WJE ENGINEERS ARCHITECTS MATERIALS SCIENTISTS

Wiss, Janney, Elstner Associates, Inc.
330 Pfingsten Road
Northbrook, Illinois 60062
847.272.7400 tel | 847.291.5189 fax
www.wje.com

INTEROFFICE MEMORANDUM

Via: Email

To: Richard Dethlefs

From: Laura Powers

Date: May 14, 2008

Project: Concrete, WA Historical Flood Investigation
WJE No. 2008.0860

Subject: Microscopical Studies

Microscopical studies have been conducted on samples of wood exhibiting deposits of debris and silt deposits taken from five residences to characterize the nature of the deposits. Presented in Tables 1 through 5 are sample designations, locations, and brief descriptions of the materials observed.

Table 1 – F Samples from 612 Fairhaven Residence Taken March 19, 2008

Sample ID Figure No.	Sample Type	Location	Description
F-1 Figure 1	Wood chip	Not stated	Very small amounts of dust-size siliceous mineral grains and gray-black biological material on one side
F-2 Figure 2	Wood chip	Not stated	Locally heavy deposits of dust-size, light gray deposits and small amounts of gray-black biological material
F-3 Figure 3	Wood chip	Not stated	Scattered locally heavy deposits of dust-size light gray minerals and traces of gray-black biological material
F-4 Figure 4	Wood chip	Not stated	Small amounts of gray-black, yellow and white biological material and traces of dust-size minerals

Mineral grains examined microscopically in immersion mounts mainly consisted of quartz, feldspar, and micaceous minerals.

Table 2 – G Samples from Gifford Residence Taken April 3, 2008

Sample ID Figure No.	Sample Type	Location	Description
G-1 Figure 5	Wood chip	Board sheathing SW ext. wall opening	Moderate to locally heavy deposits of silt-size siliceous mineral grains and small amounts of spider silk, various parts, and other biological materials
G-2 Figure 6	Wood chip	Board sheathing SW ext. wall opening	Light to moderate deposits of siliceous mineral grains and biological materials
G-3 Figure 7	Wood chip	Board sheathing SW ext. wall opening	Heavy coating a caulk-like material on one side, light deposits and biological material on another side
G-4 Figure 8	Wood chip	Board sheathing SW ext. wall opening	Light deposits of biological materials, traces of silt-size siliceous mineral grains

Sample ID Figure No.	Sample Type	Location	Description
G-5 Figure 9	Wood chip	Board sheathing SW ext. wall opening	Light to moderate deposits of silt-size siliceous mineral grains, small amounts of spider silk and other biological materials
G-6 Figure 10	Wood chip	Board sheathing SW ext. wall opening	Light to moderate deposits of silt-size siliceous mineral grains, small amounts of insect silk, rodent pellets, and other biological materials
G-7 Figure 11	Wood chip	Board sheathing SW ext. wall opening	Moderate to locally heavy deposits of silt-size siliceous mineral grains, small amounts of biological materials
G-8 Figure 12	Wood chip	Board sheathing SW ext. wall opening	Light deposits of silt-size siliceous mineral grains, small amounts of biological materials
G-10 Figure 13	Wood chip	Vertical post Basement crawlspace	Very heavy deposits of silt-size siliceous minerals and possibly cementitious material, small amounts of insect parts and other biological materials
G-11 Figure 14	Wood chip	Vertical post	Locally heavy deposits of silt-size siliceous mineral grains and possibly cementitious materials, traces of biological materials
G-12 Figure 15	Wood chip	Basement crawlspace	Moderate amounts of fibrous biological materials, scattered patches of possibly cementitious material
G-13 Figure 16	Wood chip	Vertical post	Light to locally heavy deposits of silt-size siliceous minerals, possible cementitious materials, small amounts of biological materials
G-14 Figure 17	Wood chip	Basement crawlspace	Light deposits of silt-size siliceous mineral grains, small amounts of biological materials
G-15 Figure 18	Wood chip	Vertical post	Light deposits of silt-size siliceous mineral grains, small amounts of biological materials
G-16 Figure 19	Wood chip	Basement crawlspace	Light deposits of silt-size siliceous mineral grains, small amounts of biological materials
G-17 Figure 20	Wood chip	Vertical post	Moderate to heavy deposits of silt and dust-size siliceous minerals and biological materials
G-18 Figure 21	Wood chip	Basement crawlspace	Moderate to heavy deposits of silt-size siliceous mineral grains, small amounts of biological materials
G-20 Figure 22	Debris	Top of concrete foundation wall, SW ext. wall opening	Wood chips, paint flakes, insect casts, insect parts, plant fibers/rootlets, spider silk, rodent pellets, corrosion scale, siliceous mineral grains ranging from silt-size to coarser particles (about 1 mm)

Mineral grains examined microscopically in immersion mounts mainly consisted of quartz, feldspar, micaceous minerals, opaque grains (magnetite and others), and miscellaneous rock fragments (quartzite, schist, and others).

