Thin Section Analysis Report

Sample ID:	WZ-1
Formation/Member Name:	Weir
Lithologic Classification:	Sandstone/Graywacke
Depth/Depth Range:	2462.7 ft
Date of Analysis:	6/28/2017
Analyzed by:	S. Shank

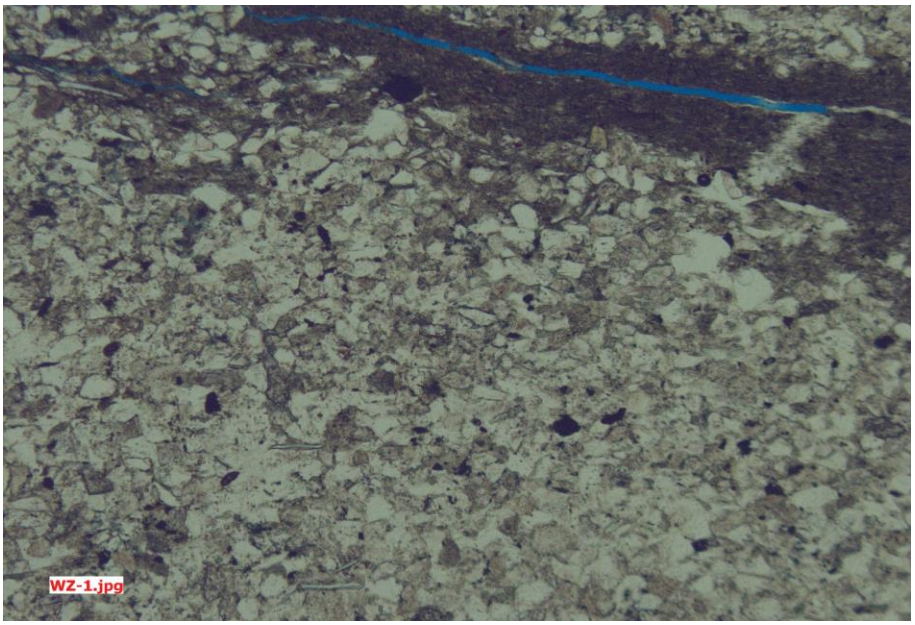
Texture		Comments
Grain Size	very fine-grained, 62-125µ	very fine-grained dirty sandstone, clays appear to be from alteration of feldspar, detrital and cement?, sparse carbonate
Rounding	subangular	
Sorting		

Composition/Detrital Minerals		Comments
Quartz		
Polycrystalline	<<1%	
Monocrystalline	65%	
Microcrystalline		
Feldspar		
Plagioclase	10%	
Orthoclase		rough estimates, now strongly altered to sericite
Microcline	10%	
Carbonate		
Calcite		
Dolomite		
Aragonite		
Clay		
Illite		
Smectite		
Kaolinite		
Muscovite	<1%	few scattered flakes, biotite also?
Chlorite	5%	scattered greenish grunge
Glauconite		
Rock Fragments		
Sedimentary		
Volcanic		
Metamorphic		
Other (Accessory Minerals)		

Cementing Materials		Comments
Quartz		minimal, difficult to observe because very fine-grained
Feldspar		
Carbonate	2%	scattered patches
Clay	8%	rough guess, hard to distinguish from detrital clay, altered feldspar
Iron Oxide, Hydoxide and/or Sulfide		
Other		

Visual Porosity Estimate	Comments
<<1%	no porosity except for thin discontinuous fracture

50x magnification, 2.5 mm field of view



Thin Section Analysis Report

Sample ID: WZ-2
Formation/Member Name: Weir
Lithologic Classification: Sandstone/Graywacke
Depth/Depth Range: 2474.9 ft
Date of Analysis: 6/28/2017
Analyzed by: S. Shank

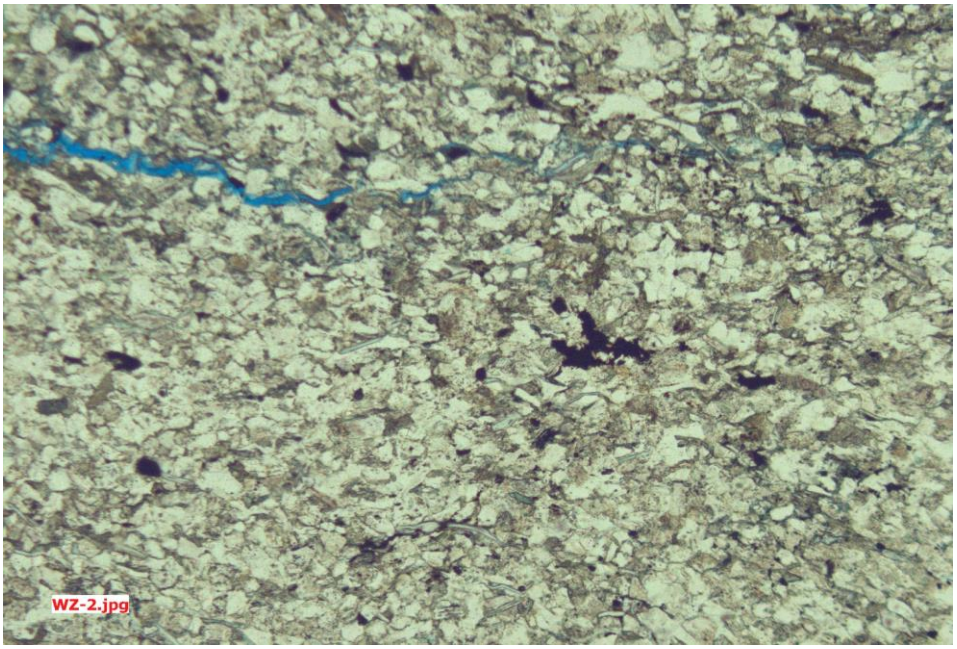
Texture		Comments
Grain Size	very fine-grained, 62-125µ	very fine-grained dirty sandstone, clays appear to be from alteration of feldspar, detrital and cement?, sparse carbonate
Rounding	subangular to subrounded	
Sorting	well sorted	

