CHAPTER 9

CONCLUSIONS

1). The area under study comprises the lower Eagle Ford Group of North Central Texas and is focused on studying how the depositional environment affected its paleontology and paleoecology. For this purpose, ten localities were chosen: eight corresponding to the Britton Formation, lower calcareous unit (Turner Park Member), one corresponding to the upper Britton, non-calcareous unit (Camp Wisdom Member), and one representing the lowermost Eagle Ford, the Tarrant Formation.

2). The assignment of this Tarrant Formation to the Eagle Ford Group remains controversial. The focus of the controversy is the stratigraphic position and lithic association of the Tarrant Formation, as to whether it should be assigned to the Eagle Ford Group or it merely represents a facies change of the uppermost Woodbine.

Based on the lithological, micro- and macropaleontological data gathered for this thesis, it is the opinion of the writer that the Tarrant Formation, locally known as "Tarrant beds", is indeed a member of the uppermost Woodbine, whose depositional environment represents a transition from the paralic Woodbine to the deeper Eagle Ford shales. Other geologists in the Metroplex, have also placed the Tarrant in this stratigraphic position.

3). The Eagle Ford Group of North Central Texas was geographically situated on the southeastern margin of the Western Interior Seaway, during which the Eagle Ford shales were deposited. The lower Eagle Ford shales are gently dipping at about 2° to the SE. Eagle

Ford strata were deposited during a transgression of the Late Cretaceous Western Interior Seaway, which had a regression or stillstand near the Cenomanian-Turonian boundary, then another transgression through the rest of the Eagle Ford time.

4). Based on previously published studies the Cenomanian-Turonian boundary is contained within the Eagle Ford, specifically within the Britton Formation. The exact stratigraphic position of this boundary has not been well defined. Based on this thesis (calcareous nannoplankton and ammonite data) the C/T boundary appears to be stratigraphically located in site LEF-4 (Grand Prairie, TX).

Further work would have been desirable to confirm this but rapid residential development on the site did not allow this. A search for additional localities will be necessary.

5). The lower Eagle Ford Group was deposited under dysaerobic/anoxic conditions. This is inferred by the thinly laminated mudstones/shales, the lack of bioturbation, the absence of benthic microfauna and the rarity of invertebrate macrofauna (inoceramids, which are known to have favored dysaerobic environments).

It is concluded that the change in color of the tan (bluff color) lower Britton (Turner Park Mbr.) in opposition to the classical dark shales of the Eagle Ford (upper Britton, Camp Wisdom Mbr.) is not due to weathering of the units, since interfingering of the two colors was observed clearly in several of the localities under study (LEF-2, LEF-3, LEF-4, LEF-5). Analytical data (XRD, TOC%) indicate that the lower and upper Britton are lithologicaly distinct and were deposited under different environmental conditions. It is concluded that both were dysoxic/anoxic environments but the lower Britton's tan (bluff) color is due not to weathering or more oxygenated depositional environment, but to its highly calcareous nature.

6). It is important to point out that the localities under study do not represent complete sections of the lower Eagle Ford. Upper and lower contacts of these sections were not clearly identified. Due to rapid urban development of the area (housing, new railroad bridges and highways) new sections of the Eagle Ford are being exposed and this is a great opportunity for further research.

At the same time, the downside of this urbanization is that the construction is typically very rapid, making the sections ephemeral for geologic or paleontological studies.

7). The layered bentonites found in the lower Britton (Turner Park Mbr.) are windblown volcanic ash that was altered *in situ* in a shallow marine environment. The bentonites are conspicuous and abundant. They are excellent stratigraphic marker beds that can be correlated throughout the study area, although not individual bentonite seams.

8). The depositional environment for the localities under study is interpreted as a transitional environment for locality LEF-10 (Tarrant Formation) ranging from deltaic brackish uppermost Woodbine to classical deeper water Eagle Ford black shales. The depositional environment of localities LEF-1 to LEF-9 is interpreted as low-energy (below wave base) quite, shallow to moderately deep marine neritic environment (30-70 m depth) where fish and their excreta fell to the bottom of a warm and anoxic sea floor. Large sharks, large and small fish, turtles, plesiosaurs, and primitive marine lizards lived in the upper part of the water column. When they died, they continuously accumulated on this anoxic ocean floor devoid of bottom-dwelling scavengers, where they were slowly covered by fine sediments.