Table 3 – R Samples from Ripple Residence #1 45968 Albert Street Taken April 3, 2008

Sample ID Figure No.	Sample Type	Location	Description
D-10 Figure 23	Debris	Sill plate West ext. wall opening	Wood fragments, insect parts, rodent fecal pellets, various plant debris, small amounts of siliceous minerals (mostly coarse), paint flakes, mortar
R-1 Figure 24	Wood chip	Sill plate, first floor West ext. wall opening	Heavy deposits of silt-size siliceous mineral grains, insect parts, and other biological materials
R-2 Figure 25	Wood chip	Sill plate, first floor West ext. wall opening	Heavy deposits of silt-size siliceous mineral grains, insect parts, and other biological materials
R-3 Figure 26	Wood chip	Sill plate, first floor West ext. wall opening	Moderate to heavy deposits of silt-size siliceous mineral grains, insect parts, and other biological materials
R-4 Figure 27	Wood chip	Board sheathing West ext. wall opening	Moderate deposits of silt-size siliceous mineral grains, insect parts, and other biological materials
R-5 Figure 28	Wood chip	Board sheathing West ext. wall opening	Traces of dust to silt-size mineral grains and biological materials
R-6 Figure 29	Wood chip	Board sheathing West ext. wall opening	Moderate deposits of insect parts and other biological materials, traces of dust-size mineral grains
R-7 Figure 30	Wood chip	Board sheathing West ext. wall opening	Moderate deposits of insect parts and other biological materials, traces of dust-size mineral grains
R-8 Figure 31	Wood chip	Board sheathing West ext. wall opening	Light deposits of insect parts and other biological materials, traces of dust-size mineral grains
R-9 Figure 32	Wood chip	Board sheathing West ext. wall opening	Light deposits of insect parts and other biological materials, traces of dust-size mineral grains
R-10 Figure 33	Wood chip	Board sheathing West ext. wall opening	Moderate deposits of dust-size mineral grains, insect part and other biological materials
R-11 Figure 34	Wood chip	Board sheathing West ext. wall opening	Moderate deposits of dust-size mineral grains, insect part and other biological materials
R-12 Figure 35	Wood chip	Board sheathing West ext. wall opening	Moderate deposits of dust-size mineral grains, insect part and other biological materials
R-13 Figure 36	Wood chip	Board sheathing West ext. wall opening	Light deposits of dust to silt-size mineral grains and small amounts of biological materials

Mineral grains examined microscopically in immersion mounts mainly consisted of quartz, quartzite, feldspar, micaceous minerals, amphiboles, pyroxene, opaque grains, epidote, and miscellaneous rock fragments.

Table 4 – S Samples from Ripple Residence #2 45956 Albert Street Taken April 3, 2008

Sample ID	Sample Type	Location	Description
S-1 Figure 37	Wood chip	Base of wood stud, 1st floor East ext. wall	Light deposits of silt-size siliceous mineral grains and biological material
S-2 Figure 38	Wood chip	Base of wood stud, 1st floor East ext. wall	Light deposits of biological materials, possible traces of dust-size mineral grains
S-3 Figure 39	Wood chip	Base of wood stud, 1st floor East ext. wall	Light deposits of biological materials, possible traces of dust-size mineral grains
S-4 Figure 40	Wood chip	Board sheathing East ext. wall opening	Moderate deposits of biological materials, light deposits of dust-size mineral grains
S-5 Figure 41	Wood chip	Board sheathing East ext. wall opening	Light deposits of biological materials, traces of dust-size mineral grains
45956 #1 Figure 42	Silt	Wood sill plate 40” below floor level	Fine pale beige gray powder visually similar to dust-size material on various samples. Microscope: clay, insect parts, pollen, spores, minor quartz, feldspar, wollastonite, iron oxides, plant material, soot, traces of others
45956 #2 Figure 43	Silt	Foundation wall sill plate 30” below floor level	Fine medium beige powder visually similar to silt-size material. Microscope: Quartz, feldspar, mica, epidote, volcanic glass and other volcanic rocks, iron oxides, mafic mineral grains, fiberglass and mineral wool, insect parts, wood fragments, cloth fibers, plant fibers
45956 #3 Figure 44	Silt	Top of CMU foundation wall 20” below floor level	Medium brown fine to medium grained powder with abundant fiberglass and dyed cloth fibers. Microscope: Quartz, feldspar, volcanic glass and other volcanic rocks, quartzite, schist, mica, epidote, iron oxides, mafic mineral grains, fiberglass and mineral wool, insect parts, wood fragments, cloth fibers, plant fibers, and pollen
45956 #4 Figure 45	Silt	Top of 6x6 beam 8” below floor level	Medium to dark brown, small sample, mostly granular minerals with small amounts of green paint chips, wood fragments, insect parts, and fibrous material. Microscope: Quartz, feldspar, volcanic rock fragments, quartzite, schist, mica, iron oxides, epidote, pyroxene, amphiboles, traces of pollen, and fiberglass