Composition/Detrital Minerals		Comments
Quartz		
Polycrystalline		
Monocrystalline	65%	
Microcrystalline		
Feldspar		
Plagioclase	10%	
Orthoclase		rough estimates, now strongly altered to sericite, alteration to carbonate also?
Microcline	10%	
Carbonate		
Calcite	2%	scattered grains and patches
Dolomite		
Aragonite		
Clay		
Illite		
Smectite		
Kaolinite		
Muscovite	<1%	few scattered flakes, biotite also?
Chlorite	5%	scattered greenish grunge
Glauconite		
Rock Fragments		
Sedimentary	<1%	1 mm shale clast
Volcanic		
Metamorphic		
Other (Accessory Minerals)		
	opaques	

Cementing Materials		Comments
Quartz		minimal, difficult to observe because very fine-grained
Feldspar		
Carbonate	2%	scattered patches
Clay	8%	rough guess, hard to distinguish from detrital clay, altered feldspar
Iron Oxide, Hydoxide and/or Sulfide		
Other		

Visual Porosity Estimate		Comments
	<<1%	virtually no porosity except for thin discontinuous fractures

50x magnification, 2.5 mm field of view



Thin Section Analysis Report

Sample ID: WZ-3
Formation/Member Name: Weir
Lithologic Classification: Sandstone/Graywacke
Depth/Depth Range: 2482.5 ft
Date of Analysis: 6/28/2017
Analyzed by: S. Shank

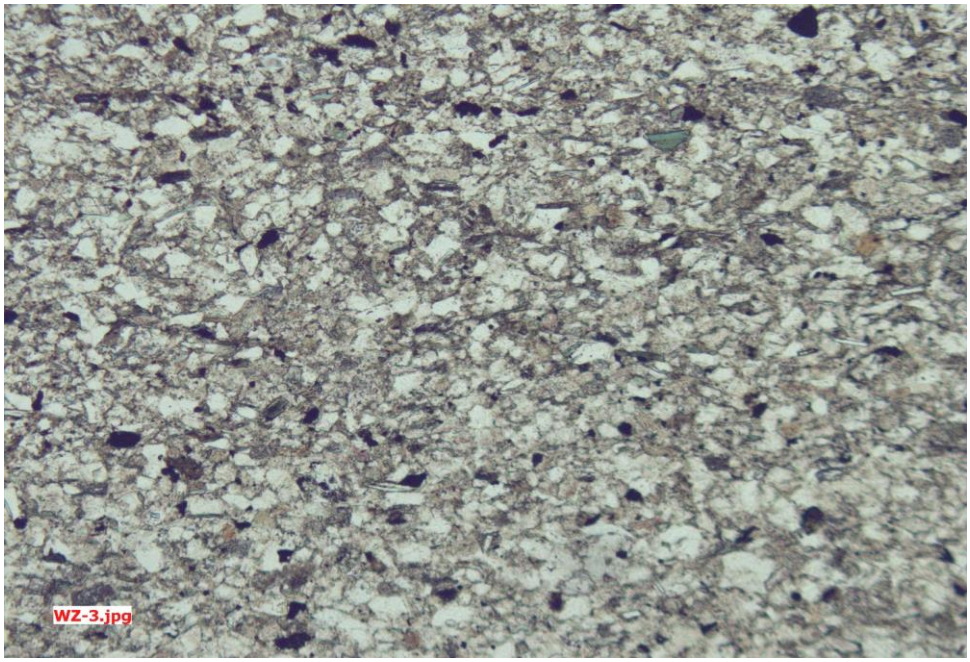
Texture		Comments
Grain Size	very fine-grained, 62-125µ	very fine-grained dirty sandstone, clays appear to be from alteration of feldspar, detrital and cement?, sparse carbonate
Rounding	subangular to subrounded	
Sorting	well sorted	

Composition/Detrital Minerals		Comments
Quartz		
Polycrystalline		
Monocrystalline	65%	
Microcrystalline		
Feldspar		
Plagioclase	10%	
Orthoclase		rough estimates, now strongly altered to sericite, alteration to carbonate also?
Microcline	10%	
Carbonate		
Calcite	2%	scattered grains and patches
Dolomite		
Aragonite		
Clay		
Illite		
Smectite		
Kaolinite		
Muscovite	<1%	few scattered flakes, biotite also?
Chlorite	5%	scattered greenish grunge
Glauconite		
Rock Fragments		
Sedimentary		
Volcanic		
Metamorphic		
Other (Accessory Minerals)		
	opaques	

Cementing Materials		Comments
Quartz		minimal, difficult to observe because very fine-grained
Feldspar		
Carbonate	2%	scattered patches
Clay	8%	rough guess, hard to distinguish from detrital clay, altered feldspar
Iron Oxide, Hydoxide and/or Sulfide		
Other		

Visual Porosity Estimate	Comments
<<1%	virtually no porosity

50x magnification, 2.5 mm field of view



Thin Section Analysis Report

Sample ID:	WZ-4
Formation/Member Name:	Weir
Lithologic Classification:	Sandstone/Graywacke
Depth/Depth Range:	2489.8 ft
Date of Analysis:	6/28/2017
Analyzed by:	S. Shank

