

Wisconsin Geological and Natural History Survey Open-File Report 2019-01  
Zambito, J.J., IV, Haas, L.D., Parsen, M.J., and McLaughlin, P.I.

## Appendix E. XRD results

Site	Region	Type	Sample	WID	Sample	Unit	Quartz SiO <sub>2</sub>	K-Spar KAISi <sub>3</sub> O <sub>8</sub>	Glaucanite K(Fe,Al) <sub>2</sub> (Si,Al) <sub>4</sub> OH <sub>2</sub>	Dolomite CaMg(CO <sub>3</sub> ) <sub>2</sub>	Calcite/ Aragonite CaCO <sub>3</sub>	Pyrite FeS <sub>2</sub>	Sphalerite ZnS <sub>2</sub>	Chalcopyrite CuFeS <sub>2</sub>	Covellite CuS
7	west-central	outcrop	Arbor Hills Addition Well	32000107	255-260'	Tunnel City						?			
7	west-central	outcrop	Arbor Hills Addition Well	32000107	400-405'	Wonewoc									
6	west-central	core	Granddad Bluff La Crosse	outcrop	3.95a m	Tunnel City			?						
6	west-central	core	Granddad Bluff La Crosse	outcrop	3.95b m	Tunnel City						?			
6	west-central	core	Granddad Bluff La Crosse	outcrop	3.95c m	Tunnel City									
6	west-central	core	Granddad Bluff La Crosse	outcrop	3.95d m	Tunnel City									
6	west-central	core	Granddad Bluff La Crosse	outcrop	3.25a m	Tunnel City									
6	west-central	core	Granddad Bluff La Crosse	outcrop	0.95 m	Tunnel City									
6	west-central	outcrop	Granddad Bluff La Crosse	outcrop	-0.65 m	Wonewoc		?							
6	west-central	outcrop	Granddad Bluff La Crosse	outcrop	-3.55 m	Wonewoc									
2	west-central	outcrop	WGNHS Belisle Quarry	56000829	132.0'	Tunnel City		?							
2	west-central	outcrop	WGNHS Belisle Quarry	56000829	146.0'	Tunnel City									
2	west-central	outcrop	WGNHS Belisle Quarry	56000829	182.0'	Wonewoc									
2	west-central	outcrop	WGNHS Belisle Quarry	56000829	199.0'	Wonewoc									
5	west-central	core	WGNHS Arcadia Quarry	62000166	290.0'	Tunnel City									
5	west-central	core	WGNHS Arcadia Quarry	62000166	296.6'	Tunnel City									
5	west-central	core	WGNHS Arcadia Quarry	62000166	313.7'	Tunnel City					?				
5	west-central	core	WGNHS Arcadia Quarry	62000166	313.8'	Tunnel City									
5	west-central	core	WGNHS Arcadia Quarry	62000166	313.9'	Tunnel City									
5	west-central	core	WGNHS Arcadia Quarry	62000166	314.1'	Tunnel City									
5	west-central	core	WGNHS Arcadia Quarry	62000166	323.9'	Tunnel City						?			
5	west-central	core	WGNHS Arcadia Quarry	62000166	338.4'	Tunnel City							?		
5	west-central	core	WGNHS Arcadia Quarry	62000166	339.7'	Tunnel City							?		?
5	west-central	core	WGNHS Arcadia Quarry	62000166	383.1'	Wonewoc					?	?			
5	west-central	cuttings	WGNHS Arcadia Quarry	62000166	395.5'	Wonewoc					?	?	?		
5	west-central	cuttings	WGNHS Arcadia Quarry	62000166	405.5'	Wonewoc					?	?	?		
17	south-central	core	WGNHS Triemstra Quarry	110005900	165.0'	Tunnel City									
17	south-central	core	WGNHS Triemstra Quarry	110005900	166.0'	Tunnel City									?
17	south-central	core	WGNHS Triemstra Quarry	110005900	171.0'	Wonewoc		?			?				
17	south-central	core	WGNHS Triemstra Quarry	110005900	176.0'	Wonewoc									
17	south-central	core	WGNHS Triemstra Quarry	110005900	180.0'	Wonewoc									
17	south-central	core	WGNHS Triemstra Quarry	110005900	202.9'	Wonewoc									

**Summary of XRD data.**

Tunnel city samples are shaded for ease of reading. Presence of a mineral in a sample is denoted by solid color fill.

? = XRD pattern was suggestive of mineral, but it could not be identified for certain.

# Bailey X-ray Diffraction Laboratory

## Weeks Hall, UW-Madison

Report Prepared by: Tina R. Hill, Ph.D. August 8, 2016

(Adapted for this appendix by J. Zambito January, 2017)



[AH11\_061416\_113pm.asc]

Site 7

32000107 Arbor Hills Add. Well 255-260'

Quartz ( $\text{SiO}_2$ )

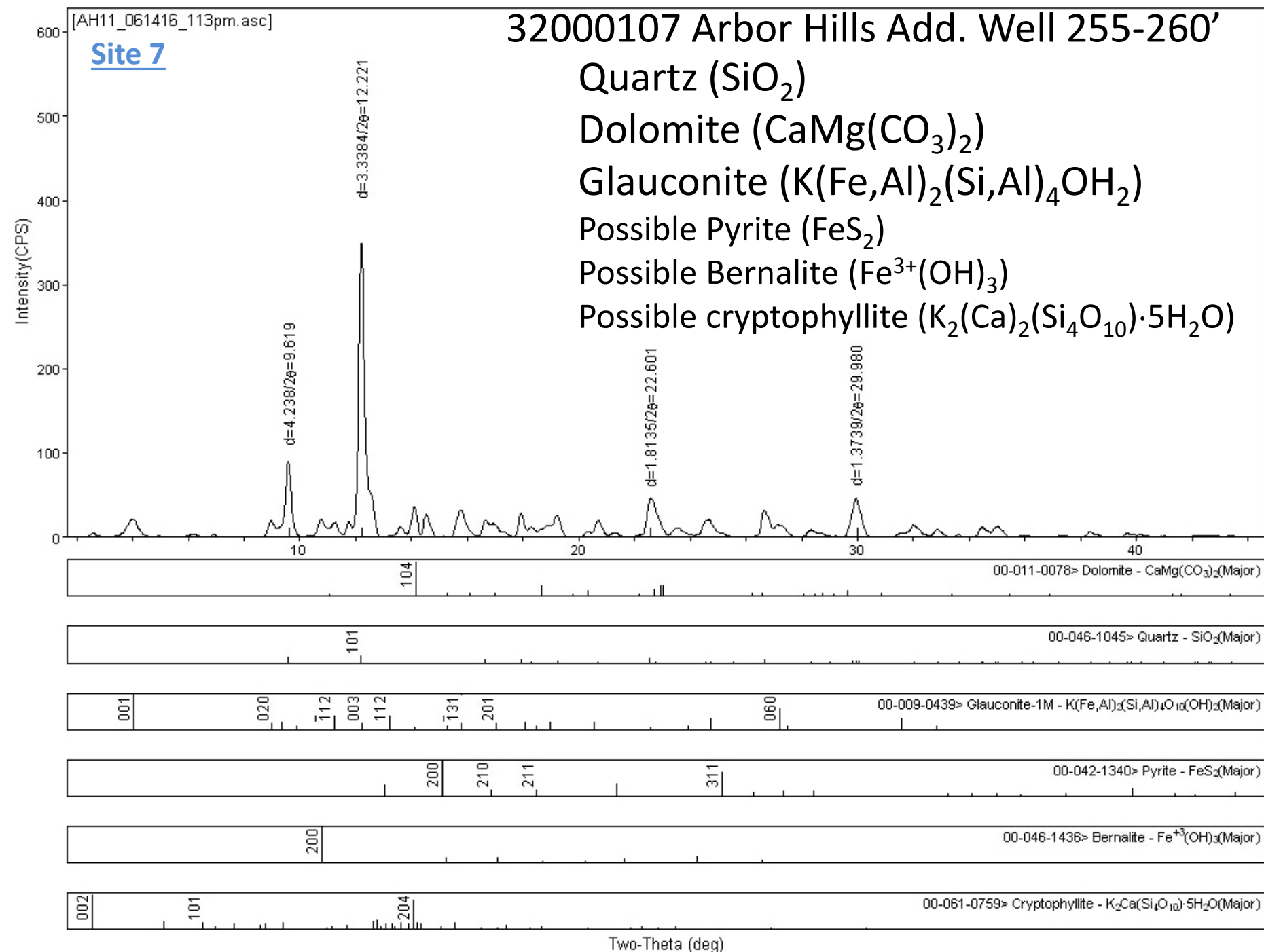
Dolomite ( $\text{CaMg}(\text{CO}_3)_2$ )

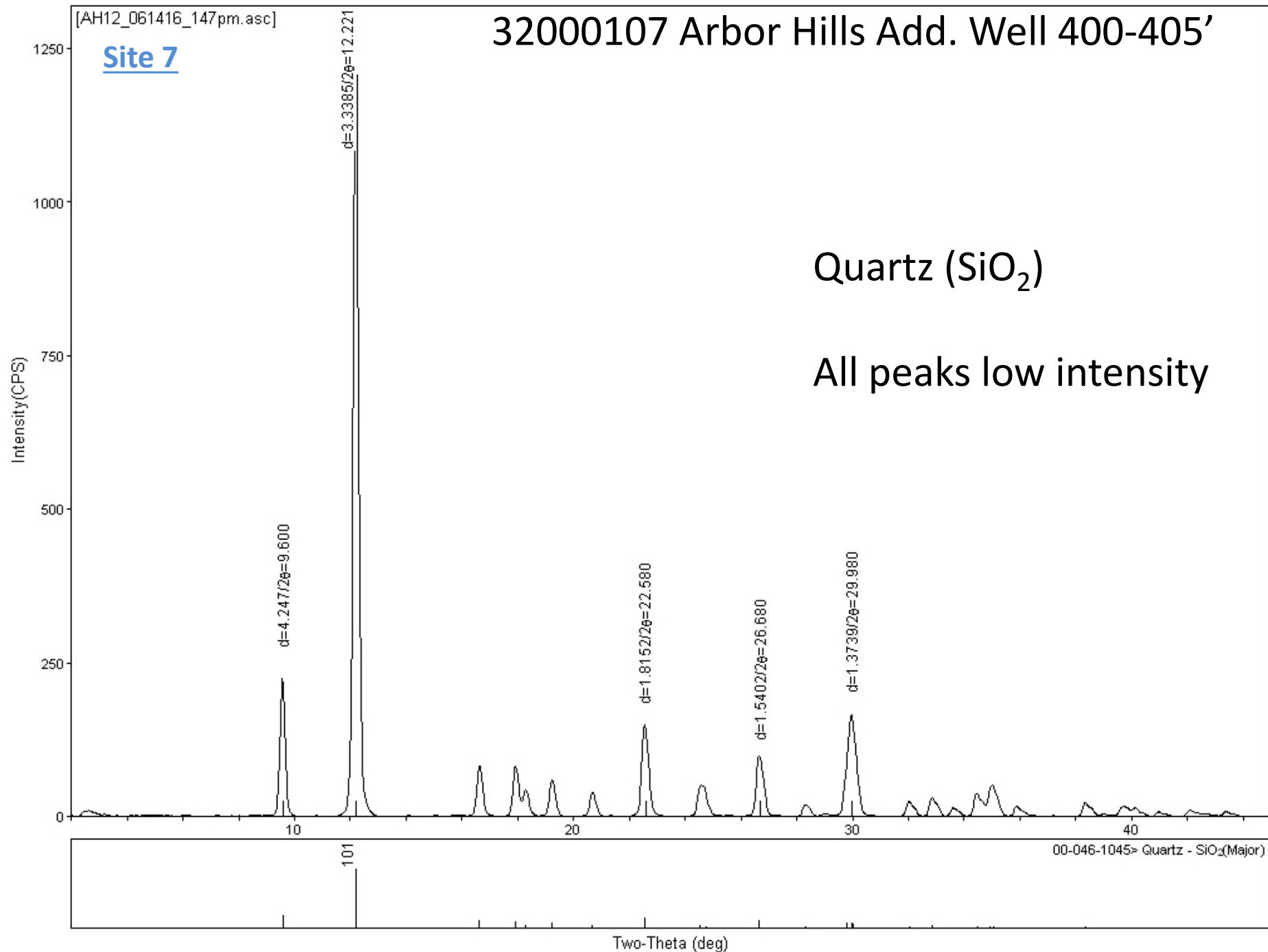
Glaucanite ( $\text{K}(\text{Fe},\text{Al})_2(\text{Si},\text{Al})_4\text{OH}_2$ )

Possible Pyrite ( $\text{FeS}_2$ )

Possible Bernalite ( $\text{Fe}^{3+}(\text{OH})_3$ )

Possible cryptophyllite ( $\text{K}_2(\text{Ca})_2(\text{Si}_4\text{O}_{10})\cdot 5\text{H}_2\text{O}$ )



[Site 7](#)

[GDB17\_061416\_218pm.asc]

Site 6

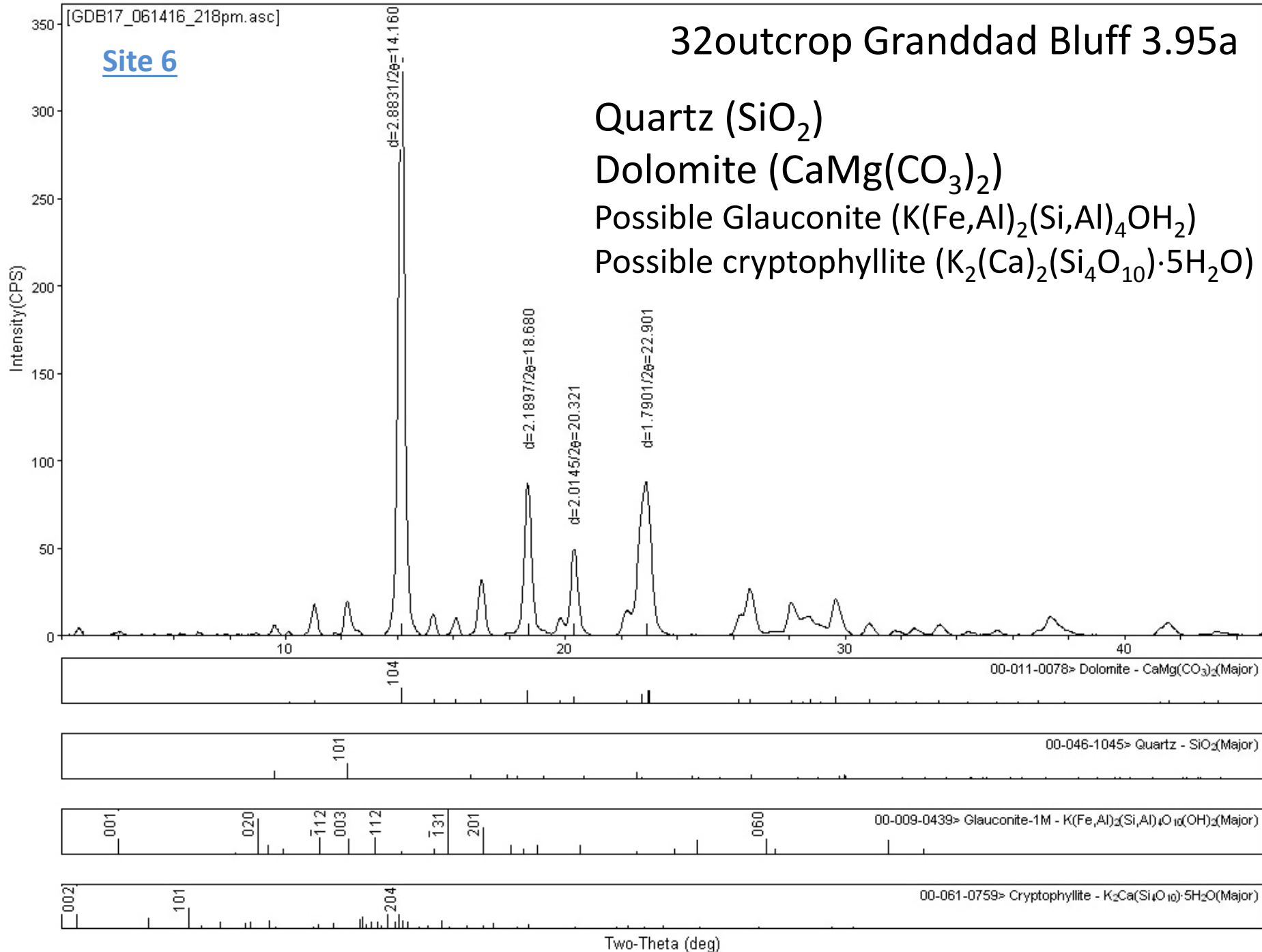
# 32outcrop Granddad Bluff 3.95a

Quartz ( $\text{SiO}_2$ )