Mineral grains removed from the wood fragments and examined microscopically in immersion mounts mainly consisted of quartz, quartzite, feldspar, micaceous minerals, opaque mineral grains (mostly magnetite), amphiboles, pyroxenes, epidote, and miscellaneous rock fragments (including glassy volcanic rocks and schist).

Table 5 – M Samples from McManaman Residence 45898 Benjamin Street Taken April 3, 2008

Sample ID	Sample Type	Location	Description
M-1 Figure 46	Wood chip	Vertical post in crawlspace	Heavy deposits of silt-size siliceous mineral grains and biological material (much is fibrous)
M-2 Figure 47	Wood chip	Vertical post in crawlspace	Heavy deposits of silt-size siliceous mineral grains, smaller amounts of biological material (much is fibrous)
M-3 Figure 48	Wood chip	Vertical post in crawlspace	Moderate deposits of silt-size siliceous mineral grains, insect parts, and other biological materials
M-4 Figure 49	Wood chip	Vertical post in crawlspace	Light to moderate deposits of dust to silt-size siliceous mineral grains and biological material
M-5 Figure 50	Wood chip	Vertical post in crawlspace	Light to moderate deposits of dust to silt-size siliceous mineral grains and biological material
M-6 Figure 51	Wood chip	Vertical post in crawlspace	Light deposits of dust and silt-size siliceous mineral grains, mostly in crevices, fibrous biological materials, and insect parts
M-7 Figure 52	Wood chip	Vertical post in crawlspace	Light deposits of dust to silt-size siliceous mineral grains and fibrous biological material
M-8 Figure 53	Wood chip	Vertical post in crawlspace	Light deposits of dust to silt-size siliceous mineral grains, insect parts, and fibrous biological material
M-10 Figure 54	Wood chip	Board sheathing North ext. wall opening	Light to moderate deposits of dust to silt-size siliceous mineral grains, insect parts, and biological material
M-11 Figure 55	Wood chip	Board sheathing North ext. wall opening	Light deposits of dust to silt-size siliceous mineral grains and biological material
M-12 Figure 56	Wood chip	Board sheathing North ext. wall opening	Light deposits of dust-size whitish grains and biological material, traces of dust-size siliceous mineral grains
M-13 Figure 57	Wood chip	Board sheathing North ext. wall opening	Trace deposits of dust-size siliceous mineral grains and biological material
M-14 Figure 58	Wood chip	Board sheathing North ext. wall opening	Light deposits of dust to silt-size siliceous mineral grains and biological material

Mineral grains examined microscopically in immersion mounts mainly consisted of quartz, quartzite, feldspar, micaceous minerals, and opaque mineral grains (mostly magnetite).

Figure 1. F-1 612 Fairhaven - Small amount of dust-size particles cling to the surface of the wood. Magnification approximately 10X.

Figure 2. F-2 612 Fairhaven - Locally heavy deposits on wood surface. Magnification approximately 10X.

Figure 3. F-3 612 Fairhaven - Locally heavy gray deposits and black biological material on wood surface. Magnification approximately 10X.

Figure 4. F-4 612 Fairhaven - Traces of dust-size particles and small amounts of biological materials on wood surface. Magnification approximately 10X.

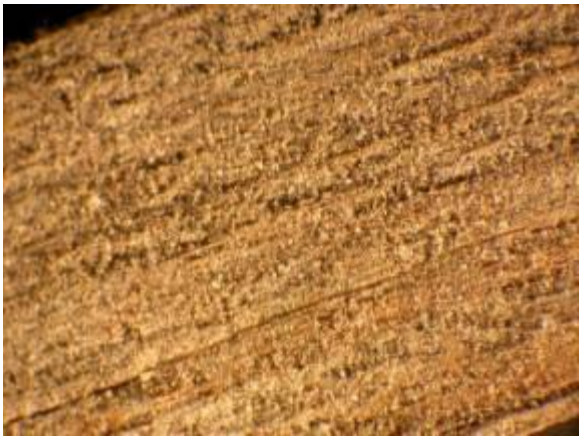

Figure 5. G-1 Gifford - Moderate to heavy deposits of debris on wood surface. Magnification approximately 10X.