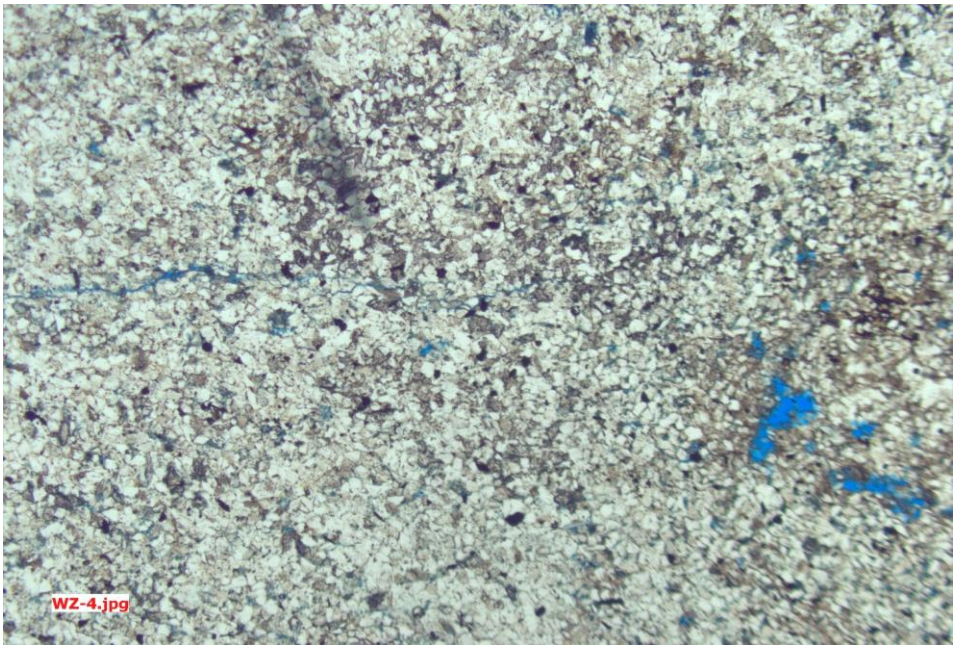
Texture		Comments
Grain Size	very fine-grained, 62-125µ	
		very fine-grained dirty sandstone, clays appear to be from alteration of feldspar, detrital and cement?, carbonate
Rounding	subangular to subrounded	
Sorting	well sorted	

Composition/Detrital Minerals		Comments
Quartz		
Polycrystalline		
Monocrystalline	75%	
Microcrystalline		
Feldspar		
Plagioclase	5%	
Orthoclase		rough estimates, now strongly altered to sericite, alteration to carbonate also?
Microcline	5%	
Carbonate		
Calcite	2%	scattered grains and patches
Dolomite		
Aragonite		
Clay		
Illite		
Smectite		
Kaolinite		
Muscovite	<1%	few scattered flakes, biotite also?
Chlorite	5%	scattered greenish grunge
Glauconite		
Rock Fragments		
Sedimentary		
Volcanic		
Metamorphic		
Other (Accessory Minerals)		
	opaques	

Cementing Materials		Comments
Quartz		minimal, difficult to observe because very fine-grained
Feldspar		
Carbonate	2%	scattered patches
Clay	8%	rough guess, hard to distinguish from detrital clay, altered feldspar
Iron Oxide, Hydoxide and/or Sulfide		
Other		

Visual Porosity Estimate		Comments
	1%	some intergranular porosity, patchy occurrence, few thin fractures

25x magnification, 5mm field of view



Thin Section Analysis Report

Sample ID:	WZ-5
Formation/Member Name:	Weir
Lithologic Classification:	Sandstone/graywacke
Depth/Depth Range:	2492.4 ft
Date of Analysis:	7/2/2017
Analyzed by:	S. Shank

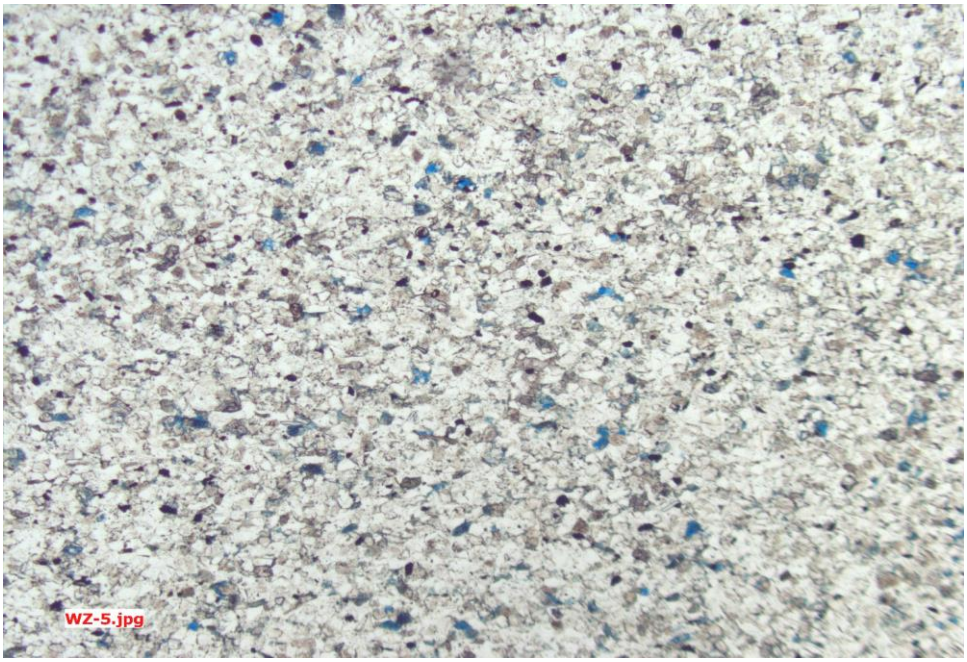
Texture		Comments
Grain Size	very fine-grained, 62-125µ	very fine-grained dirty sandstone, clays appear to be from alteration of feldspar, detrital and cement?, carbonate
Rounding	subangular to subrounded	
Sorting	well sorted	

Composition/Detrital Minerals		Comments
Quartz		
Polycrystalline		
Monocrystalline	75%	
Microcrystalline		
Feldspar		
Plagioclase	5%	
Orthoclase		rough estimates, now strongly altered to sericite, alteration to carbonate also?
Microcline	5%	
Carbonate		
Calcite	2%	scattered grains and patches
Dolomite		
Aragonite		
Clay		
Illite		
Smectite		
Kaolinite		
Muscovite	<1%	few scattered flakes, biotite also?
Chlorite	5%	scattered greenish grunge
Glauconite		
Rock Fragments		
Sedimentary		
Volcanic		
Metamorphic		
Other (Accessory Minerals)		
	opaques	