Dolomite ( $\text{CaMg}(\text{CO}_3)_2$ )

Possible Glauconite ( $\text{K}(\text{Fe},\text{Al})_2(\text{Si},\text{Al})_4\text{OH}_2$ )

Possible cryptophyllite ( $\text{K}_2(\text{Ca})_2(\text{Si}_4\text{O}_{10}) \cdot 5\text{H}_2\text{O}$ )



[GDB18\_061416\_250pm.asc]

## Site 6

## 32outcrop Granddad Bluff 3.95b

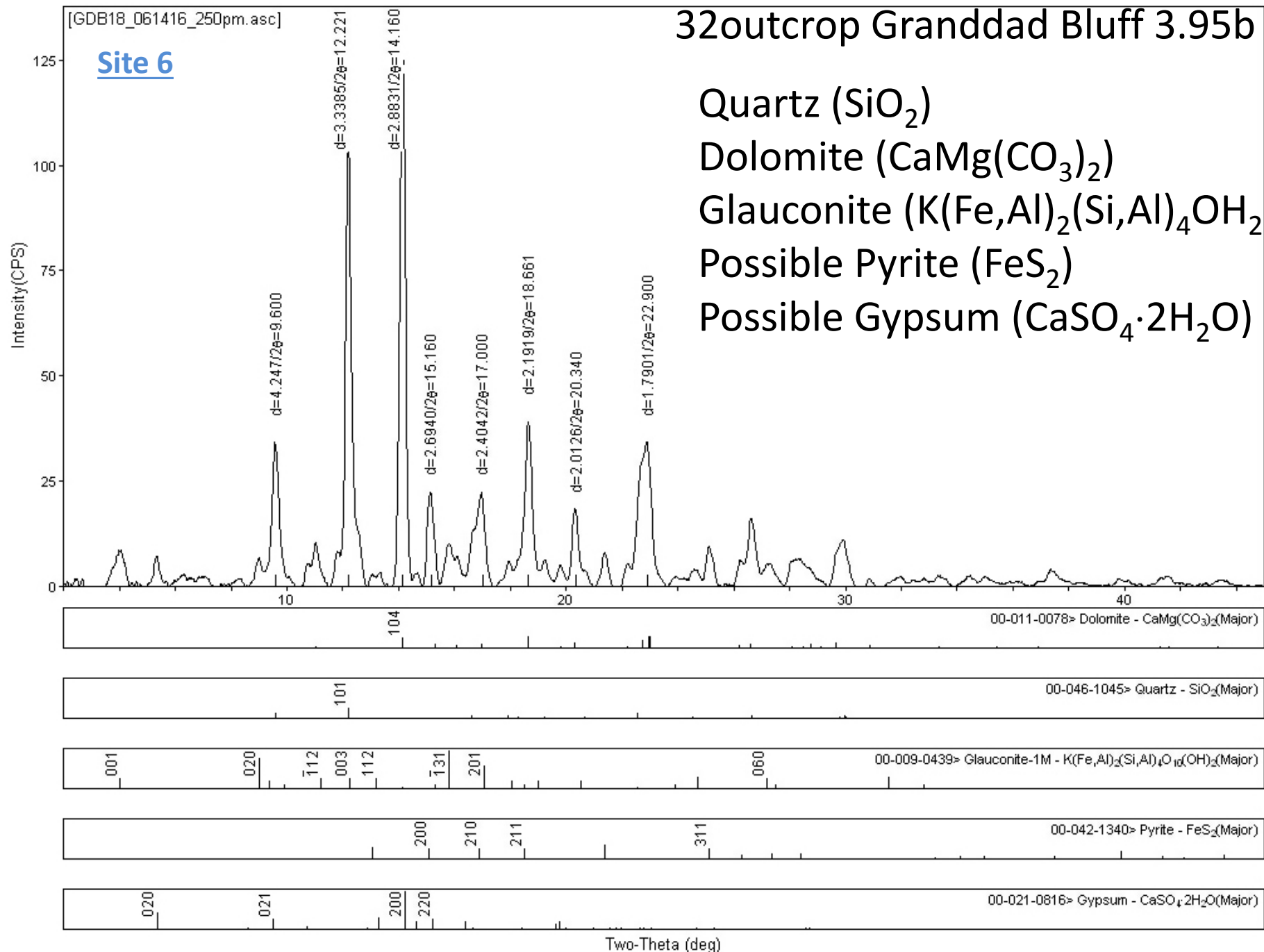
Quartz ( $\text{SiO}_2$ )

Dolomite ( $\text{CaMg}(\text{CO}_3)_2$ )

Glaucinite ( $\text{K}(\text{Fe},\text{Al})_2(\text{Si},\text{Al})_4\text{OH}_2$ )

Possible Pyrite ( $\text{FeS}_2$ )

Possible Gypsum ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ )



[GDB19\_061416\_332pm.asc]

Site 6

# 32outcrop Granddad Bluff 3.95c

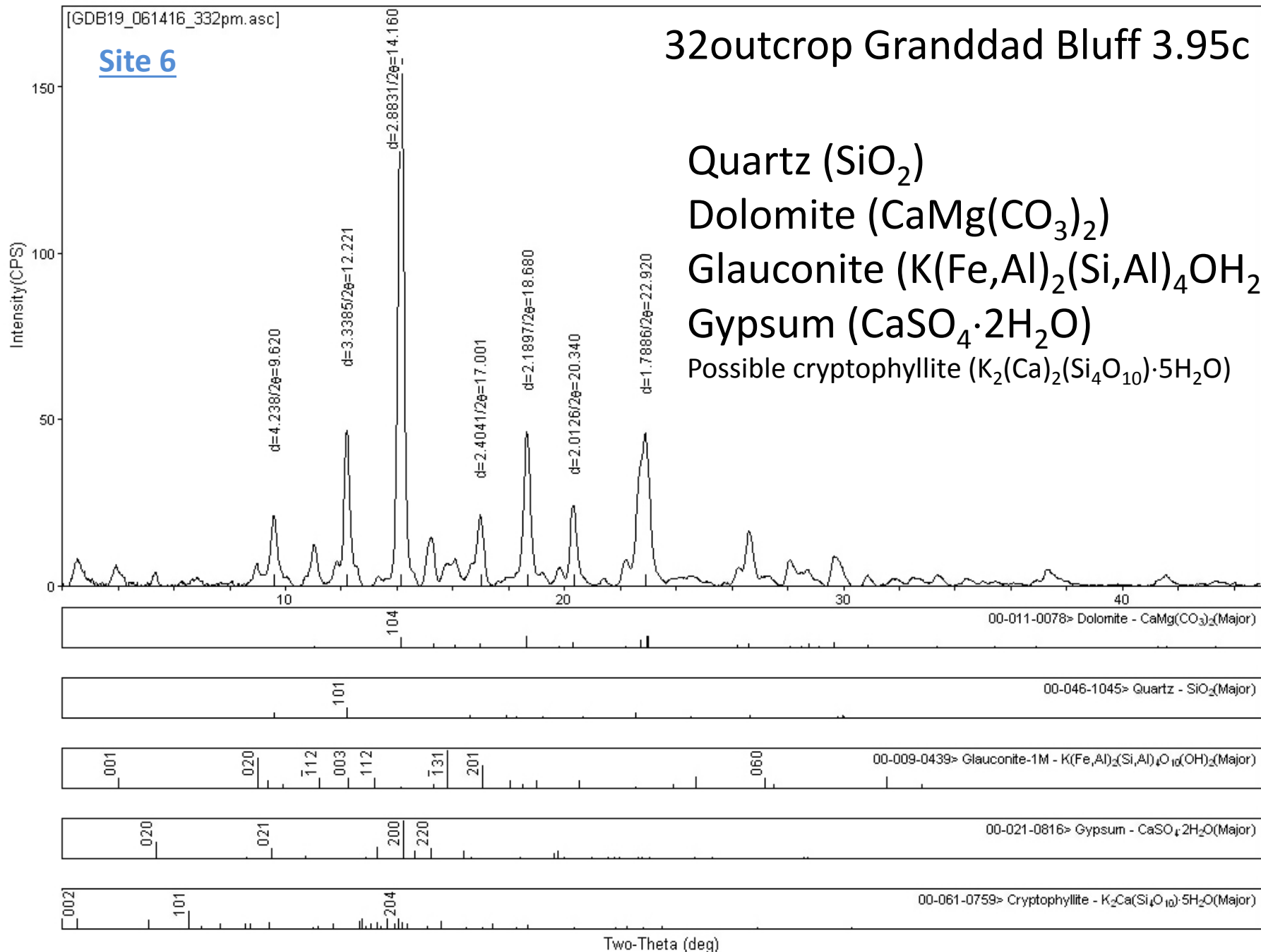
Quartz ( $\text{SiO}_2$ )

Dolomite ( $\text{CaMg}(\text{CO}_3)_2$ )

Glaucosite ( $\text{K}(\text{Fe},\text{Al})_2(\text{Si},\text{Al})_4\text{OH}_2$ )

Gypsum ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ )

Possible cryptophyllite ( $\text{K}_2(\text{Ca})_2(\text{Si}_4\text{O}_{10}) \cdot 5\text{H}_2\text{O}$ )

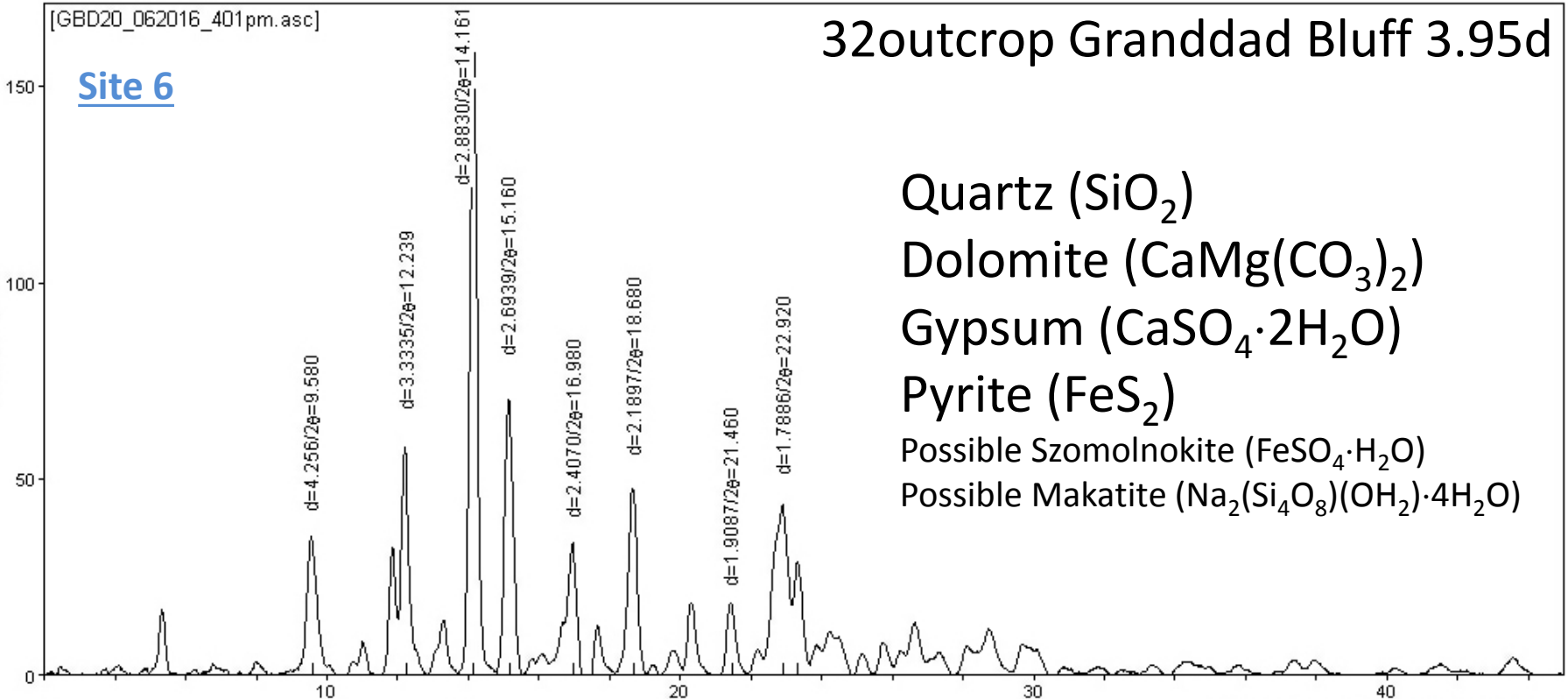


# 32outcrop Granddad Bluff 3.95d

[GBD20\_062016\_401pm.asc]

## Site 6

Intensity(CPS)



Quartz ( $\text{SiO}_2$ )

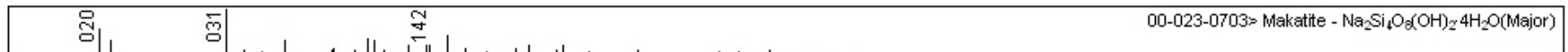
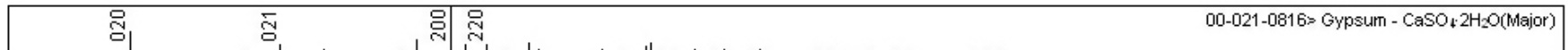
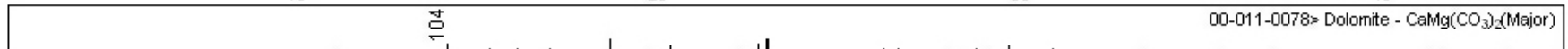
Dolomite ( $\text{CaMg}(\text{CO}_3)_2$ )

Gypsum ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ )

Pyrite ( $\text{FeS}_2$ )

Possible Szomolnokite ( $\text{FeSO}_4 \cdot \text{H}_2\text{O}$ )

Possible Makatite ( $\text{Na}_2(\text{Si}_4\text{O}_8)(\text{OH})_2 \cdot 4\text{H}_2\text{O}$ )

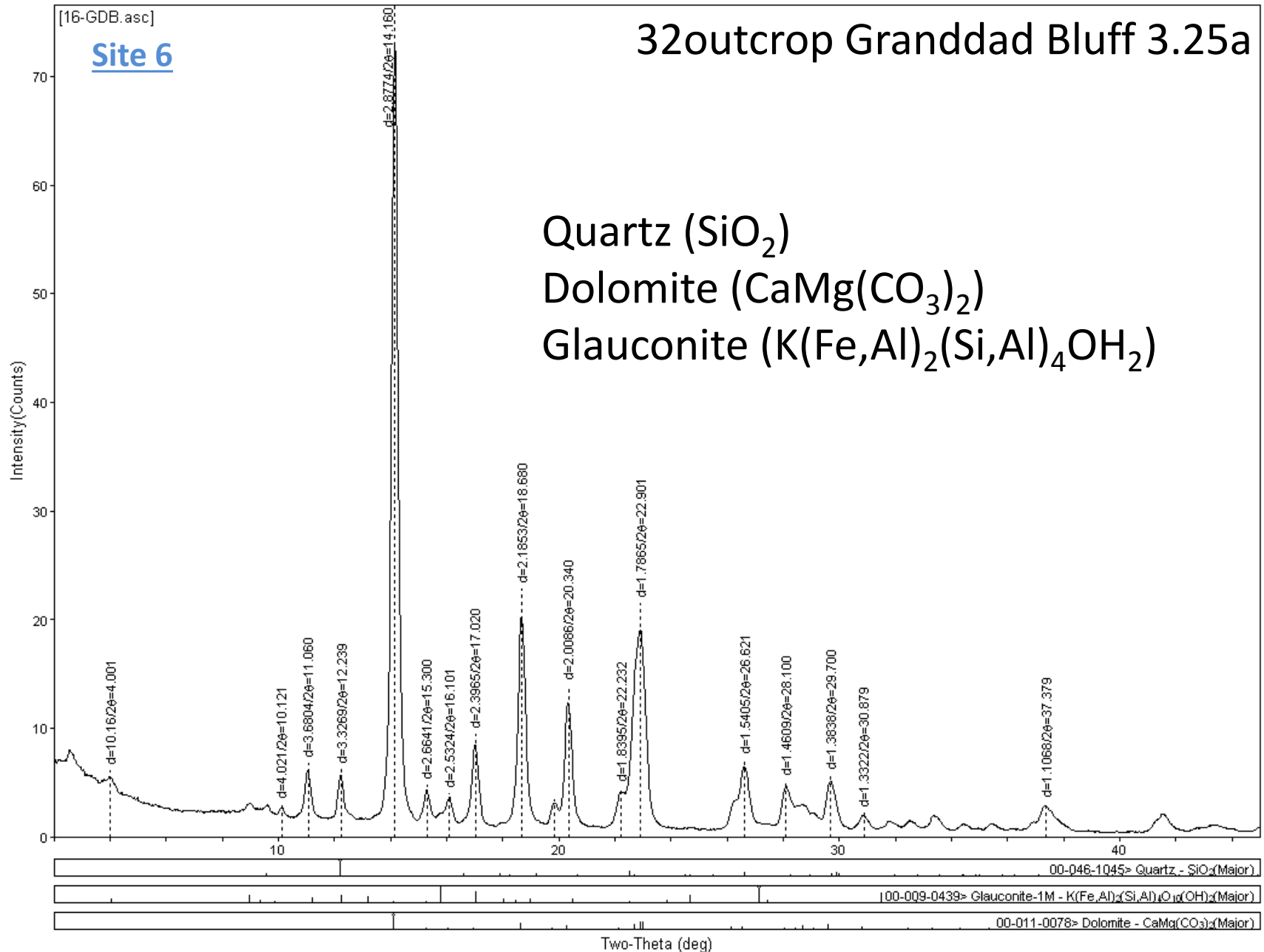


Two-Theta (deg)

