WP 1. Laboratory experiments, field analog studies

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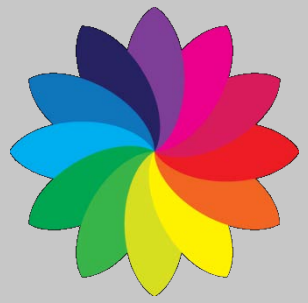
The goal is to get the best and most applicable samples

WP 1. Laboratory experiments, field analog studies

Fieldwork presentation (Henning):
Sampling of experimental and analog material

Laboratory presentation (Jean-Christophe):
Laboratory experiments and the UiO Alteration lab
XRD and SEM charactertization

Sampling sites for «Martian basalts», experimental material and field analogs



Experimental material and field analogs

Location		Main mineralogical composition
Martian basalts:		Komatiites, picrites with olivine, pyroxene (ortho- or clino-, various Ca content), plagioclase (An-rich), pyrrotite
Experimental Materials		
Iceland:	Reykjanes Volcanic Belt	Picrites: olivine, plagioclase (An90), chromite, augite Tholeiites: olivine, (quartz), plagioclase, pyroxene, titanite and glass
Oregon:	Clarno Fm.	Calc-alkaline and toleiitic tuff and flows: Plagioclase (labradoite to Ca-oligoclase), glass, alkali-feldspar, olivine, quartz, epidote, augite and clino- and ortho-pyroxenes, hematite
	John Day Fm.	Andesitic or dacitic tuffs: glass, plagioclase- andesine, sanidine, and oligoclase, quartz, smectites, clinoptiolite
	Columbia River Basalts	Tholeiites: Olivine, quartz, plagioclase (An rich), pigeonite and orthopyroxene, clinopyroxene, iron oxides, augite and glass
Tenerife:	Southern Volcanic Province	Basanites, phonolites: Olivine, clinopyroxene, amphibole, plagioclase (often An rich), alkali feldspar, iron titatium oxide, biotite, apatite.
Leka:	Ophiolite Complex	Serpentinised ultramafics with serpentine, ortho and clinopyroxene, clinochlore, olivine, chromite, magnetite
Oslo:	Rift	Fe-Ti-rich gabbros and basalts
South Africa:	Greenstone belt	Ferro-picrites
Impact melts:	Chesapeake Bay; Gardnos	Impact melts consist of amorphous glass and traces of minerals as plagioclase and quartz.
Surface Analogues		
Rio Tinto:		Jarosite, hematite, goethite and several sulphates and iron bearing minerals
Jaroso Ravine:		Jarosite, hematite, goethite and several sulphates (e.g., kieserite, gypsum) and iron bearing minerals
Oregon tuffs:	Clarno and John Day formations.	See above, in addition phases of zeolite, chlorite, smectite, kaolinite, calcite, hematite quartz, sphene
Tenerife:	Azulejos type alteration	Hydrothermal alteration; analcime, smectite, zeolite, sulphates, Mn- and Fe-oxides
Artificially composed materials		
Shergottite-like:		Crystalline and glassy materials similar to Martian meteorites, see for compositional details "Martian basalts" above.

MARTIAN BASALTS LOOK ALIKE

EXPERIMENTAL MATERIAL

SURFACE ANALOGS

ARTIFICIALLY COMPOSED MATERIAL

Experimental and field analog samples

Impact melt rocks; Gardnos, Vredefort, Chesapeake Bay. 4 samples

Brazil; Impact crater (Vista Allegre, Vargeao Dome). Brecciated volcanics. 4 samples

Spain, *Tenerife*: basanite, phonolite, altered phonolite, sandstones. 9 samples.
Gran Canary: basanite, phonolite, hyaloclastite, px rich lava, altered phonolite 9 samples.
Jaroso Ravine, recent precipitates, 3 samples
Rio Tinto, recent precipitates, 3 samples

Norway; *Oslo Rift,* gabbro, 3 samples
Leka, gabbro, harzburgite, dunite, tholeite, serpentinite cgl, 17 samples