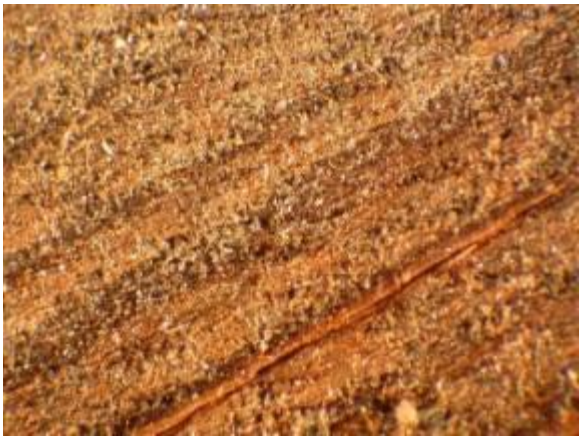

Figure 6. G-2 Gifford - Light to moderate deposits of mineral debris on wood surface. Magnification approximately 10X.

Figure 7. G-3 Gifford - Caulk and light deposits of debris on wood surface. Magnification approximately 10X.

Figure 8. G-4 Gifford - Dark biological materials and light deposits of debris on wood surface. Magnification approximately 10X.

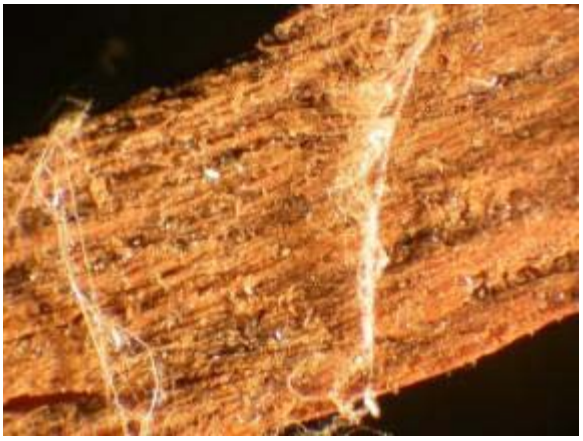

Figure 9. G-5 Gifford - Biological materials and light deposits of debris on wood surface. Magnification approximately 10X.

Figure 10. G-6 Gifford - Biological materials and light to moderate deposits of debris on wood surface. Magnification approximately 10X.

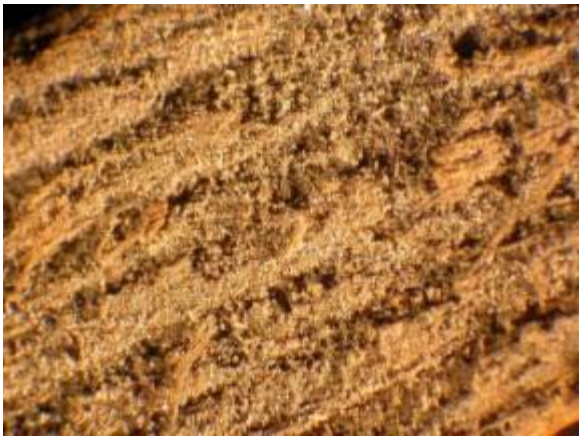

Figure 11. G-7 Gifford - Moderate to locally heavy deposits of silt-size particles and small amounts of biological materials on wood surface. Magnification approximately 10X.

Figure 12. G-8 Gifford - Small amounts of silt-size particles and small amounts of biological material on wood surface. Magnification approximately 10X.

Figure 13. G-10 Gifford - Very heavy deposits of silt-size mineral deposits, possibly cementitious material, and small amounts of biological materials on wood surface. Magnification approximately 10X.

Figure 14. G-11 Gifford - Heavy deposits of silt-size mineral deposits, possibly cementitious material, and traces of biological materials on wood surface. Magnification approximately 10X.