The environment of deposition is interpreted as being proximal offshore and of moderate depth based on the pelagic selachian assemblage (abundant cretoxyrhinids). Proximal deposition is indicated by the to the presence of carbonized plants in the bedding plane of some of the better- studied and sampled localities and by the presence in almost all the localities of the enigmatic marine lizards (*Coniasaurus*) which are unlikely to dwell in the open sea. *Coniasaurus* shares characteristics commonly found in families of both marine and terrestrial lizards. Although *Coniasaurus* appear to be abundant in the localities under study, they went extinct at the end of the Turonian, at which point, other marine lizards, the formidable mosasaurs dominated the oceans of the world.

9). Stratigraphic correlation across the area is provided by bentonite marker beds. In addition, coprolite horizons have a potential use in biostratigraphic correlation (i.e., whenever an abundance of coprolites is found within the Eagle Ford Group, such stratigraphic unit may be assigned to the lower Britton Formation, Turner Park Member).

10). The late Cenomanian to early Turonian times correspond to a worldwide biological crisis. The sedimentological, paleontological and paleoecological scenario of the lower Eagle Ford Group in North Central Texas is consistent with the events recorded during the late Cenomanian/Turonian worldwide.

APPENDIX I

PRESENTATION AND CORRELATION OF MEASURED SURFACE SECTIONS

MEASURED SECTIONS OF THE OUTCROPS UNDER STUDY

In North Central Texas fossil occurrences although scattered are abundant. Sections are rarely well exposed because of overgrown vegetation and the low relief of the area since bedrocks dip only about 2 degrees southeast. Highway construction and the never ending development of new residential and commercial areas open new stratigraphic sections continuously. Unfortunately they are rather ephemeral due to rapid construction and/or overgrown vegetation due to the hot Summers of North Central Texas.
It is in this area that 10 outcrops within the Dallas-Fort Worth Metroplex were selected for the present study. Sections were measured using Jacob's staff, Avney level and Brunton compass. The outcrops were designated as follows:

Localities LEF-1 to LEF-8	Lithostratigraphic unit: Lower Eagle Ford Group Lower Britton Formation Turner Park Member
Locality LEF-9	Lithostratigraphic unit: Lower Eagle Ford Group Upper Britton Formation Camp Wisdom Member
Locality LEF-10	Lithostratigraphic unit: Lowermost Eagle Ford Group Tarrant Formation

Locality LEF-1. (32^o 34.8' N, 97^o 05.03' W). Southwest corner of Hwy 360S and Broad St. in Mansfield, TX (Tarrant, Co).Thinly laminated calcareous buff color mudstones, abundant ironstone nodules (1 to 3 cm in length), caliche nodules fairly abundant on top of section. Several bentonite seams observed of 5 to 20 cm in thickness. Ichnofauna consisting of abundant vertebrate coprolites (float) throughout the section, but appear to come from horizon 1.2 to 2 m from base of measured section. The coprolites were found in excellent state of preservation and many contain bone inclusions (fish/shark teeth, scales, vertebrae, etc.). Throughout the section abundant ichthyofauna can be seen, including the oldest saurodontid fish in North America (Stewart and Friedman, 2001).
Reptilian remains include isolated plesiosaur teeth and vertebrae, rare turtle bones and occasional teeth and vertebrae of the enigmatic marine lizard *Coniasaurus*. Ammonites are rare throughout the section. Inoceramids are very abundant. Several fossilized pearls were found also (Friedman and Hunt, 2004).

Locality LEF-2. (32^o 33.4' N 97^o 05.1' W). Located along both sides of Hwy 360S, 3 miles south of LEF-1, Mansfield, TX (Tarrant County). Parallel-thinly laminated calcareous buff color mudstones, with black shales lower part of measured section. Occasional ironstone

nodules(1 to 3 cm in length), occasional caliche nodules throughout the section. Several bentonite seams were observed of 5 to 15 cm in thickness. Ichnofauna consisting of abundant vertebrate coprolites throughout the section. These coprolites also contain inclusions and are somehow bigger than those found in locality
LEF-1. The coprolites were all found in the tan (buff color) sediments and none in the black shales. Very abundant ichthyofaunal remains are seen throughout the section: sharks and other fish teeth and vertebrae in all sizes were found throughout the outcrop. Rare isolated plesiosaur teeth as well as a partial jaw were also found, as well as turtle remains and vertebrae and jaws of coniasaurs. Large inoceramid pelecypods are found in situ throughout the section. Fossil pearls were found as well. Ammonites fragments were very rare. Plant remains were found often in the lower part of the measured section, consisting of carbonaceous films of plants that lived either nearshore or were carried offshore by currents.