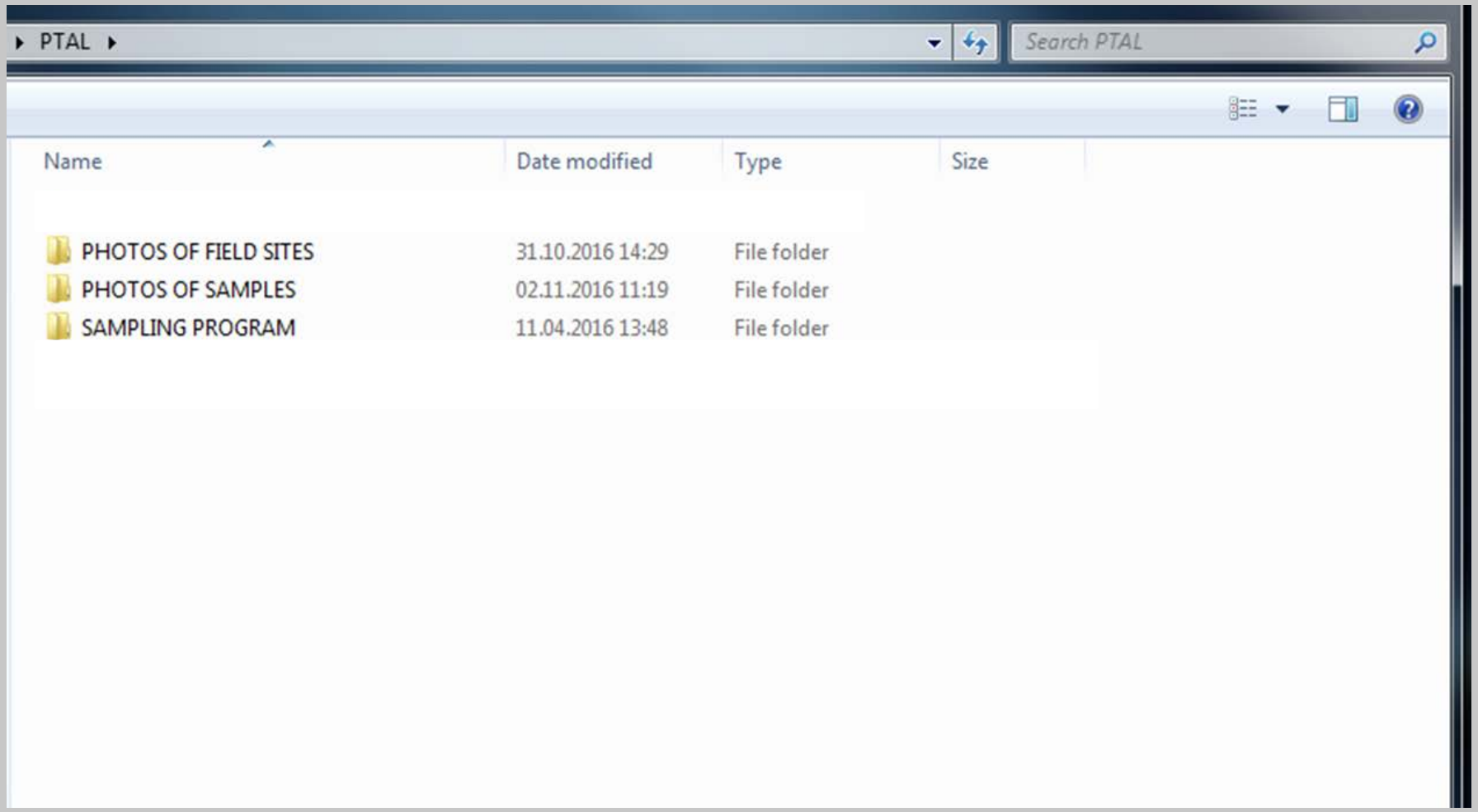
Scotland, *Rum,* ferropicrite, 1 sample

Antarctica, *Dry Vallies,* ortopyroxenite, 1 sample

USA, *Oregon,* basalts, al.ol basalt, altered basalts, rhyolites, and several soil profiles. 24 samples.