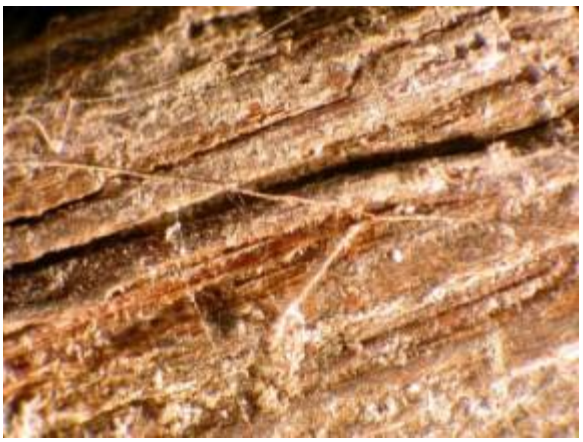

Figure 15. G-12 Gifford - Very heavy deposits of silt-size mineral deposits, possibly cementitious material, and small amounts of biological materials on wood surface. Magnification approximately 10X.

Figure 16. G-13 Gifford - Light to locally heavy deposits of silt-size mineral deposits and small amounts of biological materials on wood surface. Magnification approximately 10X.

Figure 17. G-14 Gifford - Light deposits of silt-size mineral deposits and small amounts of biological materials on wood surface. Magnification approximately 15X.

Figure 18. G-15 Gifford - Light deposits of silt-size mineral deposits, spider silk and dark biological materials on wood surface. Magnification approximately 10X.

Figure 19. G-16 Gifford - Light deposits of silt-size mineral deposits and small amounts of biological materials on wood surface. Magnification approximately 15X.

Figure 20. G-17 Gifford - Light deposits of silt-size mineral deposits and small amounts of biological materials on wood surface. Magnification approximately 15X.

Figure 21. G-18 Gifford - Moderate to heavy deposits of silt-size mineral deposits and small amounts of biological materials on wood surface. Magnification approximately 10X.

Figure 22. G-20 Gifford - Wood chips, paint flakes, insect casts, insect parts, plant fibers/rootlets, spider silk, rodent pellets, corrosion scale, siliceous mineral grains ranging from silt-size to coarser particles. Magnification approximately 10X.

Figure 23. D-10 Ripple No. 1 - Wood fragments, insect parts, rodent fecal pellets, various plant debris, small amounts of siliceous minerals (mostly coarse), paint flakes, and mortar. Magnification approximately 10X.

Figure 24. R-1 Ripple No. 1 - Heavy deposits of silt-size siliceous mineral grains, insect parts, and other biological materials. Magnification approximately 10X.

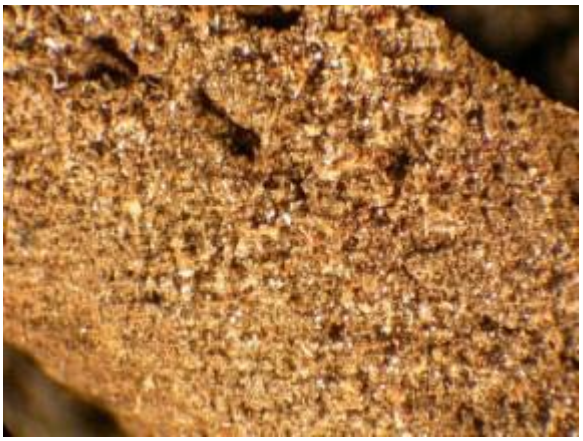

Figure 25. R-2 Ripple No. 1 - Heavy deposits of silt-size siliceous mineral grains, insect parts, and other biological materials. Magnification approximately 10X.

Figure 26. R-3 Ripple No. 1 - Moderate to heavy deposits of silt-size siliceous mineral grains, insect parts, and other biological materials. Magnification approximately 10X.

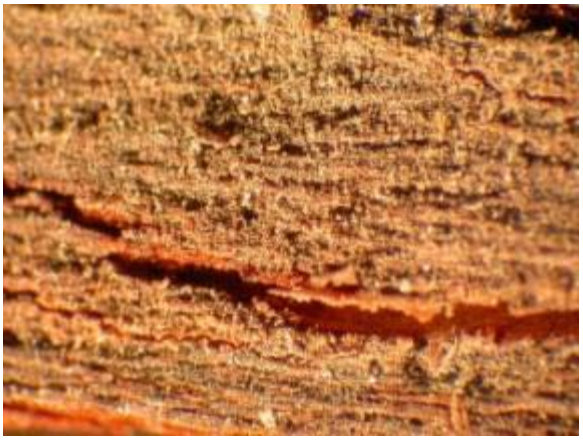

Figure 27. R-4 Ripple No. 1 - Moderate deposits of silt-size siliceous mineral grains, insect parts, and other biological materials. Magnification approximately 10X.

Figure 28. R-5 Ripple No. 1 - Traces of dust to silt-size mineral grains and biological materials. Magnification approximately 10X.

Figure 29. R-6 Ripple No. 1 - Moderate deposits of insect parts and other biological materials, traces of dust-size mineral grains. Magnification approximately 10X.