Cementing Materials		Comments
Quartz		minimal, difficult to observe because very fine-grained
Feldspar		
Carbonate	2%	scattered patches
Clay	8%	rough guess, hard to distinguish from detrital clay, altered feldspar
Iron Oxide, Hydoxide and/or Sulfide		
Other		

Visual Porosity Estimate	Comments
1%	some intergranular porosity

25x magnification, 5mm field of view



Thin Section Analysis Report

Sample ID: WZ-6
Formation/Member Name: Weir
Lithologic Classification: Sandstone/Graywacke
Depth/Depth Range: 2497.5 ft
Date of Analysis: 7/2/2017
Analyzed by: S. Shank

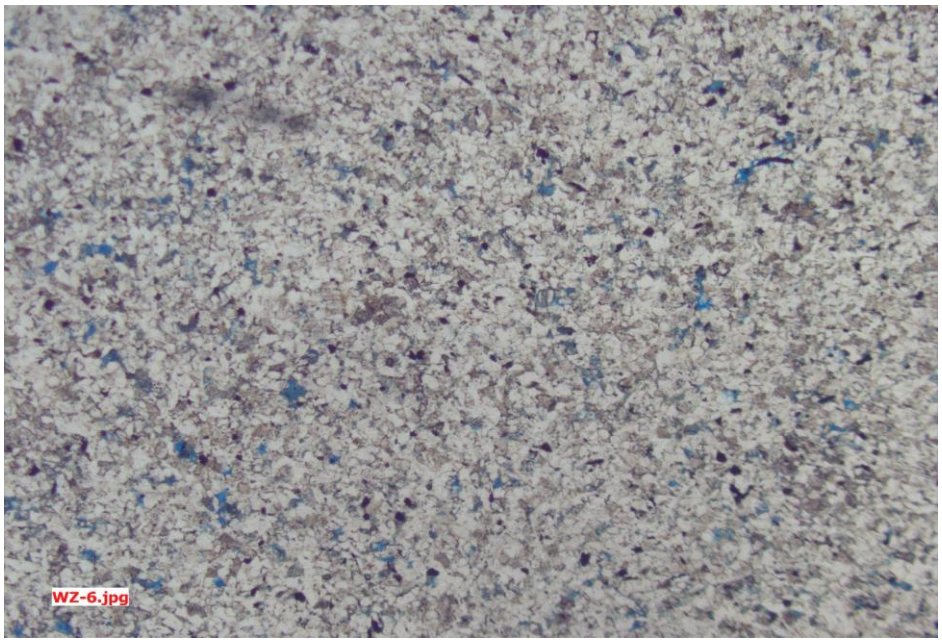
Texture		Comments
Grain Size	very fine-grained, 62-125µ	
		very fine-grained dirty sandstone, clays appear to be from alteration of feldspar, detrital and cement?, carbonate
Rounding	subangular to subrounded	
Sorting	well sorted	

Composition/Detrital Minerals		Comments
Quartz		
Polycrystalline		
Monocrystalline	75%	
Microcrystalline		
Feldspar		
Plagioclase	5%	
Orthoclase		rough estimates, now strongly altered to sericite, alteration to carbonate also?
Microcline	5%	
Carbonate		
Calcite	2%	scattered grains and patches
Dolomite		
Aragonite		
Clay		
Illite		
Smectite		
Kaolinite		
Muscovite	<1%	few scattered flakes, biotite also?
Chlorite	5%	scattered greenish grunge
Glauconite		
Rock Fragments		
Sedimentary		
Volcanic		
Metamorphic		
Other (Accessory Minerals)		
	opaques	

Cementing Materials		Comments
Quartz		
		minimal, difficult to observe because very fine-grained
Feldspar		
Carbonate	2%	scattered patches
Clay	8%	rough guess, hard to distinguish from detrital clay, altered feldspar
Iron Oxide, Hydoxide and/or Sulfide		
Other		

Visual Porosity Estimate	Comments
2%	some intergranular porosity

25x magnification, 5mm field of view



Thin Section Analysis Report

Sample ID:	WZ-3
Formation/Member Name:	Weir
Lithologic Classification:	Sandstone/Graywacke
Depth/Depth Range:	2502.8 ft
Date of Analysis:	7/2/2017
Analyzed by:	S. Shank

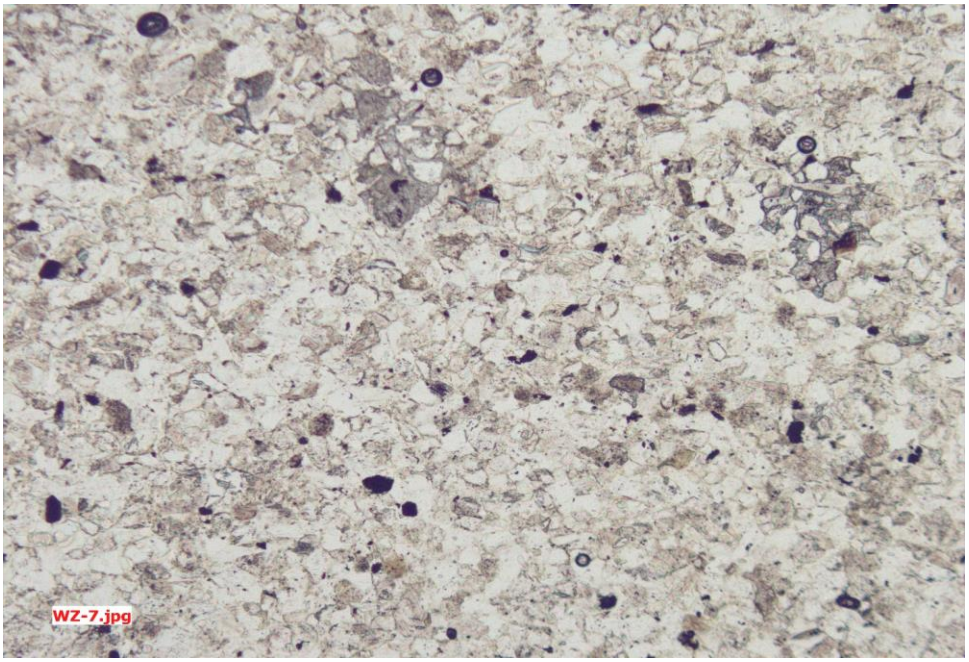
Texture		Comments
Grain Size	very fine-grained, 62-125µ	very fine-grained dirty sandstone, clays appear to be from alteration of feldspar, detrital and cement?, sparse carbonate
Rounding	subangular to subrounded	
Sorting	well sorted	