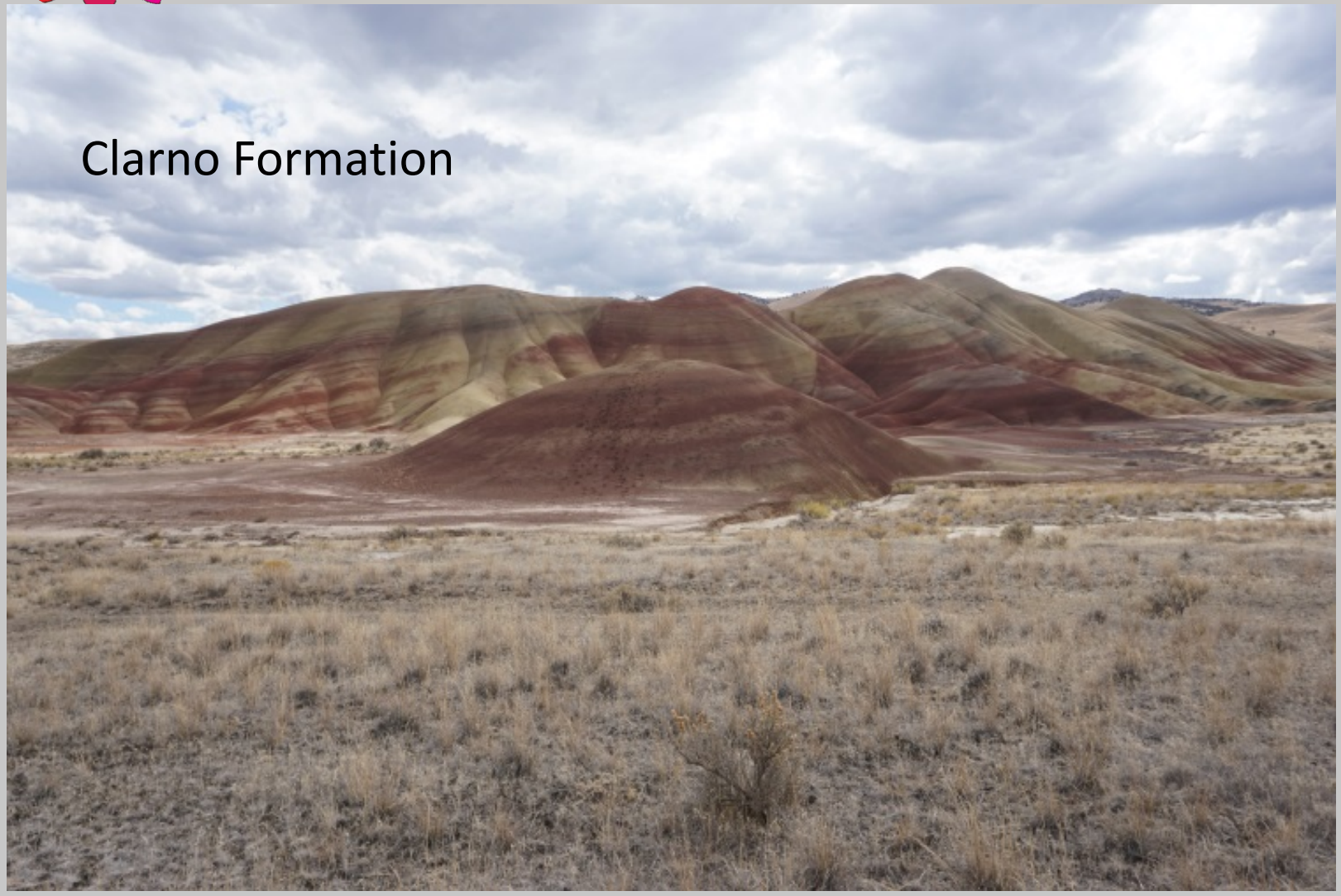
Iceland, *Reykjanes Peninsula*; ferropicrites, tholeites, recent precip. , 16 samples

The schedule program has been fulfilled with a couple of additions, totally 94 samples.
The sample selection and thin section and XRD analysis have started.
Artificially composed material have not been prepared



An example: Oregon, John Day area John Day and Clarno formations and Columbia River Basalts