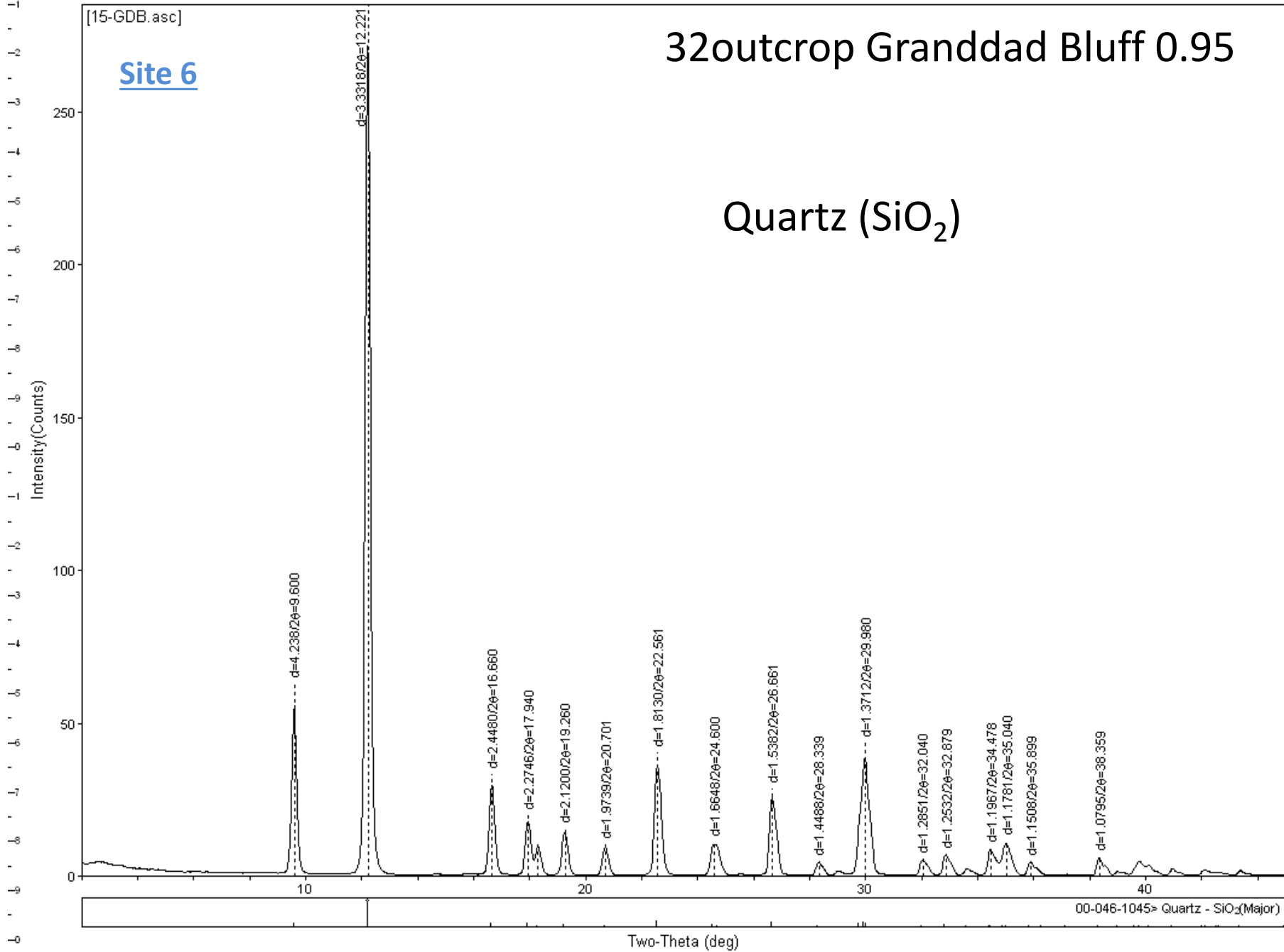
# 32outcrop Granddad Bluff 3.25a

Site 6

Quartz ( $\text{SiO}_2$ )  
Dolomite ( $\text{CaMg}(\text{CO}_3)_2$ )  
Glauconite ( $\text{K}(\text{Fe},\text{Al})_2(\text{Si},\text{Al})_4\text{OH}_2$ )



1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7



[14-GDB.asc]

Site 6

32outcrop Granddad Bluff -0.65

Quartz ( $\text{SiO}_2$ )

Probable K-spar: peak overlap, low counts

Intensity(Counts)

200

150

100

50

0

10

20

30

40

Two-Theta (deg)

00-046-1045> Quartz -  $\text{SiO}_2$ (Major)

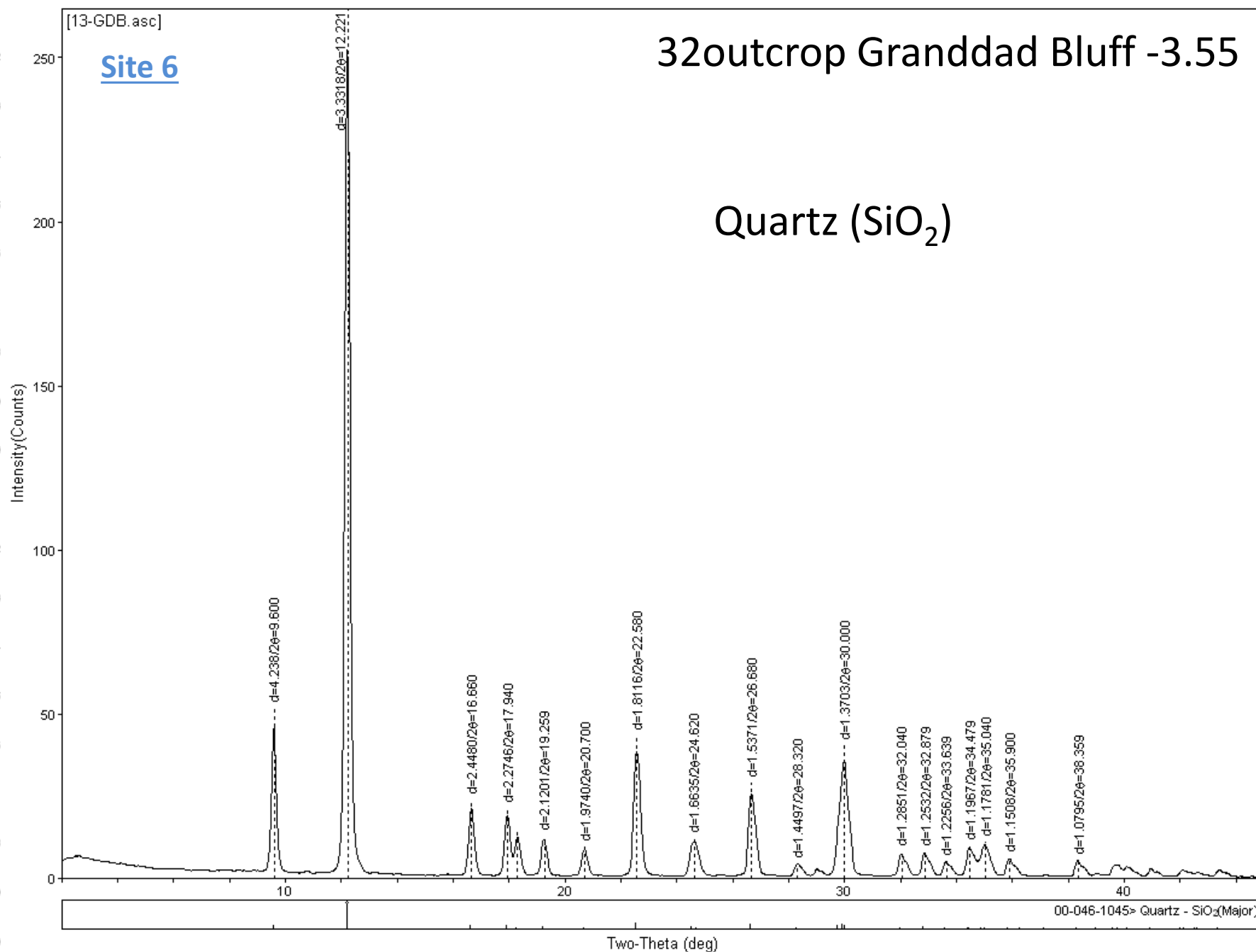
00-019-0932> Microcline -  $\text{KAlSi}_3\text{O}_8$ (Major)

[13-GDB.asc]

[Site 6](#)

32outcrop Granddad Bluff -3.55

Quartz ( $\text{SiO}_2$ )



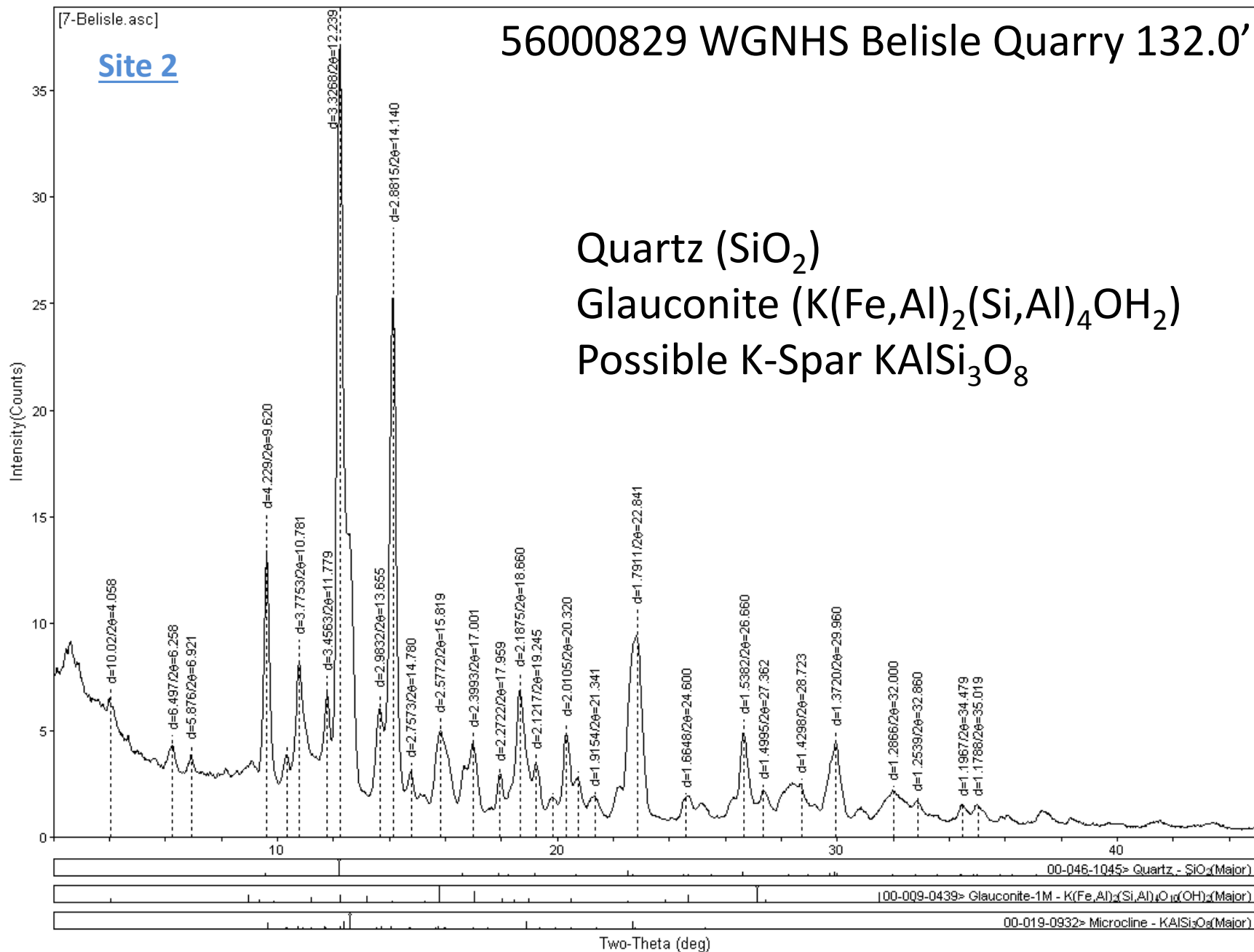
# 56000829 WGNHS Belisle Quarry 132.0'

Site 2

Quartz ( $\text{SiO}_2$ )

Glaucosite ( $\text{K}(\text{Fe},\text{Al})_2(\text{Si},\text{Al})_4\text{OH}_2$ )

Possible K-Spar  $\text{KAlSi}_3\text{O}_8$



[8-Belisle.asc]

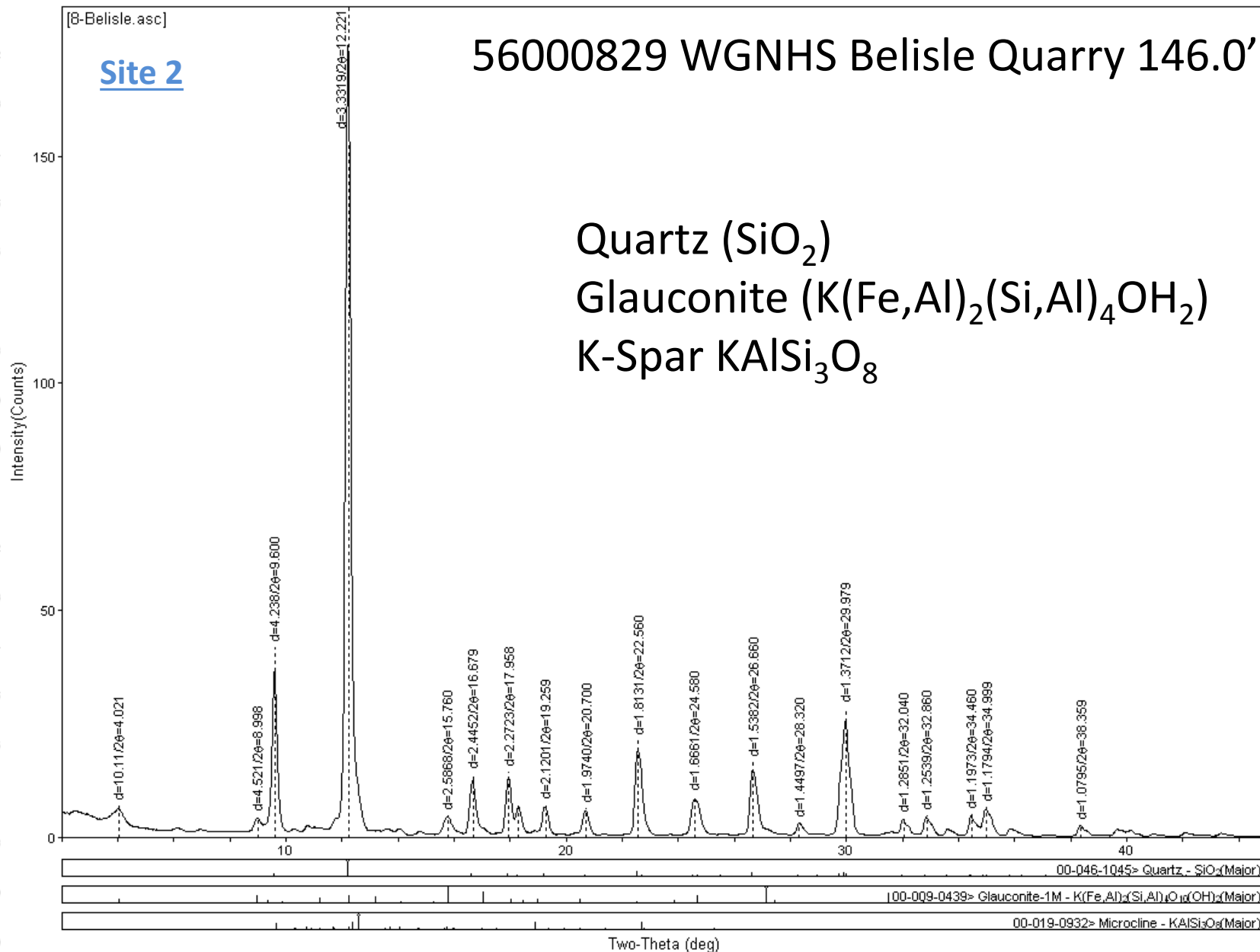
## Site 2

56000829 WGNHS Belisle Quarry 146.0'

Quartz ( $\text{SiO}_2$ )