Locality LEF-3. (32^{o} 33.4' N, 97^{o} 04.3' W). A ditch at the end of intersection of Woodcrest Ln. and Bramble Ln. in Mansfield, TX. (Tarrant County). Thinly laminated calcareous buff color mudstones, with black shales at the base of the measured section. Several bentonite seams can be seen in this section (one 18 cm in thickness, and two thinner ones of 10 cm in thickness). Occasional ironstones nodules can be seen throughout the section. Rare caliche nodules. Ichnofauna consisting of occasional vertebrate coprolites, in very good state of preservation, many contain inclusions. Abundant ichthyofauna throughout the section. Plesiosaur remains were found (occasional caudal vertebrae), as well as occasional coniasaurs articulated vertebrae. Inoceramids were found often, but none *in situ* and no pearls were ever found. Plant remains were found at the base of the section, consisting of carbonaceous films like the previous locality.

Locality LEF-4. (32^{o}45.0' N, 97^{o} 02.0' W). Housing development at the intersection of Duncan Perry Road and Avenue J in Grand Prairie, TX. (Tarrant County). This is an old locality that has been nowadays greatly expanded by residential development. The locality consists of thinly laminated calcareous buff color mudstones intertongued with thinly laminated fissile black shales which contain abundant spherical pyrite nodules (average 2 cm in diameter). Bentonite seams, 5 to 25 cm in thickness were observed throughout the outcrop. Rare ironstones nodules were found at this locality and no caliche nodules at all. Ichnofauna consists of occasional vertebrate coprolites with inclusions found in the buff color mudstones often and rarely in the black shales. Abundant ichthyofauna was found throughout the locality, as well as occasional plesiosaur teeth and vertebrae. Rare *Coniasaurus* isolated vertebrae. Inoceramid broken shells were very common. Plant remains were found often as carbonaceous impressions on the bedding planes of well indurated buff color mudstones.

Locality LEF-5. (32^{o} 45.3' N, 96^{o} 59.8' W). Located on the southwest corner of the intersection of Belt Line and I-30 in Grand Prairie, TX (Dallas County). This site is located in front of the Type section of the Turner Park Member of the Britton Fm. as designated by Reaser(2002. The outcrop consists on massive buff color calcareous mudstones that upon close examination reveal to be thinly laminated. The section is intertongued with massive dark gray blocky fissile shales. The unit presents weathering bentonitic seams. Jarosite crystals may be observed in abundance, as well as occasional pyrite nodules.This section is the only one that presents invertebrate trace fossils. A very interesting horizon (18 cm in thickness) of highly bioturbated dark gray shale was readily identified as *Chondrites* sp.

Locality LEF-6. (32° 24.9' N, 97° 13.5' W). Northeast corner of the intersection of Hwy 67 and I-35W in Alvarado, TX (Johnson County). Thinly laminated tan mudstones, thin bentonites (8cm maximum thickness), abundant vertebrate coprolites with inclusions, rare ichtyofauna and rare reptilian remains found. A sandy carbonate-cemented hardground was found containing isolated *Coniasaurus* vertebrae.