Field sites; John Day area, Oregon, USA



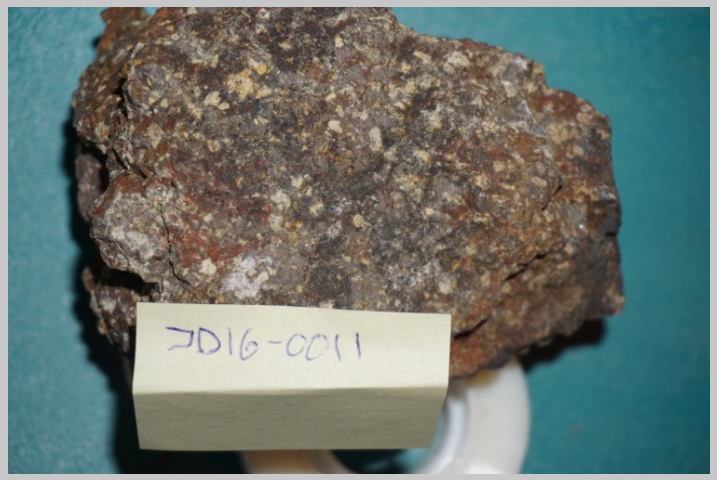
Field sites; John Day area, Oregon, USA

Field sites; John Day area, Oregon, USA

Picture Gorge Basalts

Sample photos; John Day area, Oregon, USA

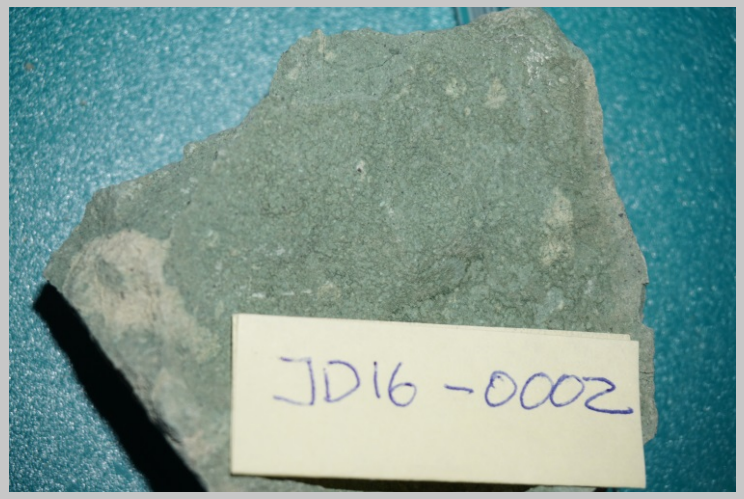
Unweathered rhyolite in the Clarno Fm.



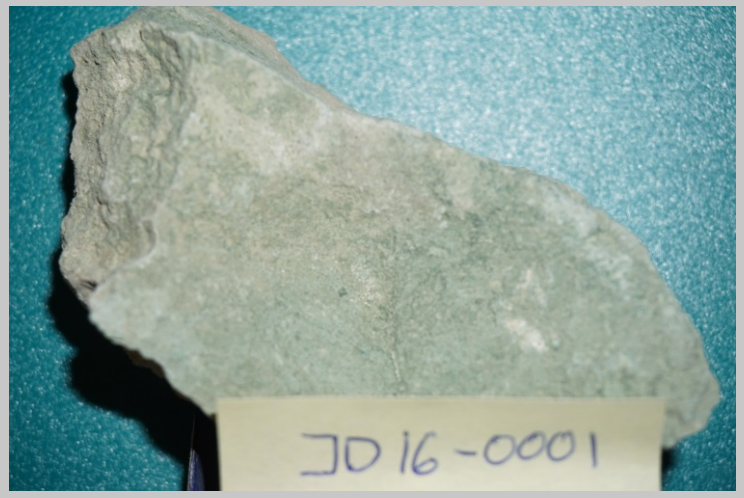
Weathered rhyolite in the Clarno Fm.

Sample photos; John Day area, Oregon, USA

Unweathered
John Day Fm.

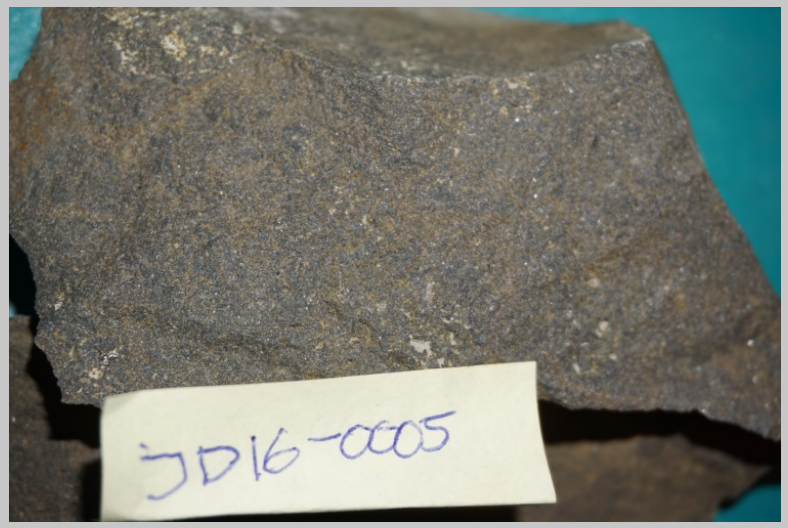


Weathered
John Day Fm.