Glaucosite ( $\text{K(Fe,Al)}_2(\text{Si,Al})_4\text{OH}_2$ )

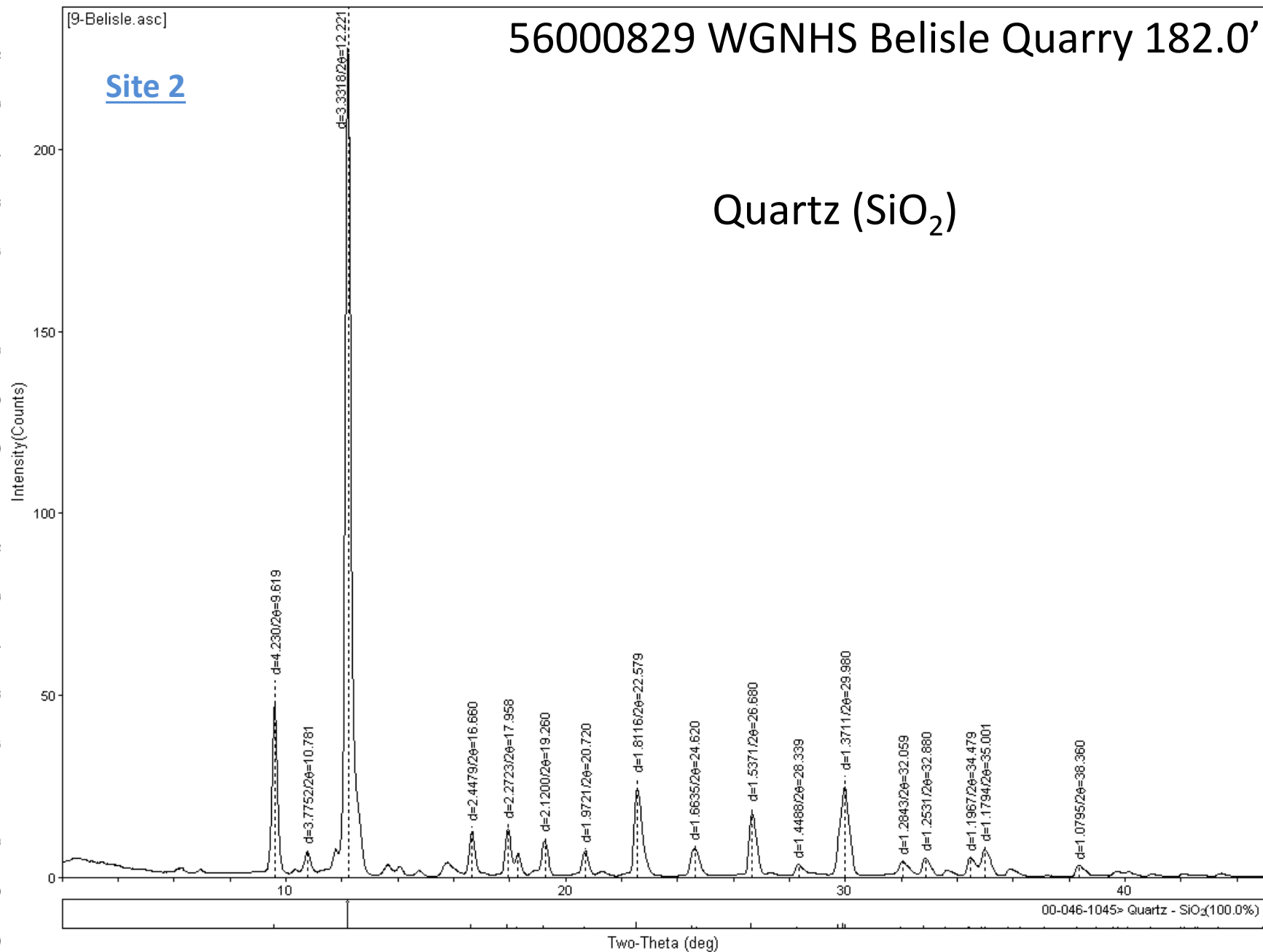
K-Spar  $\text{KAlSi}_3\text{O}_8$



# 56000829 WGNHS Belisle Quarry 182.0'

Site 2

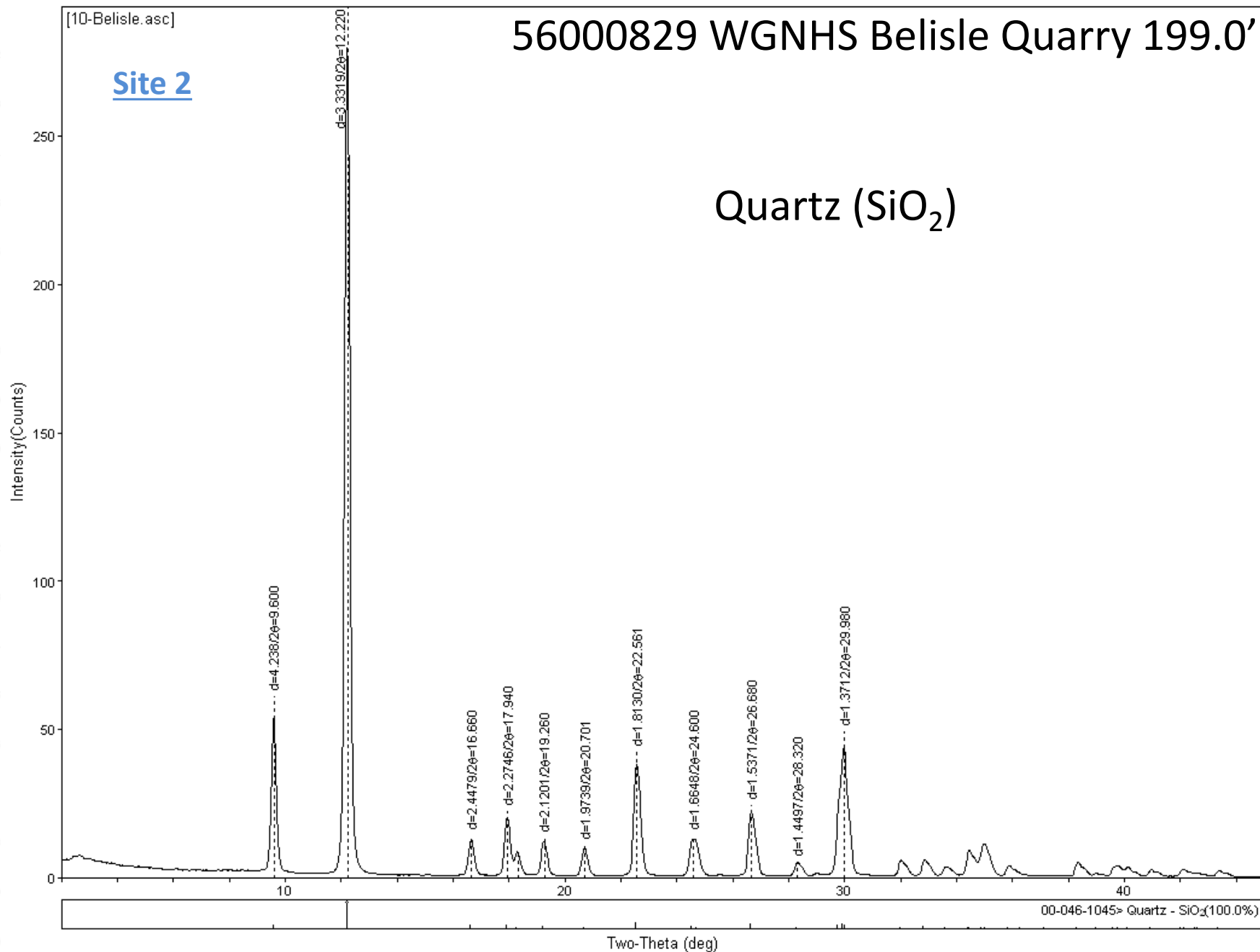
Quartz ( $\text{SiO}_2$ )



56000829 WGNHS Belisle Quarry 199.0'

Site 2

Quartz (SiO<sub>2</sub>)



# 62000166 WGNHS Arcadia Quarry 290.0'

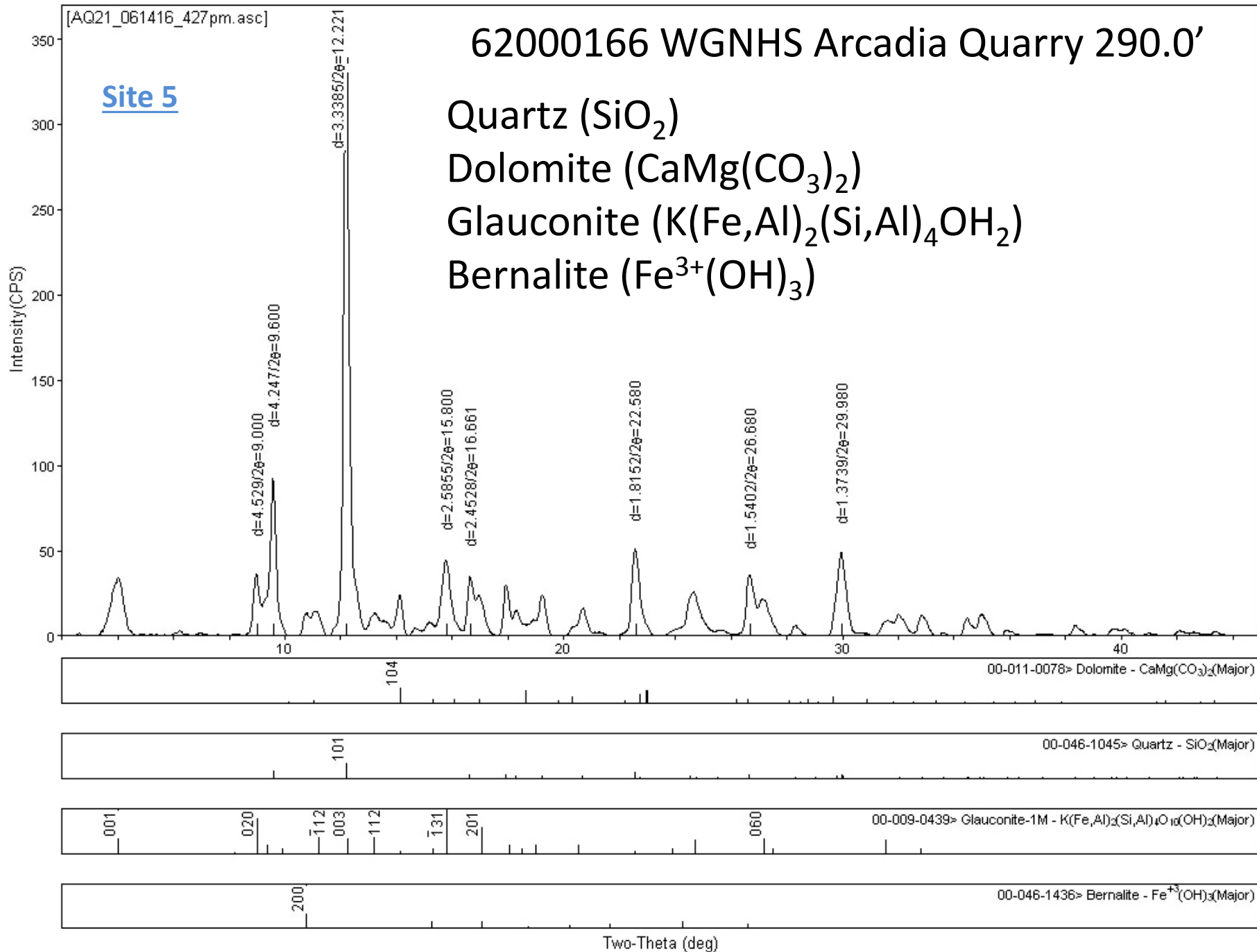
Site 5

Quartz ( $\text{SiO}_2$ )

Dolomite ( $\text{CaMg}(\text{CO}_3)_2$ )

Glaucosite ( $\text{K}(\text{Fe},\text{Al})_2(\text{Si},\text{Al})_4\text{OH}_2$ )

Bernalite ( $\text{Fe}^{3+}(\text{OH})_3$ )



[23 Arcadia Quarry.asc]

## Site 5

# 62000166 WGNHS Arcadia Quarry 296.6'

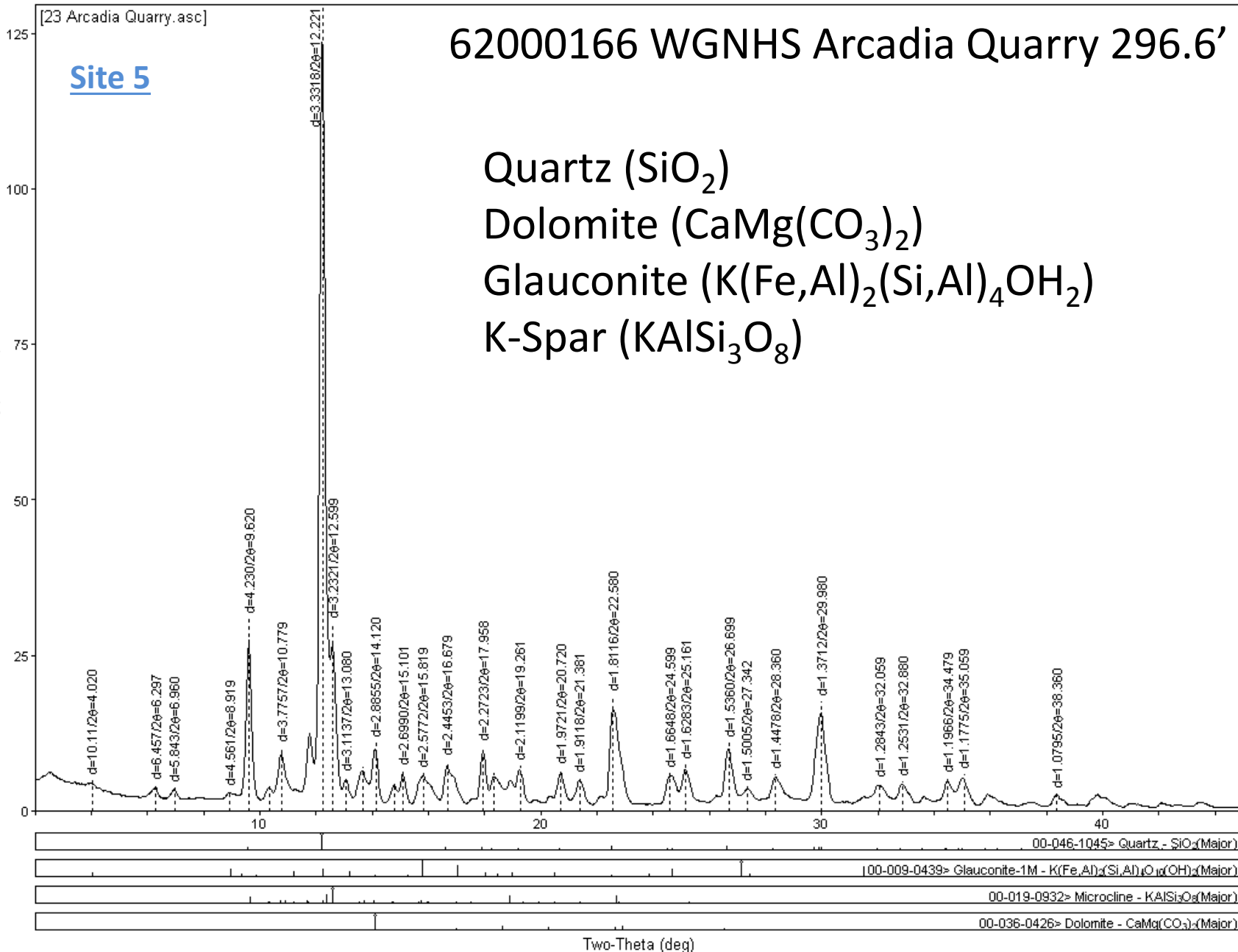
Quartz ( $\text{SiO}_2$ )