Locality LEF-7. (32° 52.0' N, 97° 01.0' W). Construction site (as of 2004) unnamed new terminal along International Parkway at Dallas-Fort Worth International Airport, Grapevine, TX (Tarrant County). Massive buff color mudstones, no detailed measured section was possible due to heavy construction at the site and no detailed fossil assessment was possible either. Workers at the site collected 3 sediment sample bags from a depth of 30 feet at the site of the new terminal (2003). Upon inquiry the foreman informed the writer as of the whereabouts of the rest of the sediments of this huge excavation. The writer was able to collect from those sediments and the megafauna found was remarkably consistent with the megafauna found at all the other localities under study. According to Jacobs (1993): "more than 90 million years ago, the shoreline ran right through the airport. Dinosaurs dwelled along the shore on the west side -the Fort Worth side- of the airport and marine animals swam in its waters on the east side, the Dallas side"

Locality LEF-8. (32°30.0' N, 97°04.0 W). North side of Hwy 287 S, 100 meters east of the Johnson/Ellis County line in Grand Prairie, TX (Ellis County). Thinly laminated buff color mudstones, thin bentonites (5 cm in thickness) abundant coprolites present in one horizon 1m from the base of the measured section. Occasional ironstone nodules and rare caliche. Moderate ichthyofaunal remains. Rare baculites present (*Sciponoceras gracile*).

Locality LEF-9. (32° 31.0' N, 97° 02.0' W). This locality is an exposure along the north side of Mansfield Road just south of Joe Pool Lake in Cedar Hill, TX (Dallas County). This locality consists of dark gray massive and blocky-fracturing to fissile shale. No calcareous microfossils (nannoplankton or foraminifers) were ever recovered. This locality is the type section of the Camp Wisdom Member of the Britton Formation (Reaser, 2002).The member is distinguished in outcrop by its ocherish, calcareous clay-ironstone nodules and gray septarian concretions in dark olive gray shale (Reaser, 2002).

Locality LEF-10. (32° 45.0' N, 97° 00' W). Johnson Creek at the end of Lower Tarrant Lane in Grand Prairie, TX (Dallas County). This sequence consists of greyish-brown sandstones (containing fine wave ripples) and thin brown limestones. Large crustacean burrows *Thalassinoides* (produced by *Callianassa* ?) were found in abundance. *Conlinoceras tarrantense* ammonites were found *in situ* and float on the creek bed. Abundant oysters and oyster fragments can be found throughout the section.

ADDITIONAL OBSERVATIONS

There are no mappable faults occurring in these outcrops the lower Eagle Ford under study. All the faults are small (6 feet at most) and are normal faults. Calcite slickensides were found at localities LEF-1, LEF-2 and LEF-4).

Low-angle cross-stratification, horizontal lamination, lack of bioturbation were the most common sedimentary structures observed. Sedimentary structures and textural parameters indicate that the sediments of localities LEF-1 to 8 were deposited by low-energy waves or currents. The distinctive foraminiferal grainstone (‘platy’ limestone) strata observed in several of the sections (LEF-1, LEF-2, LEF-3, LEF-4, LEF-5 and LEF-6) is interpreted as deposit that could have been caused by a severe event (i.e. storm, flood).

The sandy indurated layers (1-3.5 cm in thickness) lensoid in nature observed near the base of outcrops LEF-1, LEF-2, LEF-4, and LEF-6 under study containing very high concentrations of bone remains are interpreted as storm deposits of a more aggressive nature(i.e. hurricane). It is interesting to notice that a strong petroleum odor comes out as one breaks a piece of these lensoid sandy layers with a geologic hammer.

Another observation throughout the study area is that, beds with distinctive ichnofabrics (e.g.abundant *Chondrites*) are very rare (they were only observed at locality LEF-5) or are there but are not readily exposed in outcrop.

Calcareous material give the localities a buff color. This was confirmed by XRD analyses on the tan sediments of the localities.

The correlation of the sections under study was accomplished by means of lithological characteristics of the sections, bentonite beds, planktic foraminiferal data and coprolites horizons as potential proxies.

The presence of bentonites in the lower Eagle Ford has been documented since the study of Core16 (Christopher, 1982) and therefore were used as stratigraphic event marker beds to correlate the sections. The ichthyofaunal assemblage is also strikingly similar in all the sections when present. (See pocket for measure sections correlation and locality map).

APPENDIX II

X-RAY DIFFRACTION AND TOC% DATA

XRD DATA ON COPROLITES

Principle

X-ray powder diffraction analysis produces a positive identification of a sample of mineral powder, based on the principle that, when X rays linearly enter an atom, some of their energy is absorbed by the atom's orbiting electrons, which reemit X rays of their own in specific patterns due to their atomic structure. These patterns of emitted rays are recorded and enhanced on film and compared against known X-ray diffraction analysis for the various chemical elements; when a match is made, an element is identified.