Sample photos; John Day area, Oregon, USA

Unweathered
Picture Gorge Basalt
(Columbia River Basalt)



Weathered
Picture Gorge Basalt

Sample overview, Oregon, USA

		Sample place	Sample #		Sampled by	Sample date	Site	Level	Coordinates	Weight	Lithology	Strat. Level	Guidbook loc	References
88		Sample place	Sample #		Sampled by	Sample date	Site	Level	Coordinates	Weight	Lithology	Strat. Level	Guidbook loc	References
89		Dry Vallies			Dougal Jerram									
90														
91	Brazil													
92		Sample place	Sample #		Sampled by	Received inOs	Site	Level	Coordinates	Weight	Lithology	Strat. Level	Guidbook loc	References
93		Vista Allegre		VA16-0001	Alvaro Crosta	10.10.2016				134,45g	polymict breccia			Crosta et al., 2010 and 2011
94		Vargeao Dome		VO16-0001	Alvaro Crosta	10.10.2016				140,45g	BVR, brecciate volcanics			Crosta et al., 2010 and 2011
95		Vargeao Dome		VO16-0002	Alvaro Crosta	10.10.2016				133,10g	polymict breccia			Crosta et al., 2010 and 2011
96		Vargeao Dome		VO16-0003	Alvaro Crosta	10.10.2016	Alto Uruguay			257,0g	Serra General basalt			Crosta et al., 2010 and 2011
97														
98	USA													
99		John Day area												
100		Sample place	Sample #		Sampled by	Sample date	Site	Level	Coordinates	Weight	Lithology	Strat. Level	Guidbook loc	References
101		John Day Valley		JD16-0001	D	01.10.2016	Foree	along a path	N44.65.07.70 W119.63.79.27	260,89g	Paleosol+ carb.concr. Andisol, Xaxrus	John Day, Upper part. Turtle Cove		Retallack 2004, 40.1 m above base- 30.1 my
102		John Day Valley		JD16-0002	D	01.10.2016	Foree	along a path	N44.65.07.70 W119.63.79.27	209,58g	Unweatherd sed,	John Day, Upper part.Turtle Cove		Retallack 2004
103		John Day Valley		JD16-0003	D	01.10.2016	Picture Gorge	along the road	N44.53.05.70 W119.63.50.80	233,18g	weathered tuff,Entisol above, Inceptisol below			Sheldon,2003Coumbia River basalt gp.
104		John Day Valley		JD16-0004	D	01.10.2016	Picture Gorge	along the road	N44.53.05.70 W119.63.50.80	294,95g	Altered basalt	Picture G. basalt, 16 my		Coumbia River basalt gp.
105		John Day Valley		JD16-0005	D	01.10.2016	Picture Gorge	along the road	N44.53.05.70 W119.63.50.80	358,20g	Unaltered basalt	Picture G. basalt, 16 my		Coumbia River basalt gp.
106		John Day Valley		JD16-0006	D	01.10.2016	Picture Gorge	along the road	N44.51.20.65 W119.62.35.95	195,53g	Weather basalt, red zone. Alfisol. Miocene	Picture G. basalt, 16 my		Colum.Riv.Basalt, Sheldon 2003, Ilukas paleosol
107		John Day Valley		JD16-0007	D	01.10.2016	Picture Gorge	along the road	N44.51.20.65 W119.62.35.95	276,72g	Unweathered basalt	Picture G. basalt, 16 my		Colum.Riv.Basalt
108		John Day Valley		JD16-0008	D	01.10.2016	Mascall Basin	in the field	N44.50.30.3 W119.62.49.8	130,27g	Mascall Fm, M Miocene	weatherd, Skwisskwi-Alfisol. 15.5 my		Bestland et al 2008. 38m level in his section
109		John Day Valley		JD16-0009	D	01.10.2016	Mascall Basin	in the field	N44.50.30.3 W119.62.49.8	251,07g	Mascall Fm, M. miocene	Un weathered		
110		Painted Hills		JD16-0010	D	01.10.2016	Painted Hills	in the field	N44.65.32.2 W120.28.37.3	194,31g	Brown Grotto, Late Eocene- 40 my	Clarno Fm, Upper, oxisol on rhyc	A-horizon	Retallack et al 2000. Nukut paleosol. 5m below comp. Section
111		Painted Hills		JD16-0011	D	01.10.2016	Painted Hills	in the field	N44.65.32.2 W120.28.37.3	603,53g	Brown Grotto, Late Eocene 40 my	Clarno Fm, Upper	Unwethaerd	Rhyolitic lava?
112		Painted Hills		JD16-0012	D	01.10.2016	Painted Hills	in the field	N44.65.03.24 W120.28.40.14	144,69g	Brown Grotto, Late Eocene, 40 my	Clarno Fm. Upper, Oxisol(Tilwal	weathered	Retallack et al., 2000, 2 m below cop. Section
113		Painted Hills		JD16.0013	D	01.10.2016	Painted Hills	in the field	N44.65.03.24 W120.28.40.14	244,64g	Brown Grotto, late Eocene , 40 my	Clarno Fm, Upper	unweathered	