Dolomite ( $\text{CaMg}(\text{CO}_3)_2$ )

Glaucosite ( $\text{K}(\text{Fe},\text{Al})_2(\text{Si},\text{Al})_4\text{OH}_2$ )

K-Spar ( $\text{KAlSi}_3\text{O}_8$ )

Intensity(Counts)



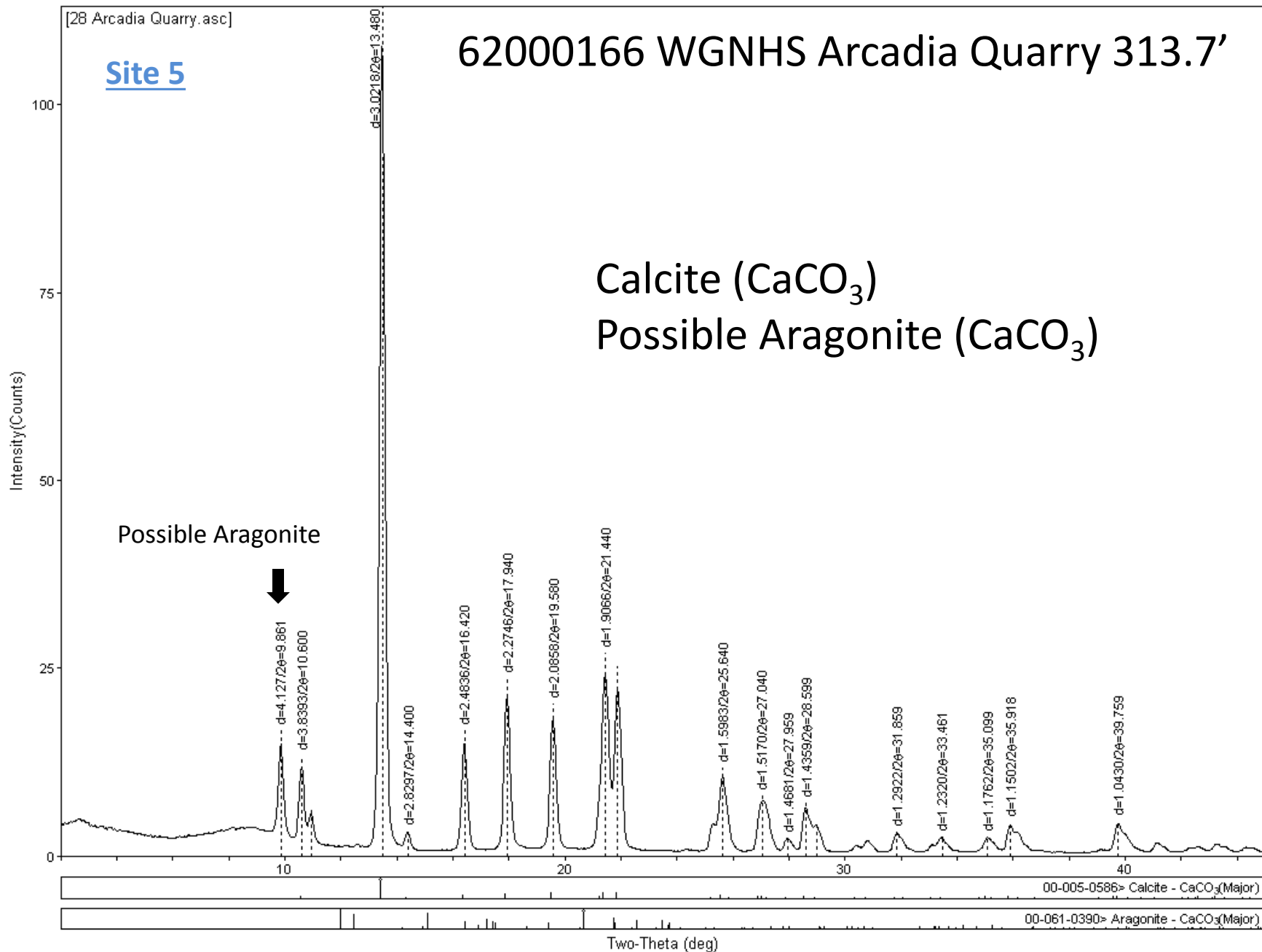
[28 Arcadia Quarry.asc]

Site 5

62000166 WGNHS Arcadia Quarry 313.7'

Calcite ( $\text{CaCO}_3$ )

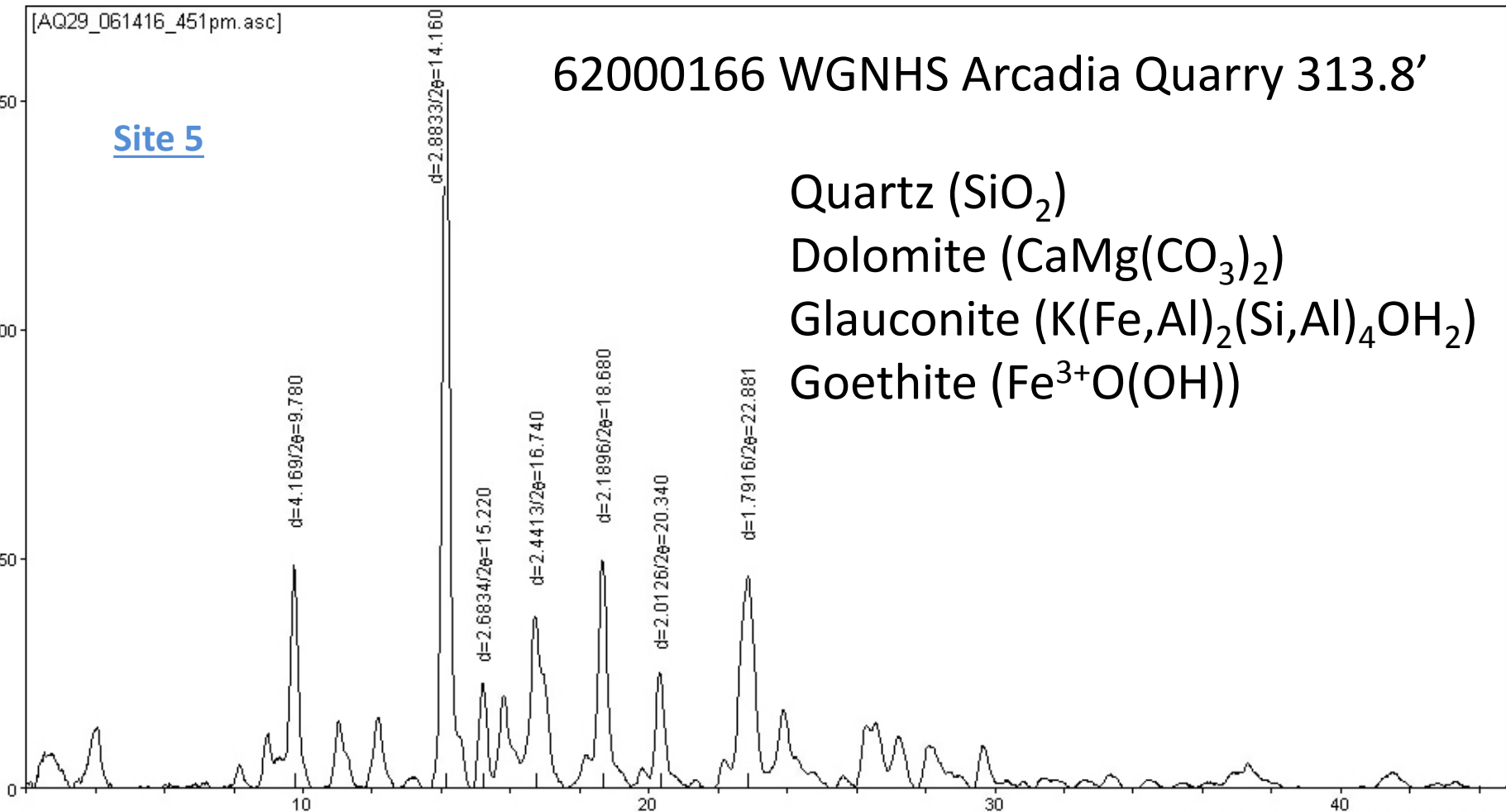
Possible Aragonite ( $\text{CaCO}_3$ )



## 62000166 WGNHS Arcadia Quarry 313.8'

Site 5Quartz ( $\text{SiO}_2$ )Dolomite ( $\text{CaMg}(\text{CO}_3)_2$ )Glauconite ( $\text{K}(\text{Fe},\text{Al})_2(\text{Si},\text{Al})_4\text{OH}_2$ )Goethite ( $\text{Fe}^{3+}\text{O}(\text{OH})$ )

Intensity(CPS)

00-011-0078> Dolomite -  $\text{CaMg}(\text{CO}_3)_2$ (Major)00-046-1045> Quartz -  $\text{SiO}_2$ (Major)00-009-0439> Glauconite-1M -  $\text{K}(\text{Fe},\text{Al})_2(\text{Si},\text{Al})_4\text{O}_{10}(\text{OH})_2$ (Major)00-029-0713> Goethite -  $\text{Fe}^{3+}\text{O}(\text{OH})$ (Major)

Two-Theta (deg)

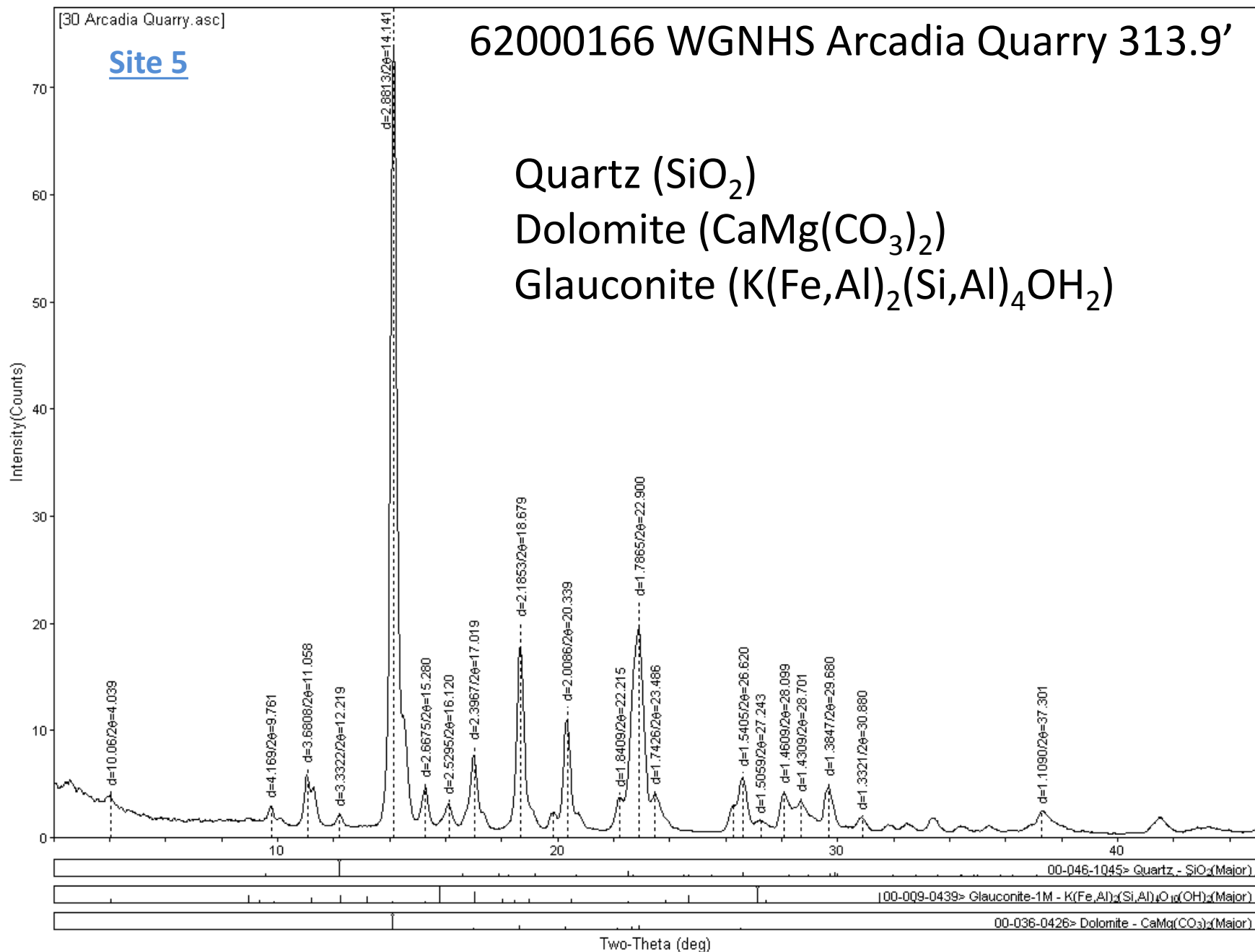
# 62000166 WGNHS Arcadia Quarry 313.9'

Site 5

Quartz ( $\text{SiO}_2$ )

Dolomite ( $\text{CaMg}(\text{CO}_3)_2$ )

Glauconite ( $\text{K}(\text{Fe},\text{Al})_2(\text{Si},\text{Al})_4\text{OH}_2$ )



[32 Arcadia Quarry.asc]

**Site 5**

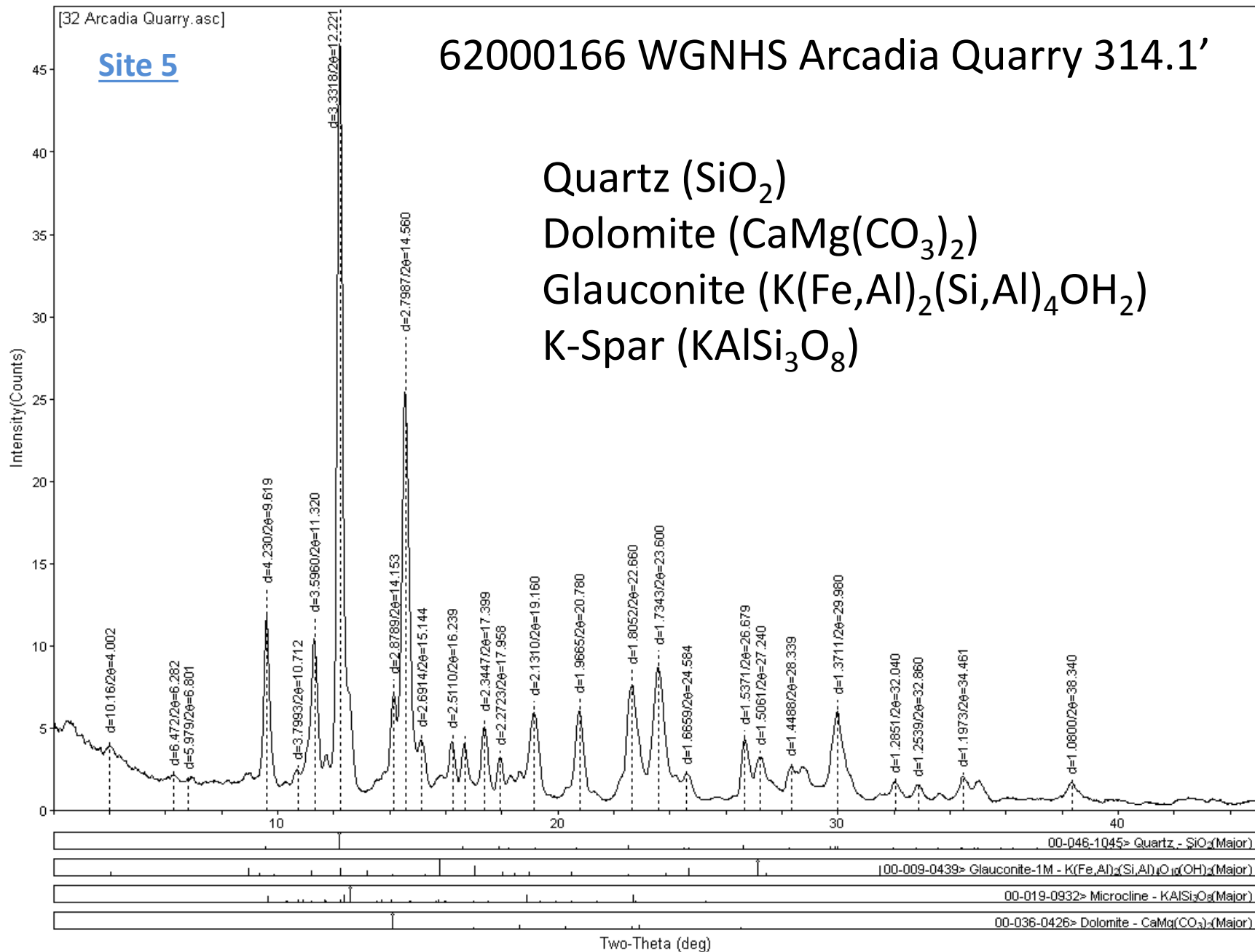
62000166 WGNHS Arcadia Quarry 314.1'