Composition/Detrital Minerals		Comments
Quartz		
Polycrystalline		
Monocrystalline	65%	
Microcrystalline		
Feldspar		
Plagioclase	10%	
Orthoclase		rough estimates, now strongly altered to sericite, alteration to carbonate also?
Microcline	10%	
Carbonate		
Calcite	2%	scattered grains and patches
Dolomite		
Aragonite		
Clay		
Illite		
Smectite		
Kaolinite		
Muscovite	<1%	few scattered flakes, biotite also?
Chlorite	5%	scattered greenish grunge
Glauconite		
Rock Fragments		
Sedimentary		
Volcanic		
Metamorphic		
Other (Accessory Minerals)		
	opaques	

Cementing Materials		Comments
Quartz		minimal, difficult to observe because very fine-grained
Feldspar		
Carbonate	2%	scattered patches
Clay	8%	rough guess, hard to distinguish from detrital clay, altered feldspar
Iron Oxide, Hydoxide and/or Sulfide		
Other		

Visual Porosity Estimate	Comments
<<1%	virtually no porosity

50x magnification, 2.5 mm field of view



Thin Section Analysis Report

Sample ID:	WZ-8
Formation/Member Name:	Weir
Lithologic Classification:	Sandstone/Graywacke
Depth/Depth Range:	2516.8 ft
Date of Analysis:	7/2/2017
Analyzed by:	S. Shank

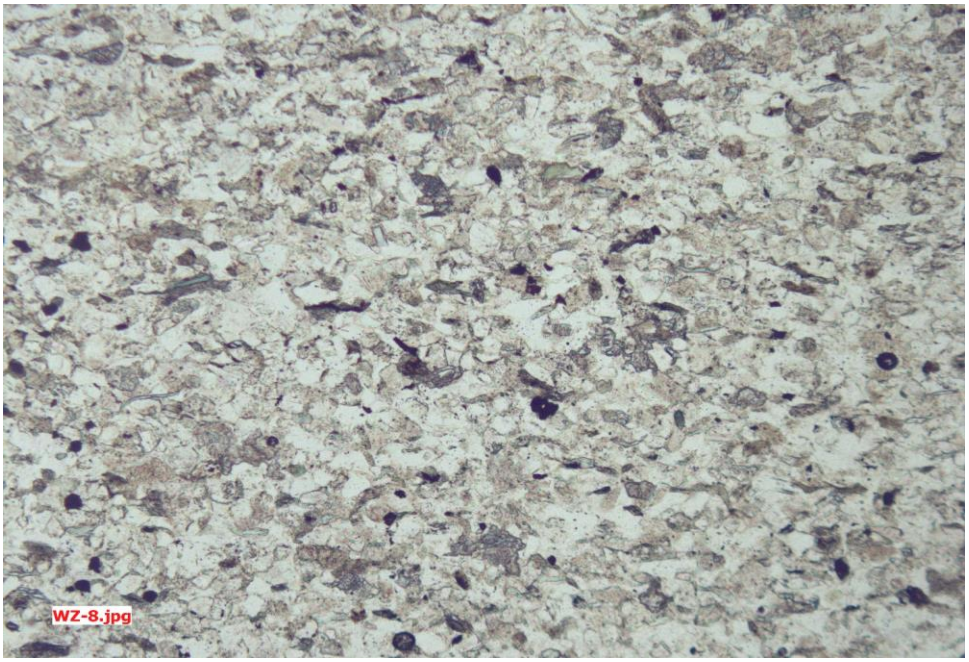
Texture		Comments
Grain Size	very fine-grained, 62-125µ	very fine-grained dirty sandstone, clays appear to be from alteration of feldspar, detrital and cement?, carbonate
Rounding	subangular to subrounded	
Sorting	well sorted	

Composition/Detrital Minerals		Comments
Quartz		
Polycrystalline		
Monocrystalline	70%	
Microcrystalline		
Feldspar		
Plagioclase	8%	
Orthoclase		rough estimates, now strongly altered to sericite, alteration to carbonate also?
Microcline	8%	
Carbonate		
Calcite	2%	scattered grains and patches
Dolomite		
Aragonite		
Clay		
Illite		
Smectite		
Kaolinite		
Muscovite	<1%	few scattered flakes, biotite also?
Chlorite	5%	scattered greenish grunge
Glauconite		
Rock Fragments		
Sedimentary		
Volcanic		
Metamorphic		
Other (Accessory Minerals)		
	opaques	

Cementing Materials		Comments
Quartz		minimal, difficult to observe because very fine-grained
Feldspar		
Carbonate	2%	scattered patches
Clay	5%	rough guess, hard to distinguish from detrital clay, altered feldspar
Iron Oxide, Hydoxide and/or Sulfide		
Other		

Visual Porosity Estimate	Comments
0%	no apparent porosity, no blue epoxy?