114		Painted Hills		JD16-0014	D	01.10.2016	Painted Hills	in the field	N44.65.27.81 W120.28.43.38	297,48g	Brown Grotto, 32 my,	John Day, Lower part, Big Basin I	weathered	Retallack et al 2000. Luca paleosol (Alfisol
115		Painted Hills		JD16-0015	D	01.10.2016	Painted Hills	in the field	N44.65.27.81 W120.28.43.38	154,92g	Brown Grotto, 32 my,	John Day, Lower part	original	
116		Clarno		JD16-0016	D	01.10.2016	Hancock Station	in the field	N44.92.21.7 W120.43.32.4	212,14g	Hancock Station, m Eocene43 my.	Clarno Fm, Upper, lower red bec	weathered	Retallack et al 2000, Lakayx -Ultisol, 70 m in comp. Section
117		Clarno		JD16-0017	D	01.10.2016	Hancock Station	in the field	N44.92.21.7 W120.43.32.4	206,63g	Hancock Station, m Eocene43 my.	Clarno Fm, Upper	unweathered	
118		Clarno		JD16-0018	D	01.10.2016	Hancock Station	in the field	N44.92.23.6 W120.43.34.7	320,01g	Hancock Station, M Eocene 42 my	Clarno Fm, Upper	weathered	Retallack et al 2000, Luca paleosol(Ultisol) 97montop Sitaxprofile.
119		Clarno		JD16-0019	D	01.10.2016	Hancock Station	in the field	N44.92.23.6 W120.43.34.7	349,90g	Hancock Station, M Eocene 42 my	Clarno Fm, Upper	unweathered	
120		Painted Hills		JD16-0020	D	02.10.2016	Painted Hills	in the field	N44.38.00.9 W120.13.10.6(WGS84	332,44g	3 mile from highway 26 intersection	John Day Fm	weathered alkali Olivin Baslat	
121		Painted Hills		JD16-0021	D	02.10.2016	Painted Hills	in the field	N44.38.00.9 W120.13.10.6(WGS84	423,27g	3 mile from highway 26 interersection	John Day Fm	unweathered alkali olivin basalt	
122		Painted Hills		JD16-0022	D	02.10.2016	Painted Hills	in the field	N44.38.22.8 W120.16.51.4(WGS84	206,07g	near Leaf Bed Parking	JohnDay, Lower, Big Basin, 37.5 r	weathered	Retallack et al., 2000
123		Painted Hills		JD16-0023	D	02.10.2016	Painted Hills	in the field	N44.38.22.8 W120.16.51.4(WGS84	213,62g	near Leaf Bed Parking	JohnDay, Lower, Big Basin, 37.5 r	unweatherec	Retallack et al., 2000
124		Painted Hills		JD16-0024	D	02.10.2016	Painted Hills	in the field	N44.38.22.8 W120.16.51.4(WGS84	325,61g	near Leaf Bed Parking	JohnDay, Lower, Big Basin, 37.5 r	unweatherd	Retallack et al., 2000
125														
126				Sampled by Henning D, under the supervision of Greg Retallack (UO)										
127	ICELAND													
128		Sample place	Sample #		Sampled by	Sample date	Site	Level	Coordinates	Weight	Lithology	Strat. Level	Guidbook loc	References
129		Reykjanes		IS16-0001	DV	26.10.2016	Haleyjabunga	in the field	N63 49 01.7 W22 39 03.1	355,77g	ferropicrite, in the crater			
130		Reykjanes		IS16-0002	DV	26.10.2016	Haleyjabunga	in the field	N63 49 01.7 W22 39 03.1	472,77g	ferropicrite, in the crater			
131		Near Stapafell		IS16-0003	DV	27.10.2016	Lagafell	in the field	N63 53 05.2 W22 32 10.8	251,81g	ferropicrite, along a fault outside crater			
132		Near Stapafell		IS16-0004	DV	27.10.2016	Lagafell	in the field	N63 52 56.4 W22 32 32.3	618,04g	ferropicrite, along a fault outside crater			
133		Near Stapafell		IS16-0005	DV	27.10.2016	Lagafell	in the field	N63 52 50.0 W22 32 24.6	647,80g	ferropicrite, in the crater			
134		Stapafell		IS16-0006	DV	27.10.2016	Stapafell	in the field	N63 54 19.9 W22 31 58.0	415,23g	sand of tholeittic lava			
135		Stapafell		IS16-0007	DV	27.10.2016	Stapafell	in the field	N63 54 19.9 W22 31 58.0	331,42g	tholeittic pillow lava			
136		Stapafell		IS16-0008	DV	27.10.2016	Stapafell	in the field	N63 54 19.9 W22 31 58.0	163,31g	tholeittic pillow lava			
137		Stapafell		IS16-0009	DV	27.10.2016	Stapafell	in the field	N63 54 15.5 W22 31 52.0	345,86g	layered sandstone of tholeittic lava			
138		Krysuvik		IS16-0010	DV	27.10.2016	Seltun	in the field	N63 53 44.9 W22 03 09.2	77,18g	Precip. Solfatara	recent		