Quartz ( $\text{SiO}_2$ )

Dolomite ( $\text{CaMg}(\text{CO}_3)_2$ )

Glaucosite ( $\text{K}(\text{Fe},\text{Al})_2(\text{Si},\text{Al})_4\text{OH}_2$ )

K-Spar ( $\text{KAlSi}_3\text{O}_8$ )



[37 Arcadia Quarry.asc]

## Site 5

# 62000166 WGNHS Arcadia Quarry 323.9'

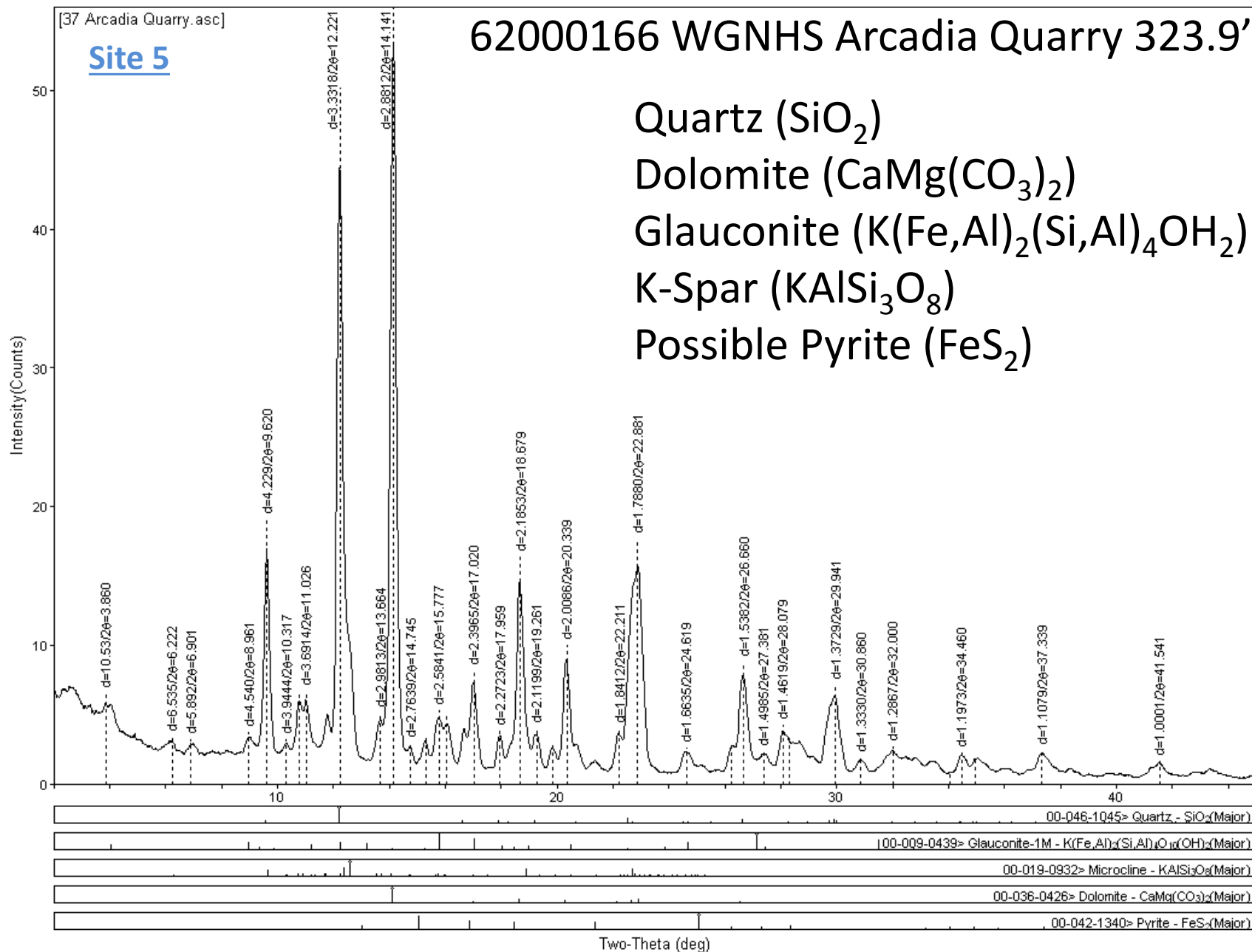
Quartz ( $\text{SiO}_2$ )

Dolomite ( $\text{CaMg}(\text{CO}_3)_2$ )

Glaucosite ( $\text{K}(\text{Fe},\text{Al})_2(\text{Si},\text{Al})_4\text{OH}_2$ )

K-Spar ( $\text{KAlSi}_3\text{O}_8$ )

Possible Pyrite ( $\text{FeS}_2$ )



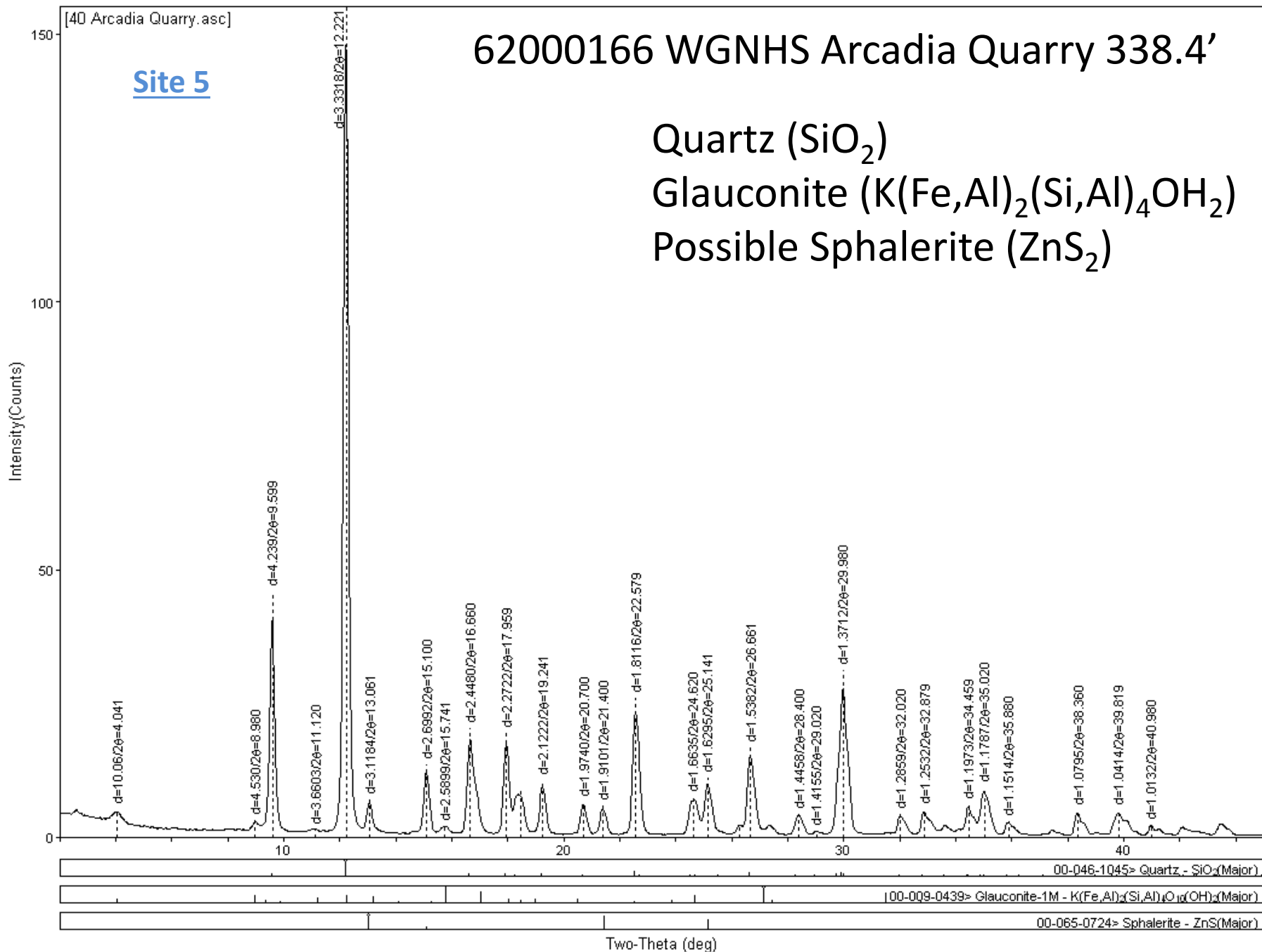
Site 5

# 62000166 WGNHS Arcadia Quarry 338.4'

Quartz ( $\text{SiO}_2$ )

Glaucosite ( $\text{K}(\text{Fe},\text{Al})_2(\text{Si},\text{Al})_4\text{OH}_2$ )

Possible Sphalerite ( $\text{ZnS}_2$ )



[41 Arcadia Quarry.asc]

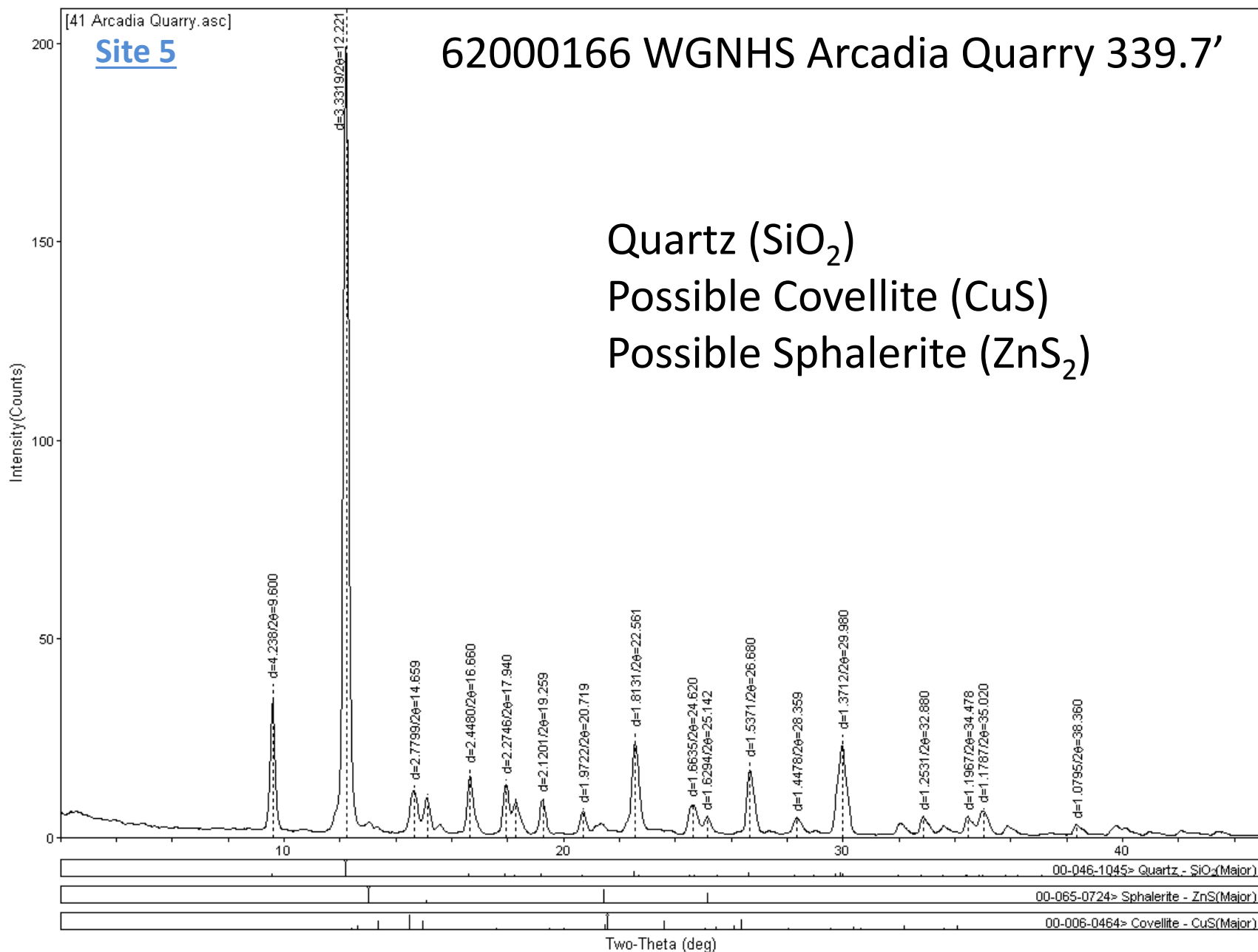
**Site 5**

62000166 WGNHS Arcadia Quarry 339.7'

Quartz ( $\text{SiO}_2$ )

Possible Covellite ( $\text{CuS}$ )

Possible Sphalerite ( $\text{ZnS}_2$ )



[51 Arcadia Quarry.asc]

Site 5

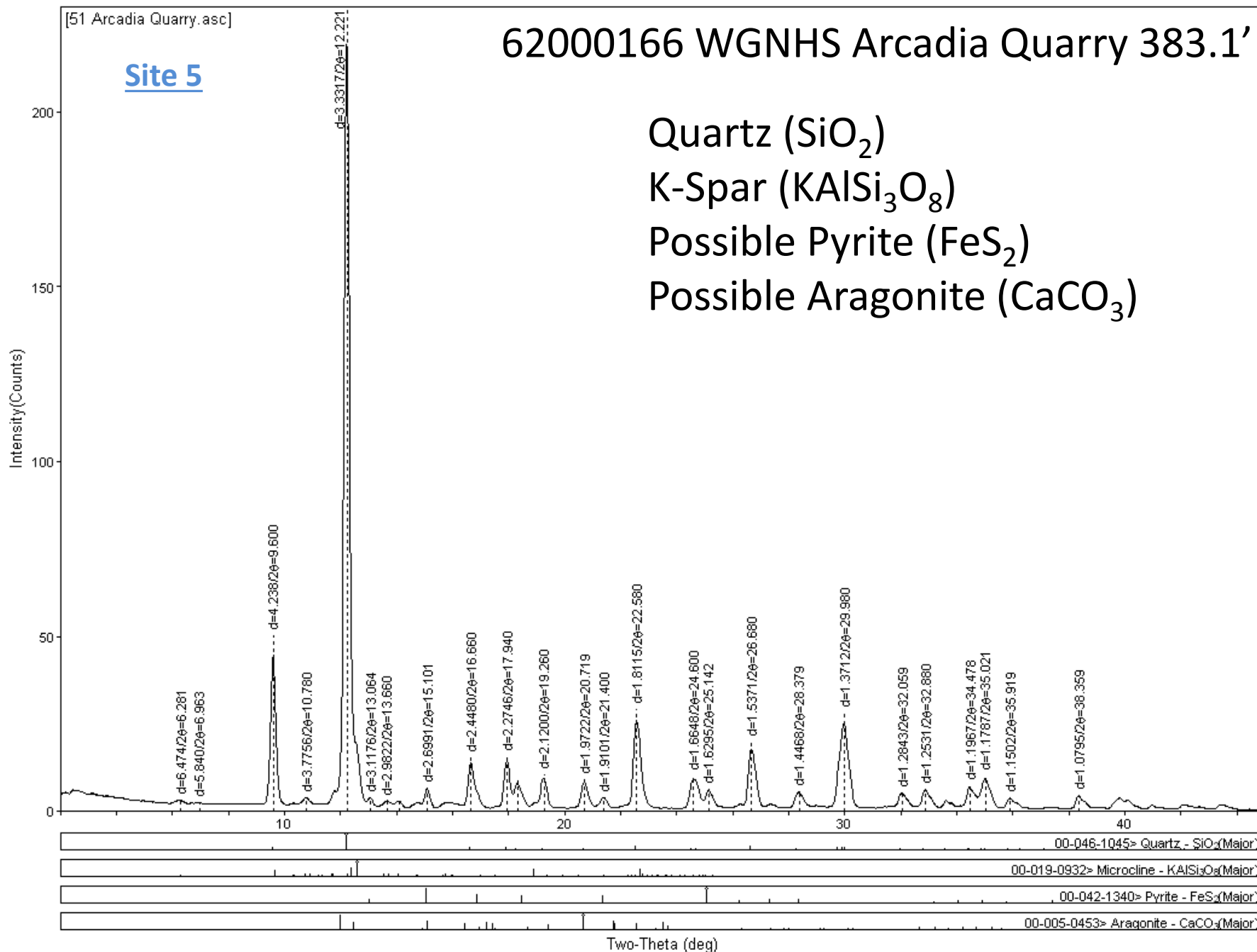
62000166 WGNHS Arcadia Quarry 383.1'

