustained by the replenishment of nutrients. Rock and rock fragments contain almost all of the nutrients that plants and animals need to thrive (Lockwood, Hazlett, 2010). Though juvenile volcanic soils contain little nitrogen, they are rich in other minerals, thus creating natural fertility due to the soil's high unsaturated water content ensuring rapid cation exchange and abundant crops (Lockwood, Hazlett, 2010). The benefits of volcanic rich soils are not immediate as the heavier ash falls can bury the soil and require more intensive tilling by farmers to restore the land. However, a light dusting, less than a few centimeters “will rejuvenate the soil by adding new nutrients without damage” (Lockwood, Hazlett, 2010).

Io, Europa, and Titan



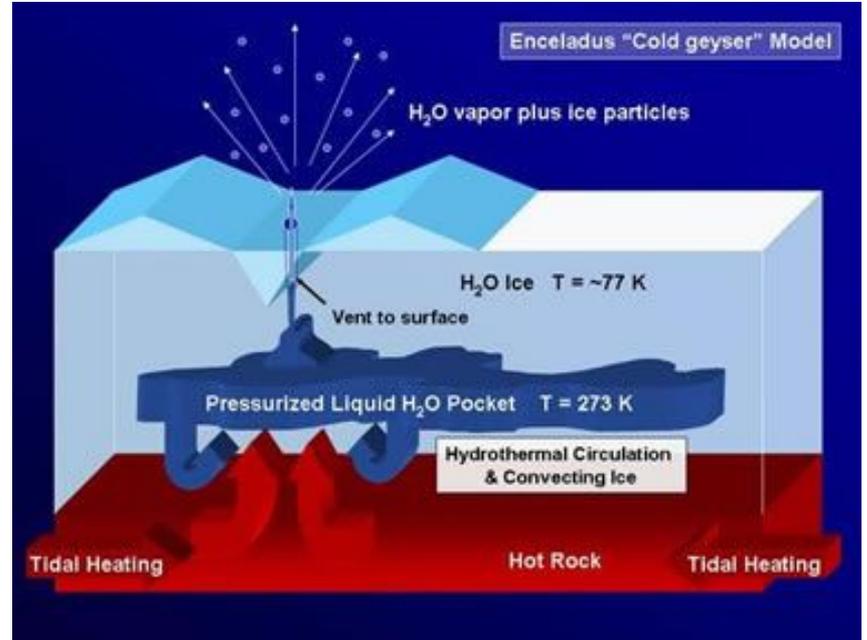
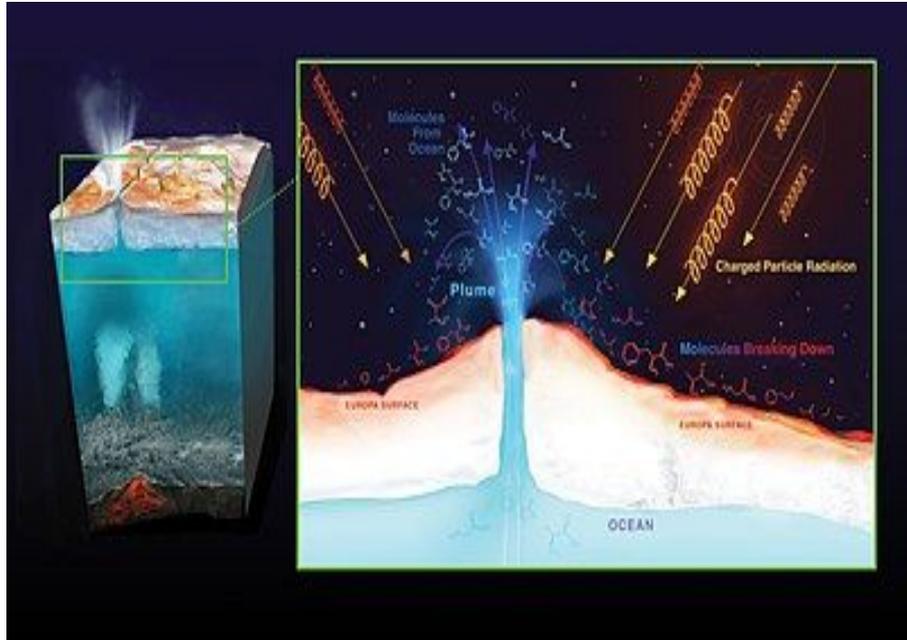
Volcanic Bodies in the Solar System

The planetary and lunar bodies that we know about which have had volcanism in the past include Mercury, Venus, Mars, as well as our own Moon. Of those mentioned, Venus and Mars are still potentially volcanic. However, the other lunar bodies in the outer Solar System are currently much more volcanic, such as Io (a Jovian moon), Europa and Ganymede (other Galilean satellites), Titan and Enceladus (moons of Saturn), and Triton (a moon of Neptune).

Volcanism leading to possible life on other worlds, when water is included

Furthermore, two characteristics bring about the possibility that life could have evolved on other planets or moons, are the necessary ingredients of heat and water, and more specifically tidal heating. These possibilities of life may exist on the most volcanically active body in the solar system, the Jovian satellite, Io (Hall, 2018).

Cryovolcanism on Other Worlds



Volcanism leading to possible life on other worlds

Volcanoes are not only responsible for providing the nutrients for both plant and animal life to flourish but are also responsible for creating the crust of planet Earth and the building of tectonic plates. Also, they release gases that have helped form our oceans and atmosphere. All of which are essential to allow life to thrive. If you have water and some kind of atmosphere along with a volcanic activity that can produce ash that is heavy with nutrients then life can potentially exist on some other lunar or planetary body within our solar system (Shekhtman, 2018).

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