50x magnification, 2.5 mm field of view



Thin Section Analysis Report

Sample ID:	WZ-9
Formation/Member Name:	Weir
Lithologic Classification:	Clayey Sandstone
Depth/Depth Range:	2536.8 ft
Date of Analysis:	6/22/2017
Analyzed by:	L. Ditzler

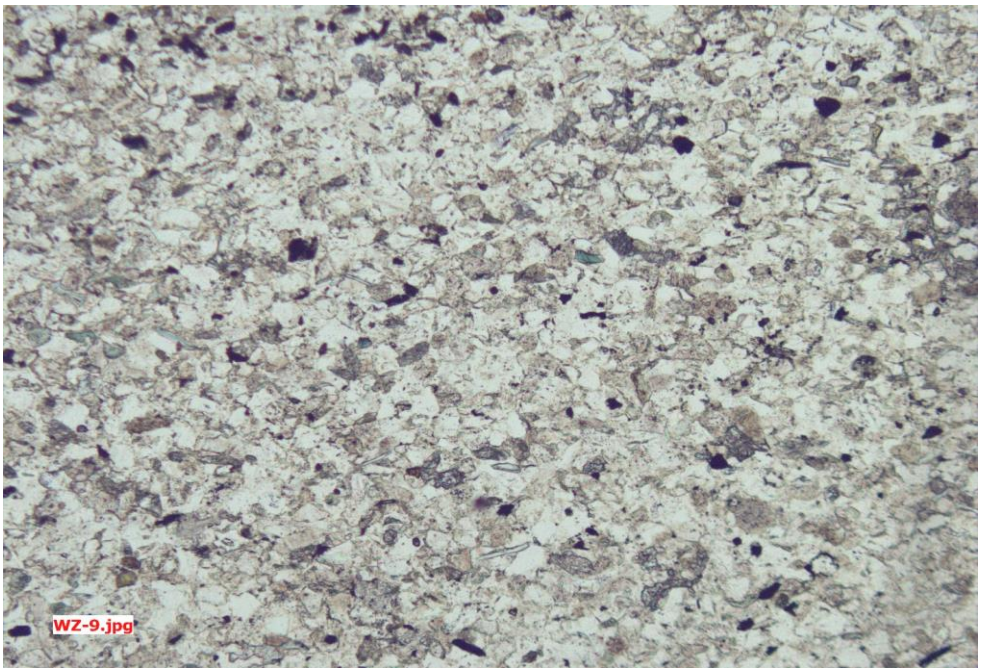
Texture		Comments
Grain Size	very fine-grained, 62-125µ	
Rounding	subrounded	
Sorting	very well sorted	

Composition/Detrital Minerals		Comments
Quartz		
Polycrystalline		
Monocrystalline	77%	
Microcrystalline		
Feldspar		
Plagioclase	1%	total feldspar
Orthoclase		
Microcline		
Carbonate		
Calcite	1%	scattered grains and patches
Dolomite		
Aragonite		
Clay		
Illite		
Smectite		
Kaolinite		
Muscovite		
Chlorite		
Glauconite		
Rock Fragments		
Sedimentary		
Volcanic		
Metamorphic		
Other (Accessory Minerals)		
	2%	opaques

Cementing Materials		Comments
Quartz		
Feldspar		
Carbonate	1%	scattered patches
Clay	18%	grains of muscovite and chlorite exist, but clays occur mostly as a cement
Iron Oxide, Hydoxide and/or Sulfide		
Other		

Visual Porosity Estimate	Comments
1%	but no blue epoxy?

50x magnification, 2.5 mm field of view



Thin Section Analysis Report

Sample ID:	WZ-10
Formation/Member Name:	Weir
Lithologic Classification:	Clayey Sandstone
Depth/Depth Range:	2539.7 ft
Date of Analysis:	6/22/2017
Analyzed by:	L. Ditzler

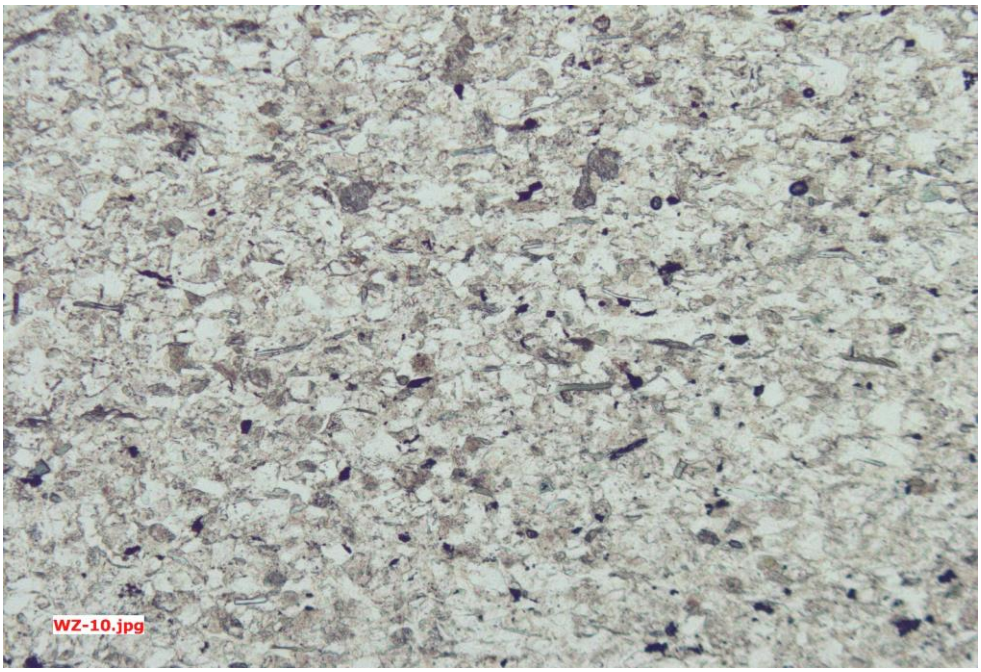
Texture		**Comments**
Grain Size	very fine-grained, 62-125µ	
Rounding	subrounded	
Sorting	very well sorted	

Composition/Detrital Minerals		**Comments**
Quartz		
Polycrystalline		
Monocrystalline	78%	
Microcrystalline		
Feldspar		
Plagioclase	1%	total feldspar
Orthoclase		
Microcline		
Carbonate		
Calcite	<1%	scattered grains and patches
Dolomite		
Aragonite		
Clay		
Illite		
Smectite		
Kaolinite		
Muscovite		
Chlorite		
Glauconite		
Rock Fragments		
Sedimentary		
Volcanic		
Metamorphic		
Other (Accessory Minerals)		
	1%	opaques

Cementing Materials		**Comments**
Quartz		
Feldspar		
Carbonate		
Clay	20%	grains of muscovite and chlorite exist, but clays occur mostly as a cement
Iron Oxide, Hydoxide and/or Sulfide		
Other		

Visual Porosity Estimate	**Comments**
2%	but no blue epoxy?