Quartz ( $\text{SiO}_2$ )

K-Spar ( $\text{KAlSi}_3\text{O}_8$ )

Possible Pyrite ( $\text{FeS}_2$ )

Possible Aragonite ( $\text{CaCO}_3$ )



[54 Arcadia Quarry.asc]

Site 5

# 62000166 WGNHS Arcadia Quarry 395.5'

Quartz ( $\text{SiO}_2$ )

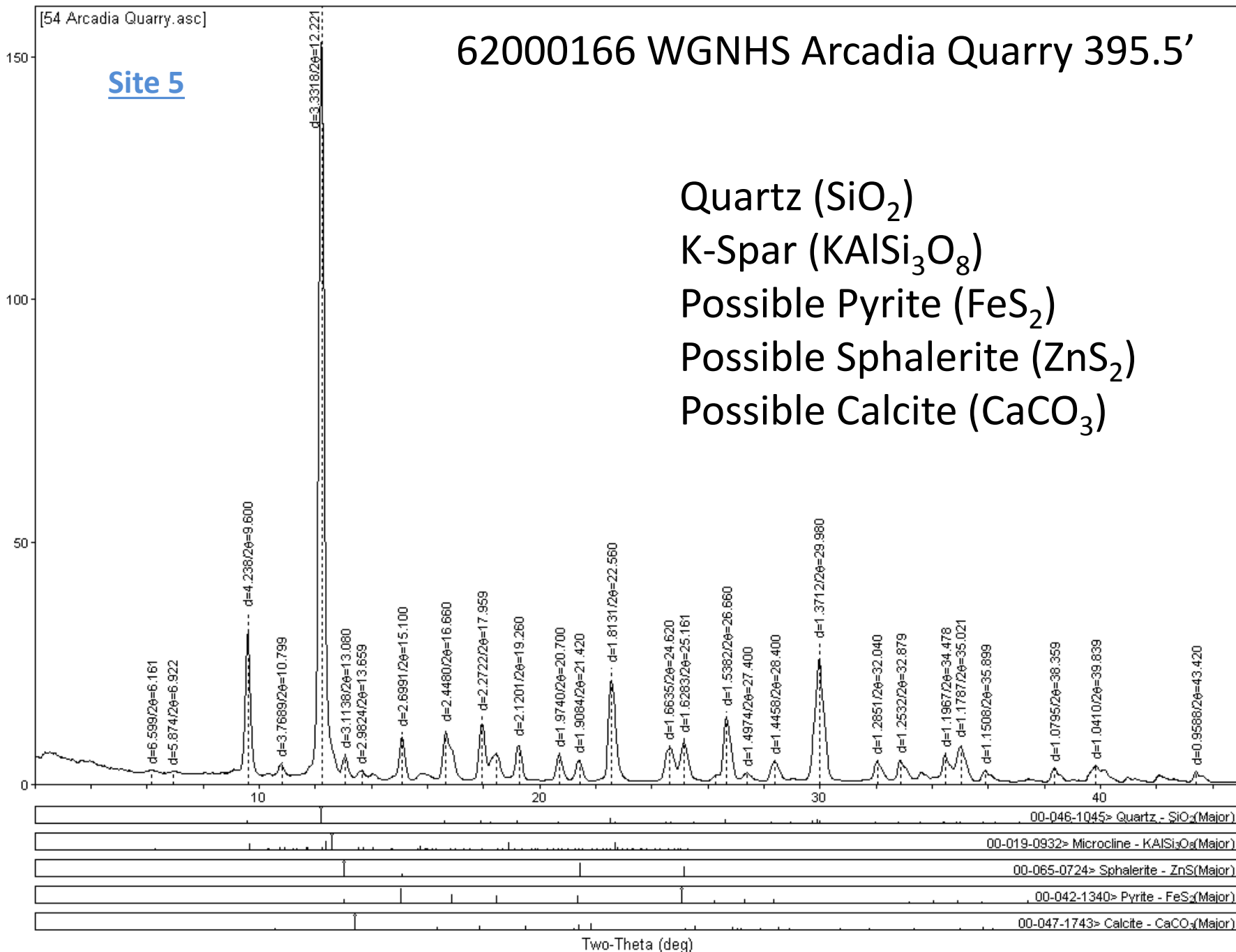
K-Spar ( $\text{KAlSi}_3\text{O}_8$ )

Possible Pyrite ( $\text{FeS}_2$ )

Possible Sphalerite ( $\text{ZnS}_2$ )

Possible Calcite ( $\text{CaCO}_3$ )

Intensity(Counts)



[56 Arcadia Quarry.asc]

Site 5

# 62000166 WGNHS Arcadia Quarry 405.5'

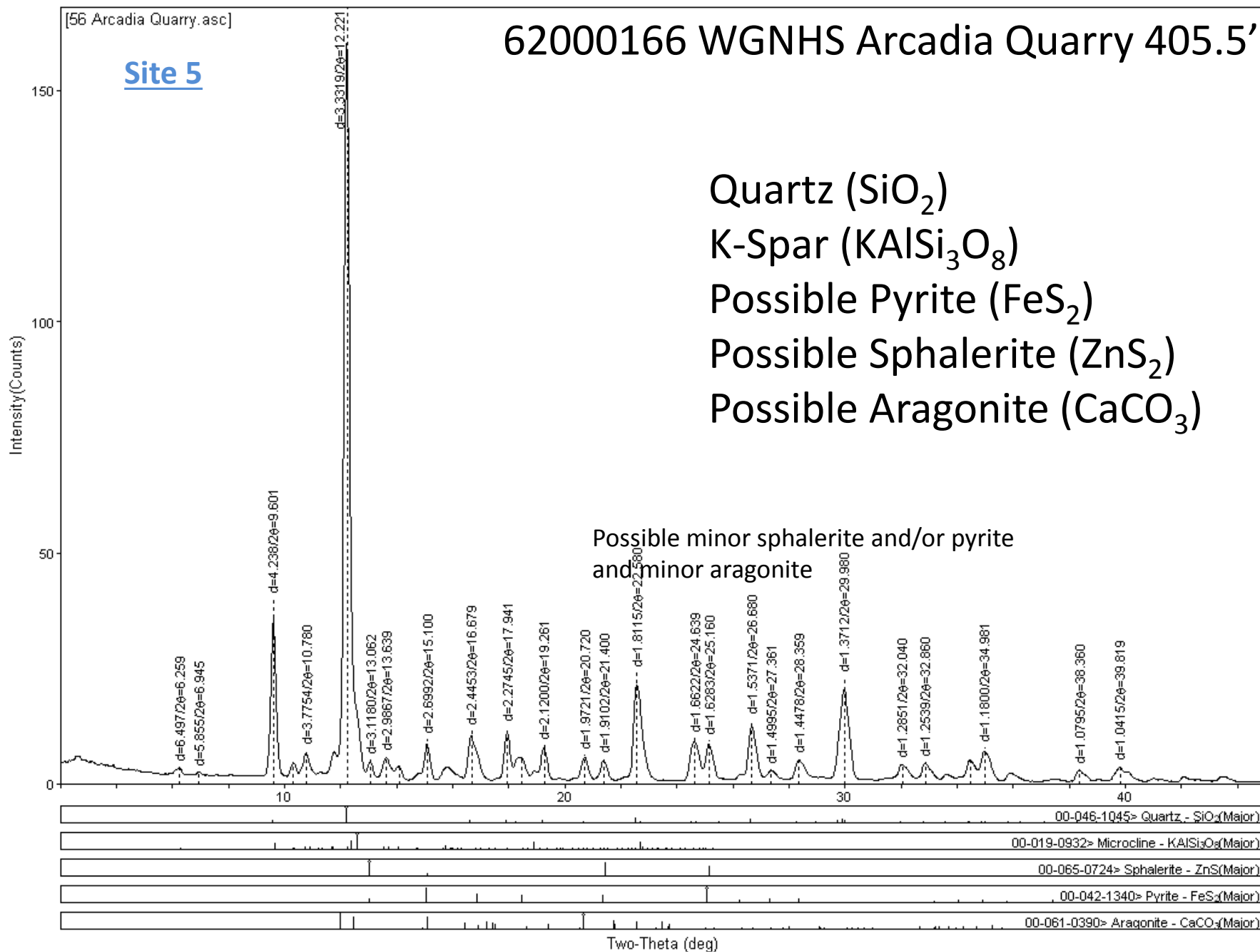
Quartz ( $\text{SiO}_2$ )

K-Spar ( $\text{KAlSi}_3\text{O}_8$ )

Possible Pyrite ( $\text{FeS}_2$ )

Possible Sphalerite ( $\text{ZnS}_2$ )

Possible Aragonite ( $\text{CaCO}_3$ )



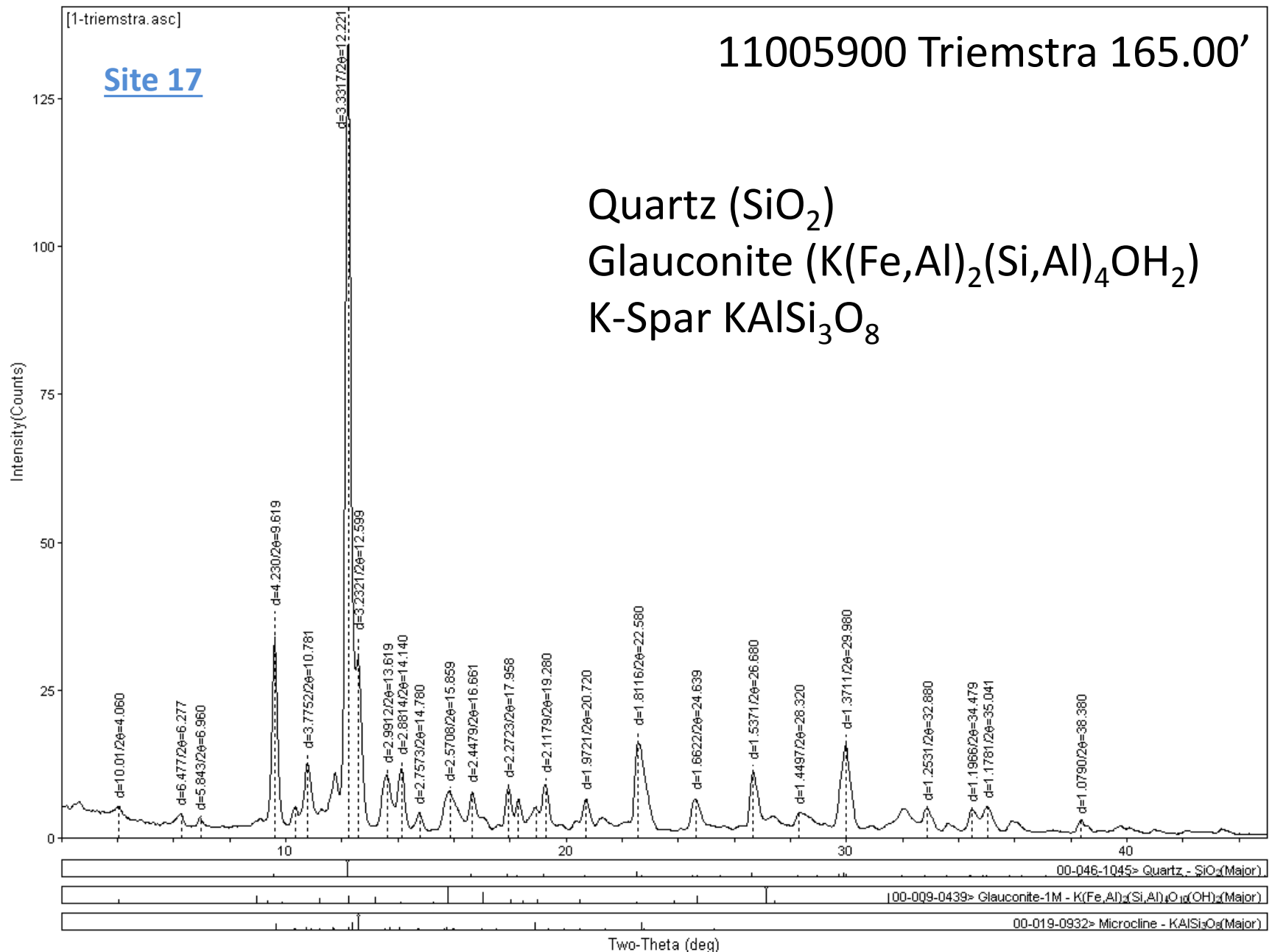
Site 17

11005900 Triemstra 165.00'

Quartz ( $\text{SiO}_2$ )

Glaucosite ( $\text{K}(\text{Fe},\text{Al})_2(\text{Si},\text{Al})_4\text{OH}_2$ )

K-Spar  $\text{KAlSi}_3\text{O}_8$



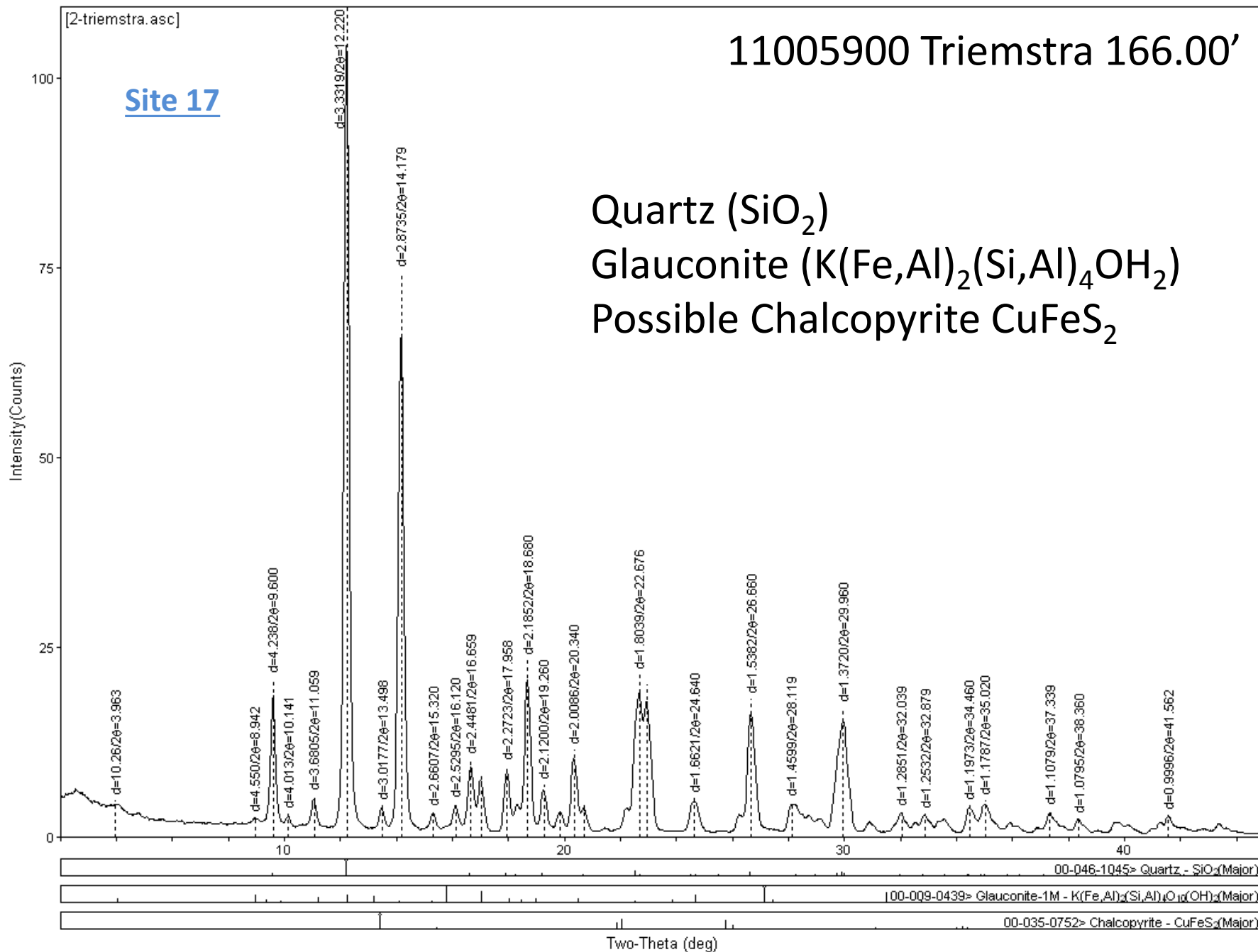
Site 17

11005900 Triemstra 166.00'

Quartz ( $\text{SiO}_2$ )