Sample Preparation

Samples submitted for whole rock mineral XRD analyses are cleaned for obvious contaminants and disaggregated in a mortar and pestle. The sample is then transferred with deionized water and pulverized using a McCrone micronizing mill. The resultant powder is dried, disaggregated, and pressure-packed into an aluminum sample holder to produce random whole-rock mounts (Talbot, 2002).

Analytical Procedures

X-ray Diffraction (XRD) analyses of the samples are performed using a Rigaku automated powder diffractometer equipped with a copper X-ray source (40kV, 35mA) and a scintillation x-ray detector. The whole rock samples are analyzed over an angular range of two to sixty degrees two theta at a scan rate of one degree per minute.
Semiquantitative determination of whole-rock mineral amounts are done utilizing integrated peak areas (derived from peak-decomposition / profile-fitting methods) and empirical

reference intensity ratio (RIR) factors determined specifically for the diffractometer used in data collection. The total phyllosilicate (clay and mica) abundance of the samples are determined on the whole-rock XRD patterns using combined {001} and {hkl} clay mineral reflections and suitable empirical RIR factors (Talbot, 2002).

Samples

The samples chosen were 16 coprolites from localities in the study area as follows:

Samples A1, A2, A3, A4 (Locality LEF-1).

Samples B1, B2, B3 (Locality LEF-2)

Sample C1 (Locality LEF-3)

Sample D1 (Locality LEF-8)

Samples F1, F2 (Locality LEF-4)

Sample G1 (Locality LEF-7)

Samples H1, H2 (Locality-6)

Samples K1, K2 (Locality LEF-5)

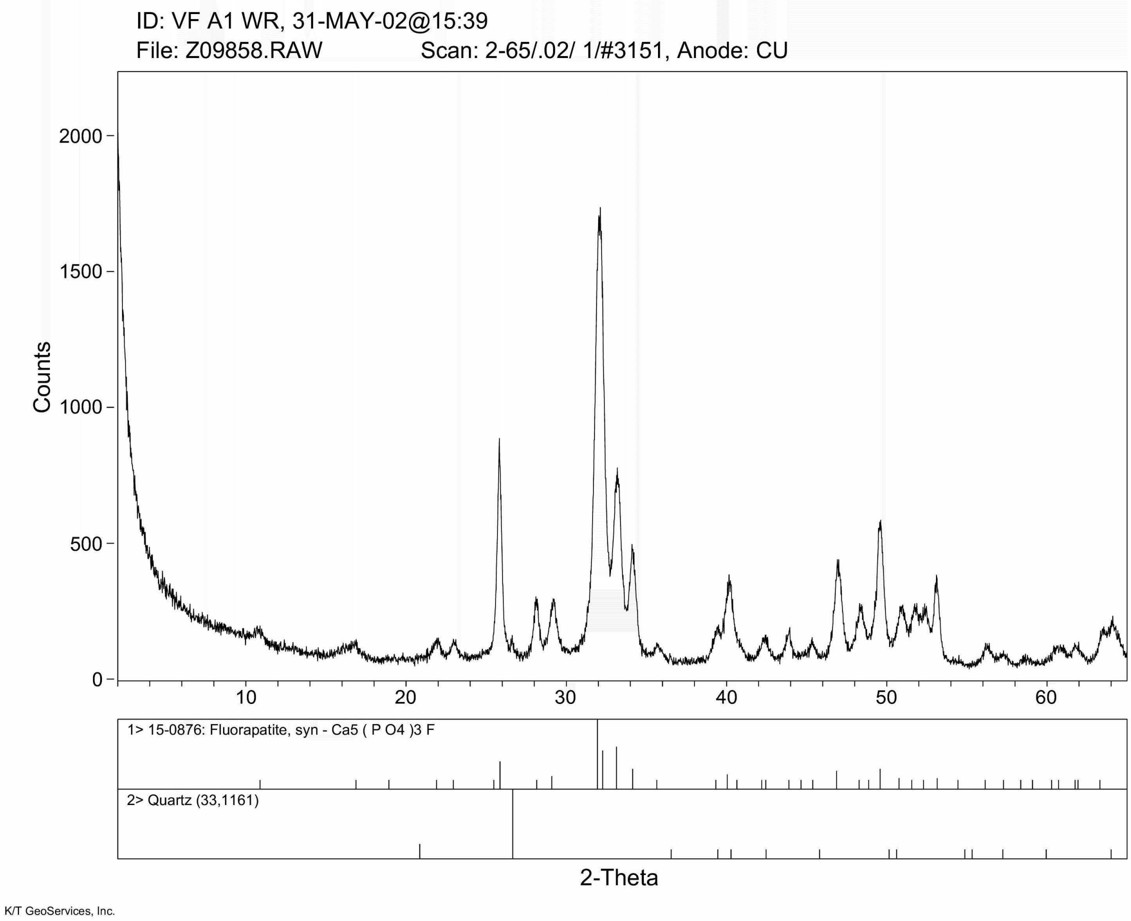
The XRD analyses showed their definitive apatitic mineralogical composition as it was expected. The results are included here as well as the diffractometer patterns.