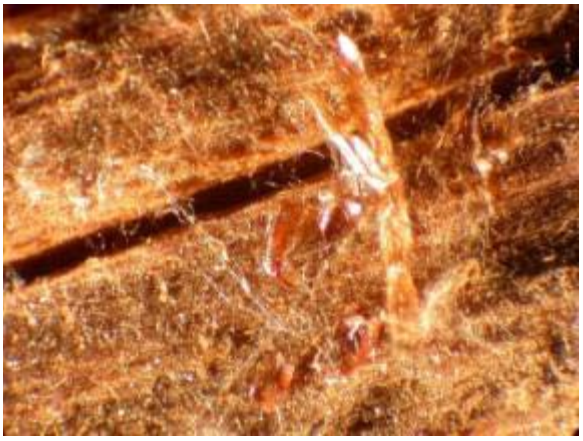

Figure 30. R-7 Ripple No. 1 - Moderate deposits of insect parts and other biological materials, traces of dust-size mineral grains. Magnification approximately 15X.

Figure 31. R-8 Ripple No. 1 - Light deposits of insect parts and other biological materials, traces of dust-size mineral grains. Magnification approximately 7X.

Figure 32. R-9 Ripple No. 1 - Light deposits of insect parts and other biological materials, traces of dust-size mineral grains. Magnification approximately 10X.

Figure 33. R-10 Ripple No. 1 - Moderate deposits of dust-size mineral grains, insect part and other biological materials. Magnification approximately 10X.

Figure 34. R-11 Ripple No. 1 - Moderate deposits of dust-size mineral grains, insect part and other biological materials. Magnification approximately 10X.

Figure 35. R-12 Ripple No. 1 - Moderate deposits of dust-size mineral grains, insect part and other biological materials. Magnification approximately 7X.

Figure 36. R-13 Ripple No. 1 - Light deposits of dust to silt-size mineral grains and small amounts of biological materials. Magnification approximately 7X.

Figure 37. S-1 Ripple No. 2 - Light deposits of silt-size siliceous mineral grains and biological material. Magnification approximately 10X.

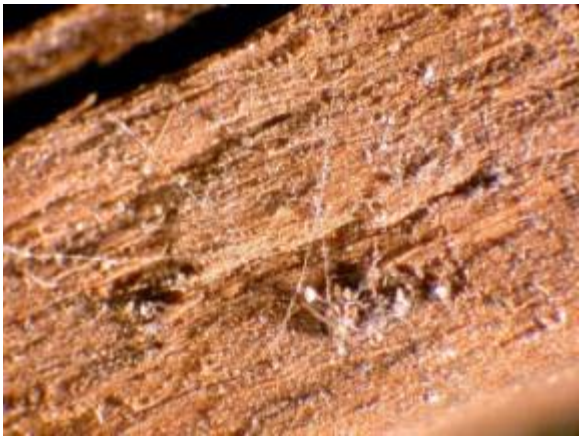

Figure 38. S-2 Ripple No. 2 - Light deposits of biological materials, possible traces of dust-size mineral grains. Magnification approximately 10X.

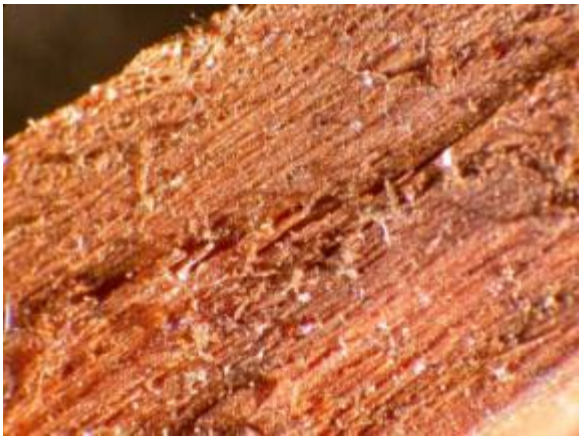

Figure 39. S-3 Ripple No. 3 - Light deposits of biological materials, possible traces of dust-size mineral grains. Magnification approximately 10X.