Glaucosite ( $\text{K}(\text{Fe},\text{Al})_2(\text{Si},\text{Al})_4\text{OH}_2$ )

Possible Chalcopyrite  $\text{CuFeS}_2$

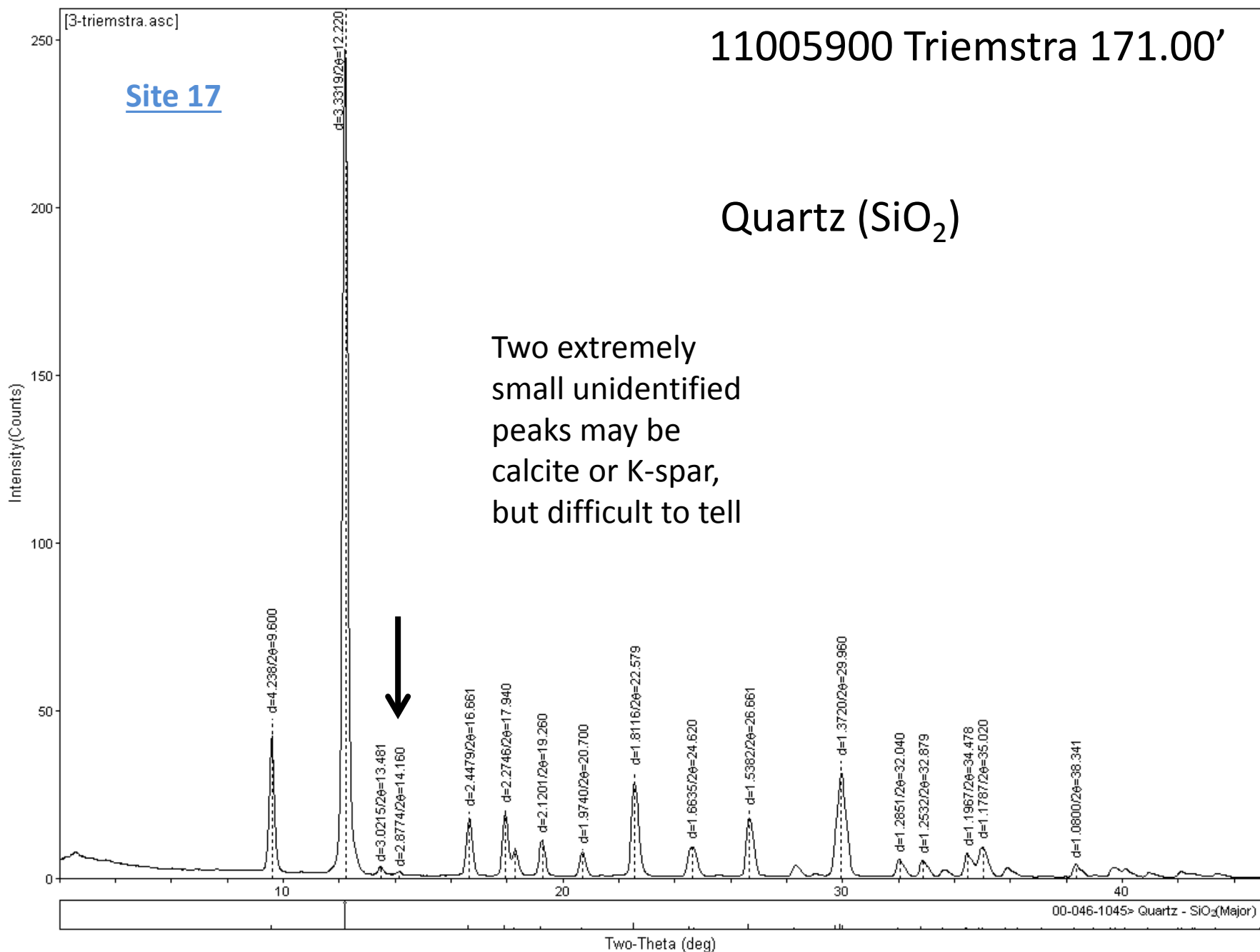


Site 17

11005900 Triemstra 171.00'

Quartz ( $\text{SiO}_2$ )

Two extremely  
small unidentified  
peaks may be  
calcite or K-spar,  
but difficult to tell



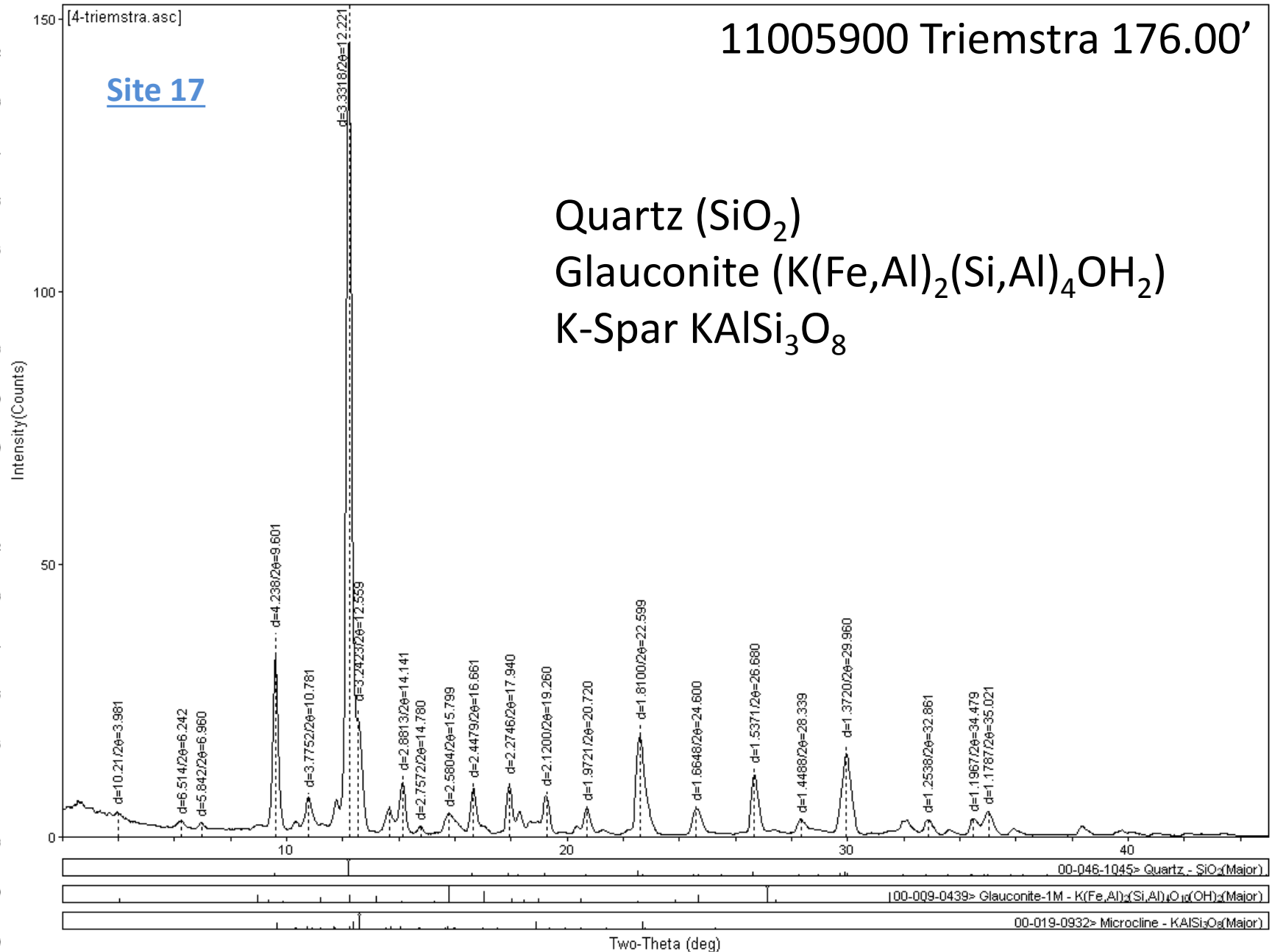
11005900 Triemstra 176.00'

Site 17

Quartz ( $\text{SiO}_2$ )

Glaucosite ( $\text{K}(\text{Fe},\text{Al})_2(\text{Si},\text{Al})_4\text{OH}_2$ )

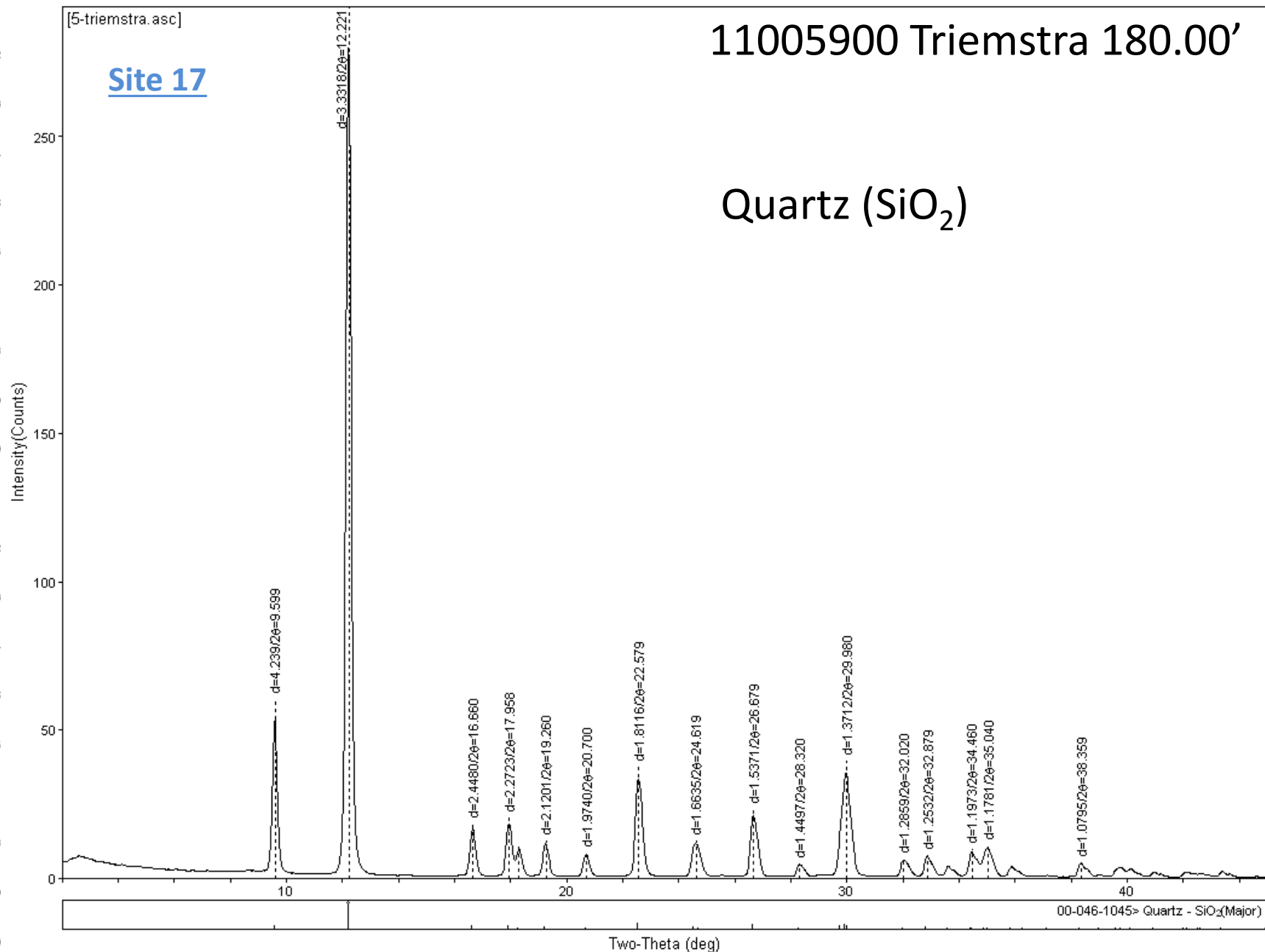
K-Spar  $\text{KAlSi}_3\text{O}_8$



Site 17

11005900 Triemstra 180.00'

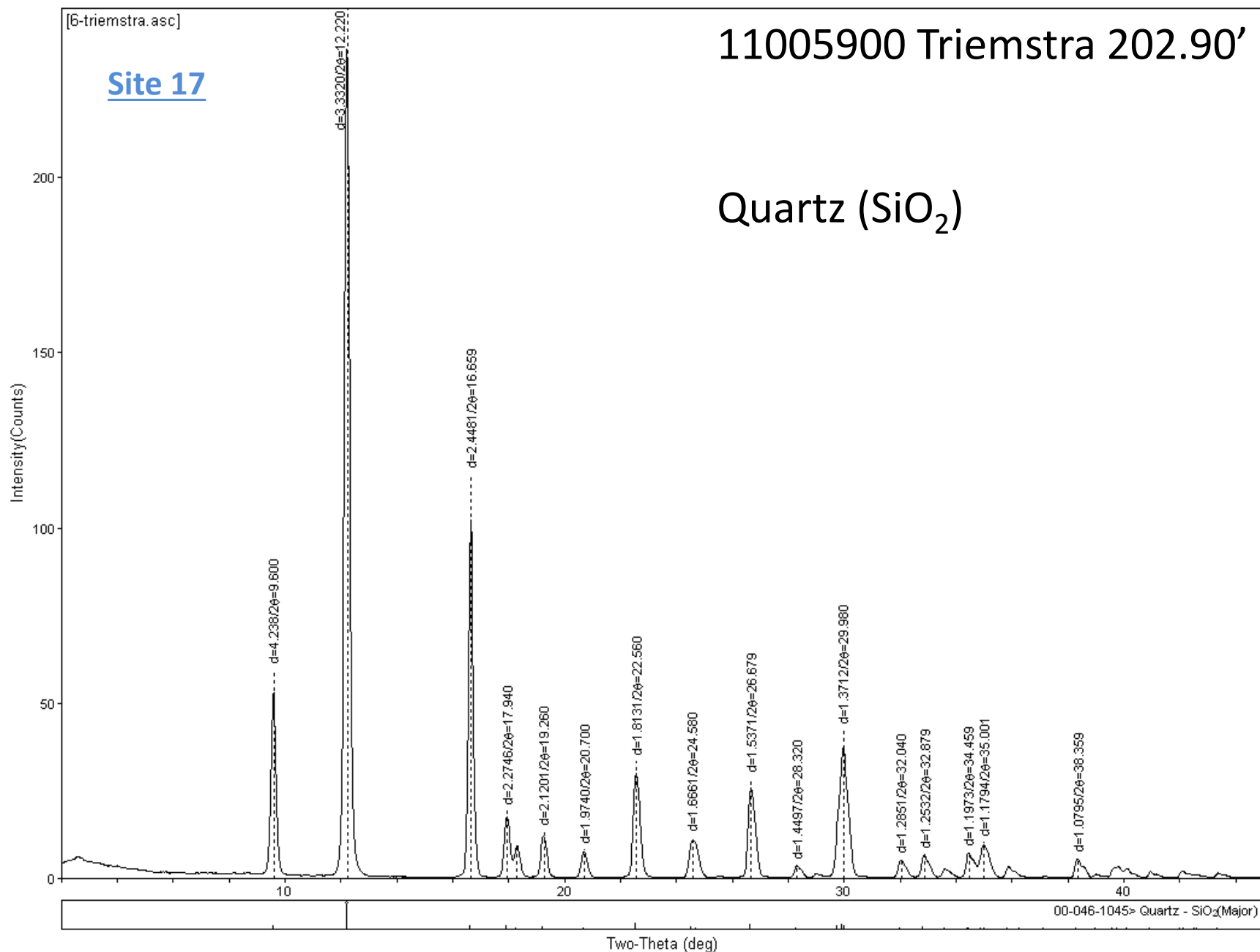
Quartz ( $\text{SiO}_2$ )



Site 17

11005900 Triemstra 202.90'

Quartz ( $\text{SiO}_2$ )



Cryptophyllite is a mica and may have many alternatives or mixed layers contributing to the high angle peaks.

Goethite: Common Fe-rich weathering product

Bernalite: near-surface oxidization zone, found in a Pb-Zn deposit-associations

Szomolnokite: Secondary mineral formed in pyrite-rich oxidized sulfide deposits, typically under highly acid and arid conditions.

Makatite: Typical of continental evaporite deposits