All XRD analyses were performed by K/T GeoServices, Inc.

X-ray Diffraction Data
Weight Percent

XRD #	Sample ID	Apatite	Quartz	Goethite	Calcite	Illite & Mica	TOTAL
1	Al	99.8%	0.2%	0.0%	0.0%	0.0%	100%
2	A2	96.9%	0.4%	2.7%	0.0%	0.0%	100%
3	A3	93.4%	0.4%	0.0%	4.9%	1.3%	100%
4	A4	98.2%	0.8%	0.0%	0.0%	1.0%	100%
5	Bl	95.3%	0.3%	0.0%	4.4%	0.0%	100%
6	B2	99.6%	0.4%	0.0%	0.0%	0.0%	100%
7	B3	93.6%	0.1%	0.0%	6.3%	0.0%	100%
8	Cl	98.2%	0.5%	0.0%	1.3%	0.0%	100%
9	DI	96.8%	0.2%	0.0%	2.3%	0.7%	100%
10	Fl	98.5%	0.0%	0.0%	0.7%	0.8%	100%
11	F2	97.5%	0.0%	0.0%	2.5%	0.0%	100%
12	GI	95.4%	0.2%	0.0%	4.4%	0.0%	100%
13	HI	96.9%	0.1%	0.0%	2.3%	0.7%	100%
14	H2	99.5%	0.2%	0.0%	0.0%	0.3%	100%
15	KI	99.2%	0.2%	0.0%	0.6%	0.0%	100%
16	K2	94.3%	0.1%	0.0%	5.6%	0.0%	100%