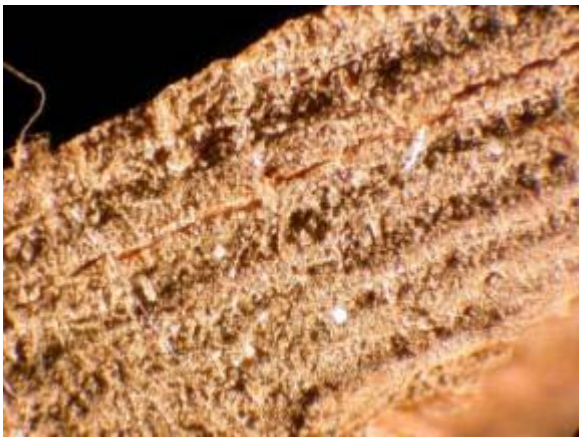

Figure 40. S-4 Ripple No. 2 - Moderate deposits of biological materials, light deposits of dust-size mineral grains. Magnification approximately 10X.

Figure 41. S-5 Ripple No. 2 - Light deposits of biological materials, traces of dust-size mineral grains. Magnification approximately 10X.

Figure 42. 45956 #1 Ripple No. 2 - Fine pale beige gray powder consisting of clay, insect parts, pollen, spores, minor quartz, feldspar, wollastonite, iron oxides, plant material, soot, traces of others. Magnification approximately 10X.

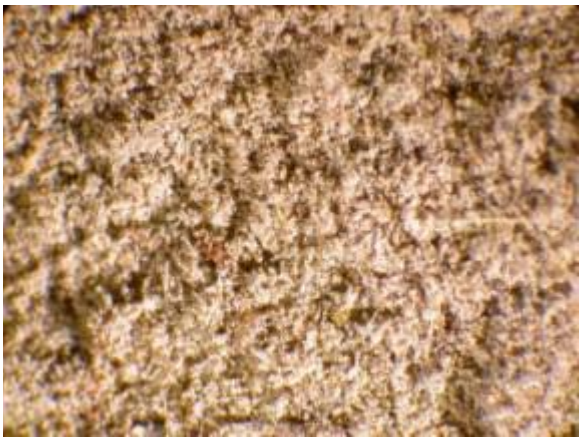

Figure 43. 45946 #2 Ripple No. 2 - Fine pale beige gray powder consisting of quartz, feldspar, mica, epidote, volcanic glass and other volcanic rocks, iron oxides, mafic mineral grains, fiberglass and mineral wool, insect parts, wood fragments, cloth fibers, plant fibers. Magnification approximately 15X.

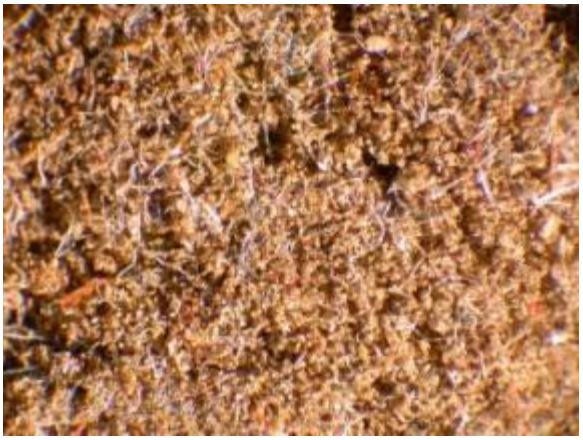

Figure 44. 45946 #3 Ripple No. 2 - Medium brown fine to medium grained powder with abundant fiberglass and dyed cloth fibers.

Microscope: Quartz, feldspar, volcanic glass and other volcanic rocks, quartzite, schist, mica, epidote, iron oxides, mafic mineral grains, fiberglass and mineral wool, insect parts, wood fragments, cloth fibers, plant fibers, and pollen. Magnification approximately 15X

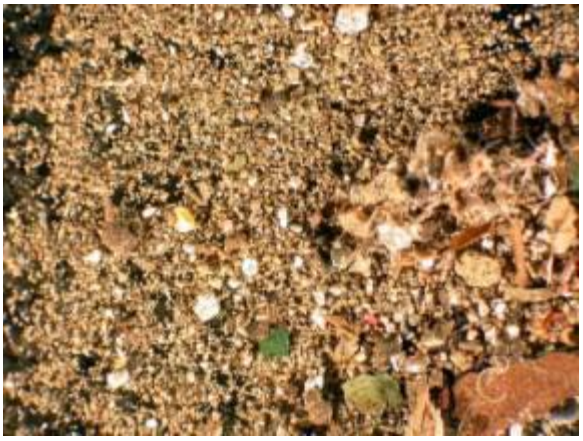

Figure 45. 45946 #4 Ripple No. 2 - Medium to dark brown, small sample, mostly granular minerals with small amounts of green paint chips, wood fragments, insect parts, and fibrous material.