50x magnification, 2.5 mm field of view



Thin Section Analysis Report

Sample ID:	WZ-11
Formation/Member Name:	Weir
Lithologic Classification:	Clayey Sandstone
Depth/Depth Range:	2545.4 ft
Date of Analysis:	6/19/2017
Analyzed by:	L. Ditzler

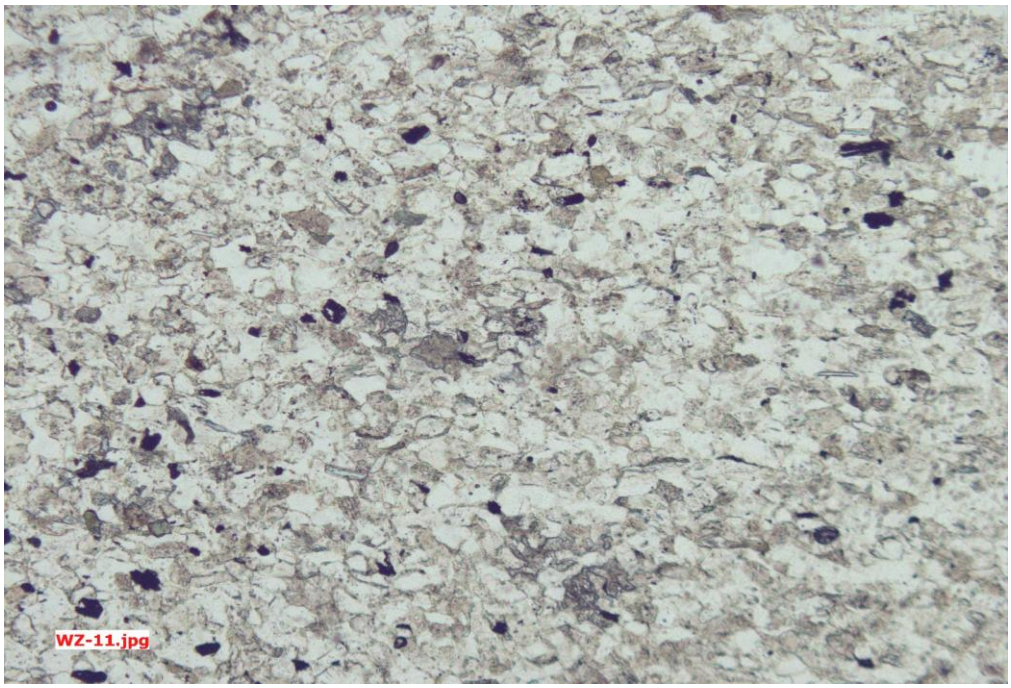
Texture		**Comments**
Grain Size	very fine-grained, 62-125µ	
Rounding	poorly rounded	
Sorting	very well sorted	

Composition/Detrital Minerals		**Comments**
Quartz		
Polycrystalline		
Monocrystalline	87%	
Microcrystalline		
Feldspar		
Plagioclase	2%	total feldspar
Orthoclase		
Microcline		
Carbonate		
Calcite	<1%	scattered grains and patches
Dolomite		
Aragonite		
Clay		
Illite		
Smectite		
Kaolinite		
Muscovite		
Chlorite		
Glauconite		
Rock Fragments		
Sedimentary		
Volcanic		
Metamorphic		
Other (Accessory Minerals)		
	1%	opaques

Cementing Materials		**Comments**
Quartz		
Feldspar		
Carbonate	2%	scattered patches
Clay	8%	cement
Iron Oxide, Hydoxide and/or Sulfide		
Other		

Visual Porosity Estimate	**Comments**
<1%	but no blue epoxy?

50x magnification, 2.5 mm field of view



Thin Section Analysis Report

Sample ID:	WZ-12
Formation/Member Name:	Weir
Lithologic Classification:	Clayey Sandstone
Depth/Depth Range:	2550.5 ft
Date of Analysis:	6/19/2017
Analyzed by:	L. Ditzler

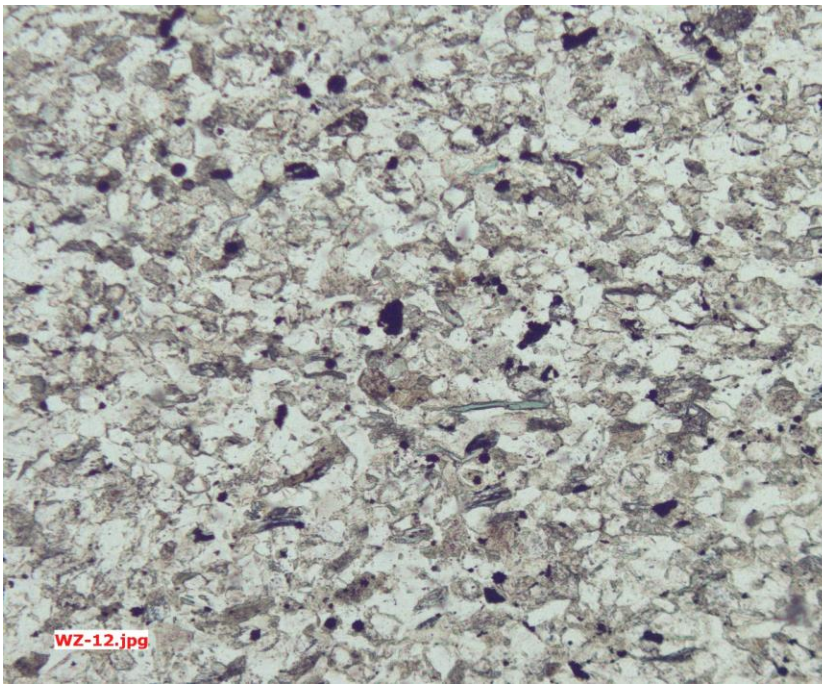
Texture		**Comments**
Grain Size	very fine-grained, 62-125µ	
Rounding	subangular	
Sorting	very well sorted	

Composition/Detrital Minerals		**Comments**
Quartz		
Polycrystalline	2%	
Monocrystalline	84%	
Microcrystalline		
Feldspar		
Plagioclase	2%	total feldspar
Orthoclase		
Microcline		
Carbonate		
Calcite		
Dolomite		
Aragonite		
Clay		
Illite		
Smectite		
Kaolinite		
Muscovite		
Chlorite		
Glauconite		
Rock Fragments		
Sedimentary		
Volcanic		
Metamorphic		
Other (Accessory Minerals)		
	2%	opaque, dark red brown

Cementing Materials		**Comments**
Quartz		
Feldspar		
Carbonate	2%	scattered patches
Clay	8%	
		grains of muscovite and chlorite exist, but clays occur mostly as a cement
Iron Oxide, Hydoxide and/or Sulfide		
Other		

Visual Porosity Estimate	**Comments**
1%	but no blue epoxy?