K/T GeoServices, Inc. June 2002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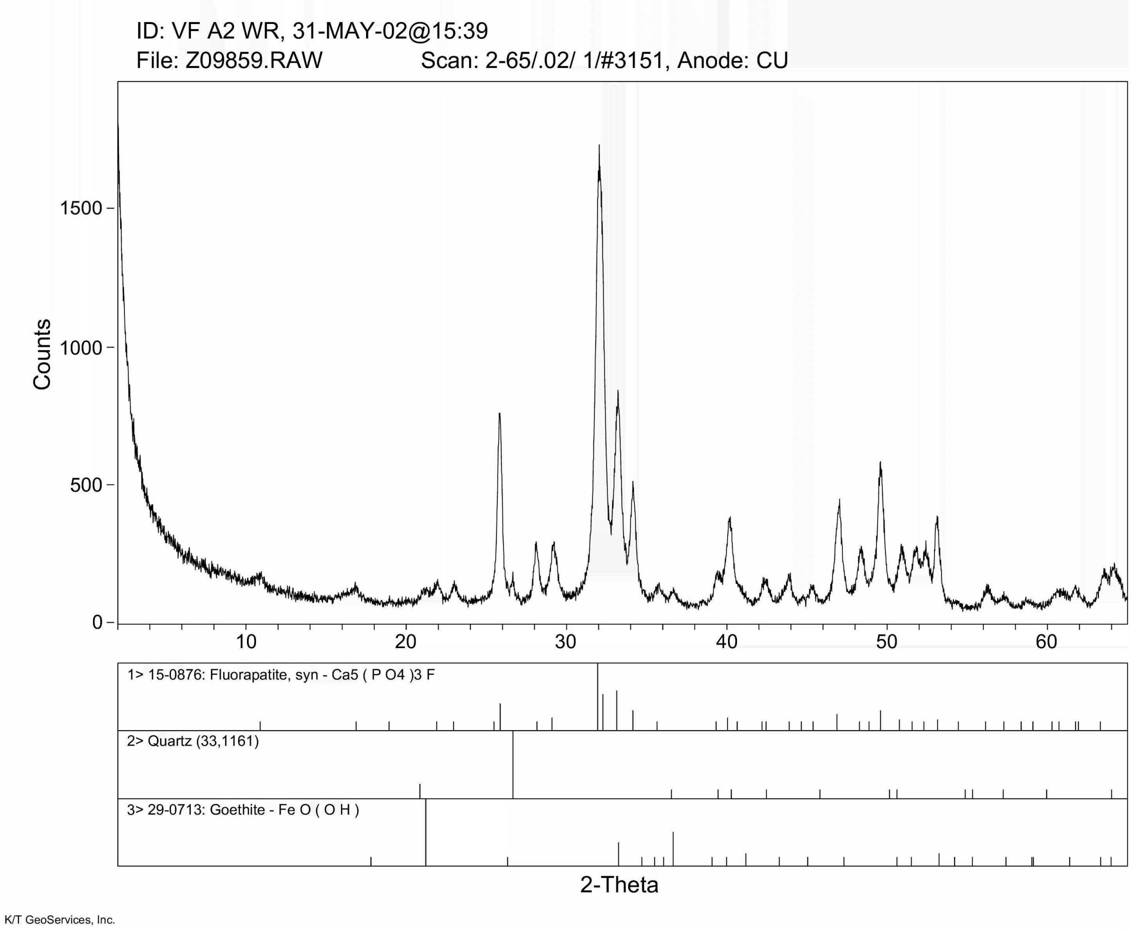
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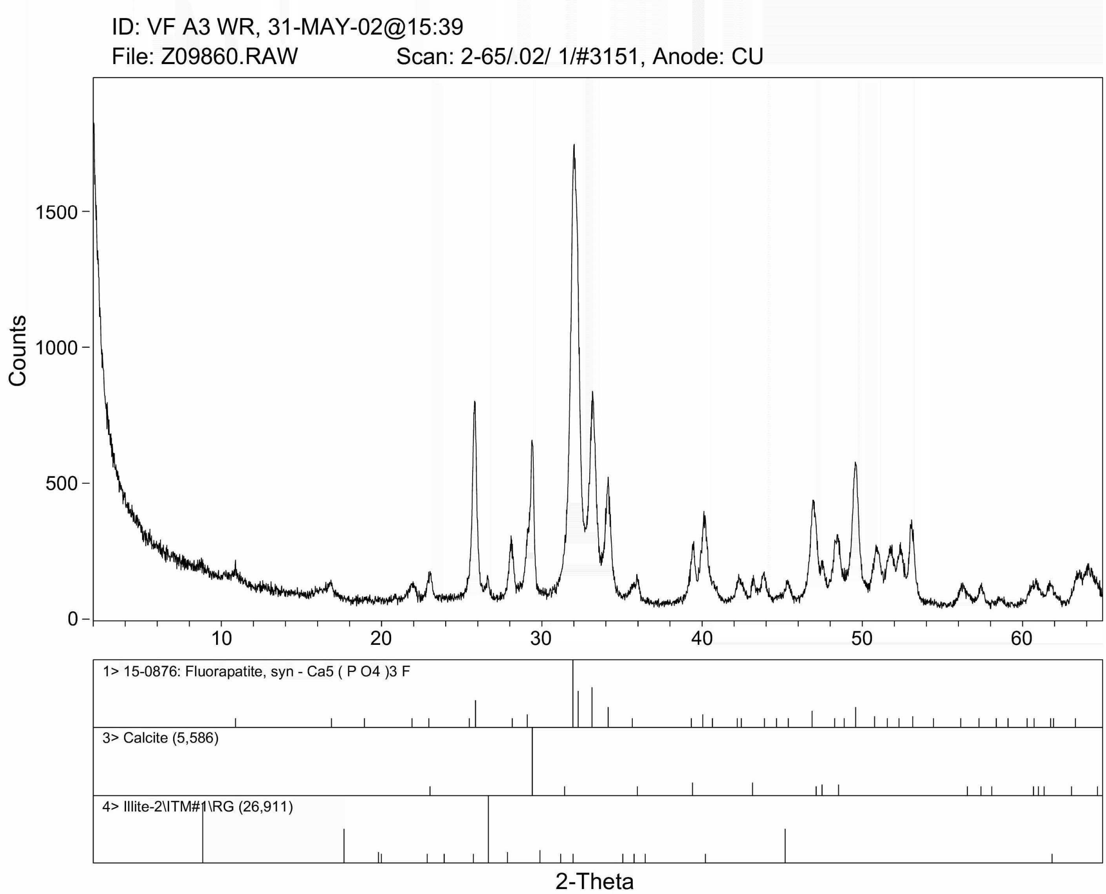