Sheet1 Sheet2 Sheet3

Ready

Sample overview, Oregon, USA

USA								
	John Day area							
	Sample place	**Sample #**		**Sampled by**	**Sample date**	**Site**	**Level**	**Coordinates**
	John Day Valley		JD16-0001	D	01.10.2016	Foree	along a path	N44.65.07.70 W119.63.79.27
	John Day Valley		JD16-0002	D	01.10.2016	Foree	along a path	N44.65.07.70 W119.63.79.27
	John Day Valley		JD16-0003	D	01.10.2016	Picture Gorge	along the road	N44.53.05.70 W119.63.50.80
	John Day Valley		JD16-0004	D	01.10.2016	Picture Gorge	along the road	N44.53.05.70 W119.63.50.80
	John Day Valley		JD16-0005	D	01.10.2016	Picture Gorge	along the road	N44.53.05.70 W119.63.50.80
	John Day Valley		JD16-0006	D	01.10.2016	Picture Gorge	along the road	N44.51.20.65 W119.62.35.95
	John Day Valley		JD16-0007	D	01.10.2016	Picture Gorge	along the road	N44.51.20.65 W119.62.35.95
	John Day Valley		JD16-0008	D	01.10.2016	Mascall Basin	in the field	N44.50.30.3 W119.62.49.8
	John Day Valley		JD16-0009	D	01.10.2016	Mascall Basin	in the field	N44.50.30.3 W119.62.49.8
	Painted Hills		JD16-0010	D	01.10.2016	Painted Hills	in the field	N44.65.32.2 W120.28.37.3
	Painted Hills		JD16-0011	D	01.10.2016	Painted Hills	in the field	N44.65.32.2 W120.28.37.3
	Painted Hills		JD16-0012	D	01.10.2016	Painted Hills	in the field	N44.65.03.24 W120.28.40.14
	Painted Hills		JD16.0013	D	01.10.2016	Painted Hills	in the field	N44.65.03.24 W120.28.40.14
	Painted Hills		JD16-0014	D	01.10.2016	Painted Hills	in the field	N44.65.27.81 W120.28.43.38
	Painted Hills		JD16-0015	D	01.10.2016	Painted Hills	in the field	N44.65.27.81 W120.28.43.38
	Clarno		JD16-0016	D	01.10.2016	Hancock Station	in the field	N44.92.21.7 W120.43.32.4
	Clarno		JD16-0017	D	01.10.2016	Hancock Station	in the field	N44.92.21.7 W120.43.32.4
	Clarno		JD16-0018	D	01.10.2016	Hancock Station	in the field	N44.92.23.6 W120.43.34.7
	Clarno		JD16-0019	D	01.10.2016	Hancock Station	in the field	N44.92.23.6 W120.43.34.7
	Painted Hills		JD16-0020	D	02.10.2016	Painted Hills	in the field	N44.38.00.9 W120.13.10.6(WGS8
	Painted Hills		JD16-0021	D	02.10.2016	Painted Hills	in the field	N44.38.00.9 W120.13.10.6(WGS8
	Painted Hills		JD16-0022	D	02.10.2016	Painted Hills	in the field	N44.38.22.8 W120.16.51.4(WGS8
	Painted Hills		JD16-0023	D	02.10.2016	Painted Hills	in the field	N44.38.22.8 W120.16.51.4(WGS8
	Painted Hills		JD16-0024	D	02.10.2016	Painted Hills	in the field	N44.38.22.8 W120.16.51.4(WGS8
			Sampled by Henning D, under the supervision of Greg Retallack (UO)					