50x magnification, 2.5 mm field of view



Thin Section Analysis Report

Sample ID:	WZ-13
Formation/Member Name:	Weir
Lithologic Classification:	clayey sandstone
Depth/Depth Range:	2560.2 ft
Date of Analysis:	6/19/2017
Analyzed by:	L. Ditzler

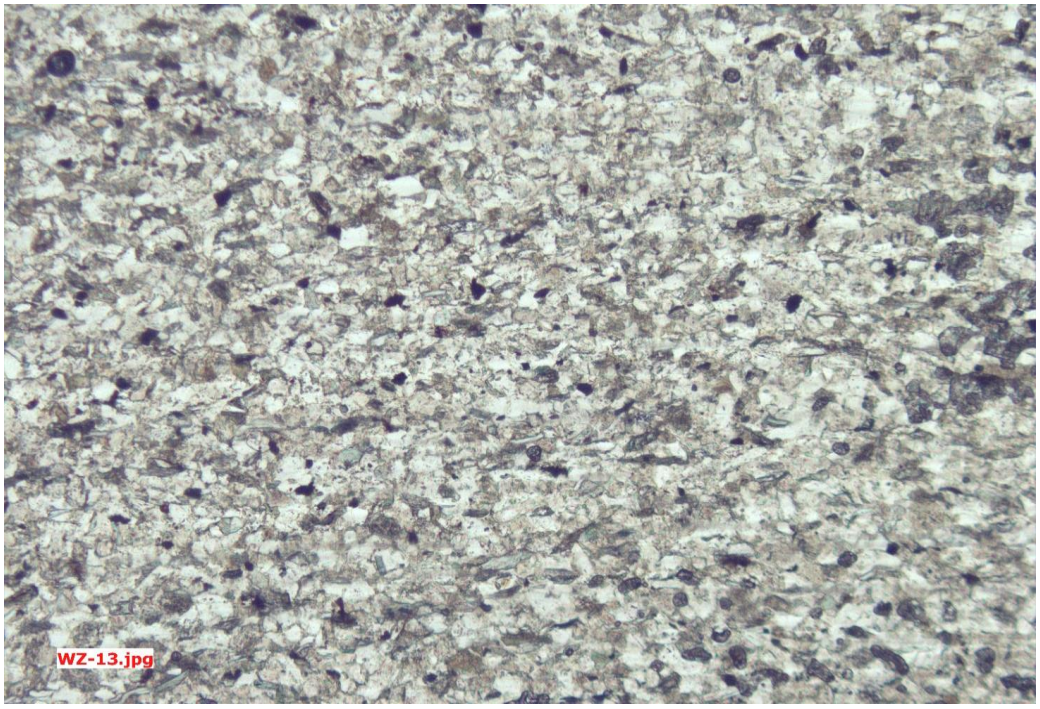
Texture		**Comments**
Grain Size	very fine-grained, 62-125µ	
Rounding	subangular	
Sorting	well sorted	

Composition/Detrital Minerals			**Comments**
Quartz			
Polycrystalline			
Monocrystalline		50%	
Microcrystalline			
Feldspar			
Plagioclase	<1%		total feldspar
Orthoclase			
Microcline			
Carbonate			
Calcite			
Dolomite			
Aragonite			
Clay			
Illite			
Smectite			
Kaolinite			
Muscovite	<1%		
Chlorite	<1%		
Glauconite			
Rock Fragments			
Sedimentary			
Volcanic			
Metamorphic			
Other (Accessory Minerals)			
		1%	opaque, dark red brown

Cementing Materials		**Comments**
Quartz		
Feldspar		
Carbonate	<1%	scattered patches
		some clay and mica grains, some clay
Clay	49%	cement
Iron Oxide, Hydoxide and/or Sulfide		
Other		

Visual Porosity Estimate		**Comments**
	1%	but no blue epoxy?

50x magnification, 2.5 mm field of view



Thin Section Analysis Report

Sample ID:	WZ-14
Formation/Member Name:	Weir
Lithologic Classification:	clayey sandstone
Depth/Depth Range:	2685 ft
Date of Analysis:	6/19/2017
Analyzed by:	L. Ditzler

Texture		**Comments**
Grain Size	very fine-grained, 62-125µ	
Rounding	subangular	
Sorting	well sorted	

Composition/Detrital Minerals		**Comments**
Quartz		
Polycrystalline		
Monocrystalline	85%	
Microcrystalline		
Feldspar		
Plagioclase	<1%	total feldspar
Orthoclase		
Microcline		
Carbonate		
Calcite		
Dolomite		
Aragonite		
Clay		
Illite		
Smectite		
Kaolinite		
Muscovite	1%	
Chlorite		
Glauconite		
Rock Fragments		
Sedimentary		
Volcanic		
Metamorphic		
Other (Accessory Minerals)		
	5%	opaque, dark red brown

Cementing Materials		**Comments**
Quartz		
Feldspar		
Carbonate	<1%	scattered patches
Clay	9%	
Iron Oxide, Hydoxide and/or Sulfide	<1%	some Fe-oxide cement
Other		

Visual Porosity Estimate	**Comments**
<1%	but no blue epoxy?

50x magnification, 2.5 mm field of view