Microscope: Quartz, feldspar, volcanic rock fragments, quartzite, schist, mica, iron oxides, epidote, pyroxene, amphiboles, traces of pollen, and fiberglass. Magnification approximately 15X

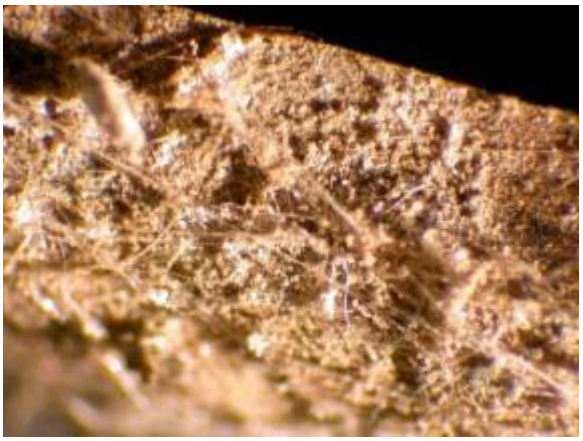

Figure 46. M-1 McManaman - Heavy deposits of silt-size siliceous mineral grains and biological material (much is fibrous). Magnification approximately 10X.

Figure 47. M-2 McManaman - Heavy deposits of silt-size siliceous mineral grains, smaller amounts of biological material (much is fibrous). Magnification approximately 10X.

Figure 48. M-3 McManaman - Moderate deposits of silt-size siliceous mineral grains, insect parts, and other biological materials. Magnification approximately 10X.

Figure 49. M-4 McManaman - Light to moderate deposits of dust to silt-size siliceous mineral grains and biological material. Magnification approximately 10X.

Figure 50. M-5 McManaman - Light to moderate deposits of dust to silt-size siliceous mineral grains and biological material. Magnification approximately 10X.

Figure 51. M-6 McManaman - Light deposits of dust and silt-size siliceous mineral grains, mostly in crevices. Locally, fibrous biological materials and insect parts. Magnification approximately 15X.

Figure 52. M-7 McManaman - Light deposits of dust to silt-size siliceous mineral grains and fibrous biological material. Magnification approximately 10X.

Figure 53. M-8 McManaman - Light deposits of dust to silt-size siliceous mineral grains, insect parts, and fibrous biological material. Magnification approximately 15X.

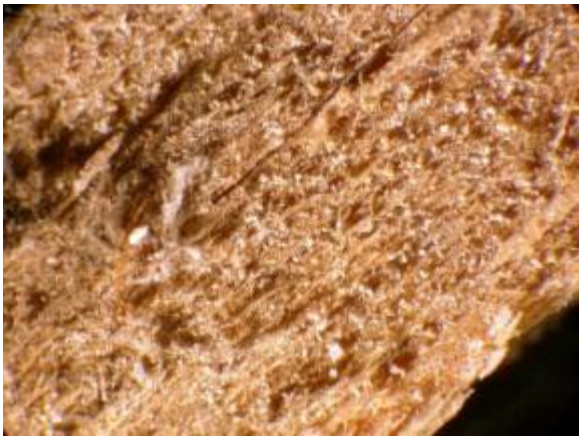

Figure 54. M-10 McManaman - Light to moderate deposits of dust to silt-size siliceous mineral grains, insect parts, and biological material. Magnification approximately 15X.

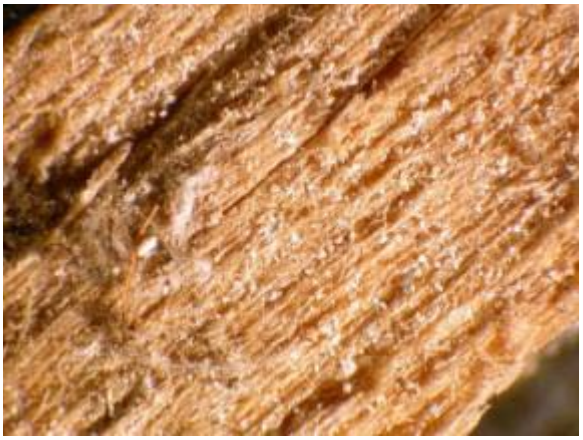

Figure 55. M-11 McManaman - Light deposits of dust to silt-size siliceous mineral grains and biological material. Magnification approximately 10X.

Figure 56. M-12 McManaman - Light deposits of dust-size whitish grains and biological material, traces of dust-size siliceous mineral grains. Magnification approximately 10X.

Figure 57. M-13 McManaman - Trace deposits of dust-size siliceous mineral grains and biological material. Magnification approximately 10X.

Figure 58. M-14 McManaman - Light deposits of dust to silt-size siliceous mineral grains and biological material. Magnification approximately 10X