Sample overview, Oregon, USA

Weight	Lithology	Strat. Level	Guidbook loc	References
260,89g	Paleosol+ carb.concr. Andisol, Xaxrus	John Day, Upper part. Turtle Cove		Retallack 2004, 40.1 m above base- 30.1 my
209,58g	Unweatherd sed,	John Day, Upper part.Turtle Cove		Retallack 2004
233,18g	weathered tuff,Entisol above, Inceptisol below			Sheldon,2003Coumbia River basalt gp.
294,95g	Altered basalt	Picture G. basalt, 16 my		Coumbia River basalt gp.
358,20g	Unaltered basalt	Picture G. basalt, 16 my		Coumbia River basalt gp.
195,53g	Weather basalt, red zone. Alfisol. Miocene	Picture G. basalt, 16 my		Colum.Riv.Basalt, Sheldon 2003, Ilukas paleosol
276,72g	Unweathered basalt	Picture G. basalt, 16 my		Colum.Riv.Basalt
130,27g	Mascall Fm, M Miocene	weatherd, Skwisskwi-Alfisol. 15.5 my		Bestland et al 2008. 38m level in his section
251,07g	Mascall Fm, M. miocene	Un weathered		
194,31g	Brown Grotto, Late Eocene- 40 my	Clarno Fm, Upper, oxisol on rhyc	A-horizon	Retallack et al 2000. Nukut paleosol. 5m below comp. Section
603,53g	Brown Grotto, Late Eocene 40 my	Clarno Fm, Upper	Unwethaerd	Rhyolitic lava?
144,69g	Brown Grotto, Late Eocene, 40 my	Clarno Fm. Upper, Oxisol(Tilwal	weathered	Retallack et al., 2000, 2 m below cop. Section
244,64g	Brown Grotto, late Eocene , 40 my	Clarno Fm, Upper	unweathered	
297,48g	Brown Grotto, 32 my,	John Day, Lower part, Big Basin I	weathered	Retallack et al 2000. Luca paleosol (Alfisol
154,92g	Brown Grotto, 32 my,	John Day, Lower part	original	
212,14g	Hancock Station, m Eocene43 my.	Clarno Fm, Upper, lower red bec	weathered	Retallack et al 2000, Lakayx -Ultisol, 70 m in comp. Section
206,63g	Hancock Station, m Eocene43 my.	Clarno Fm, Upper	unweathered	
320,01g	Hancock Station, M Eocene 42 my	Clarno Fm, Upper	weathered	Retallack et al 2000, Luca paleosol(Ultisol) 97montop Sitaxprofile.
349,90g	Hancock Station, M Eocene 42 my	Clarno Fm, Upper	unweathered	
4 332,44g	3 mile from highway 26 intersection	John Day Fm	weathered	alkali Olivin Baslat
4 423,27g	3 mile from highway 26 interersection	John Day Fm	unweathered	alkali olivin basalt
4 206,07g	near Leaf Bed Parking	JohnDay, Lower, Big Basin, 37.5 r	weathered	Retallack et al., 2000
4 213,62g	near Leaf Bed Parking	JohnDay, Lower, Big Basin, 37.5 r	unweatherec	Retallack et al., 2000
4 325,61g	near Leaf Bed Parking	JohnDay, Lower, Big Basin, 37.5 r	unweatherd	Retallack et al., 2000

Thank you!