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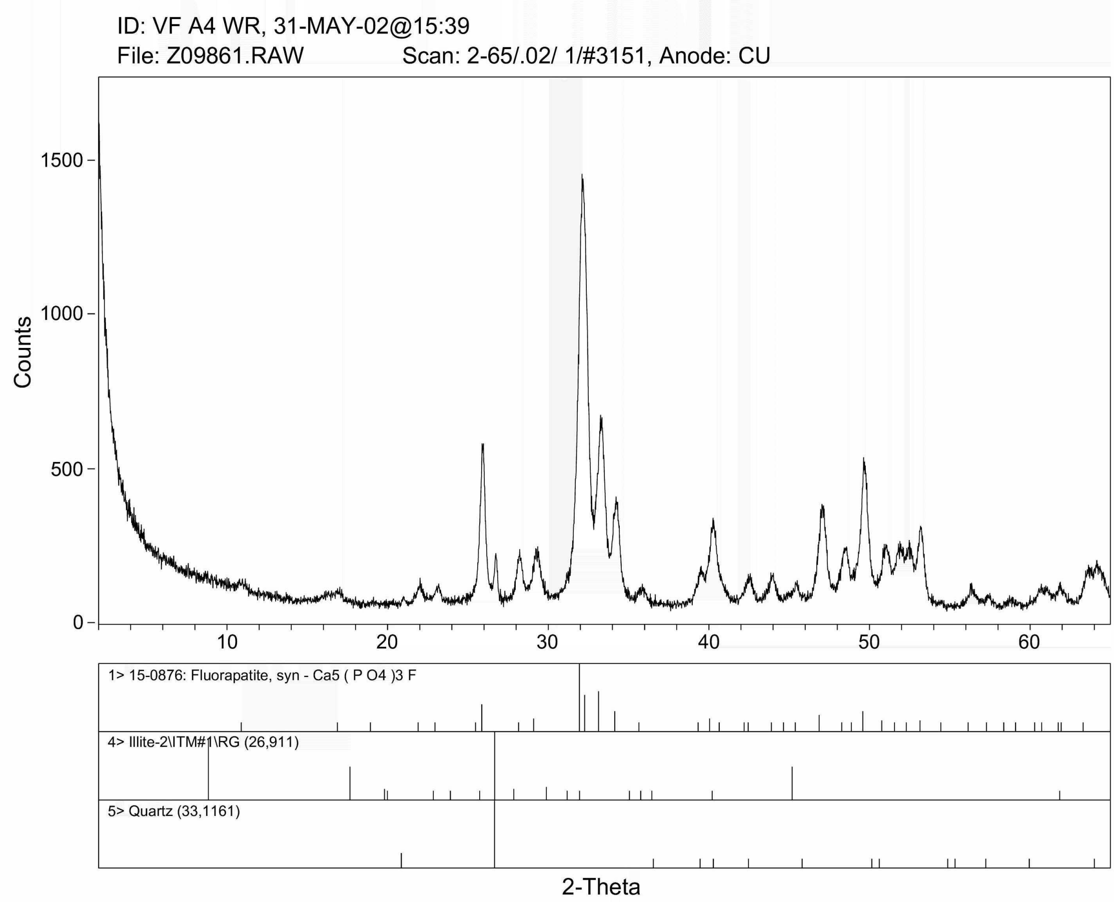

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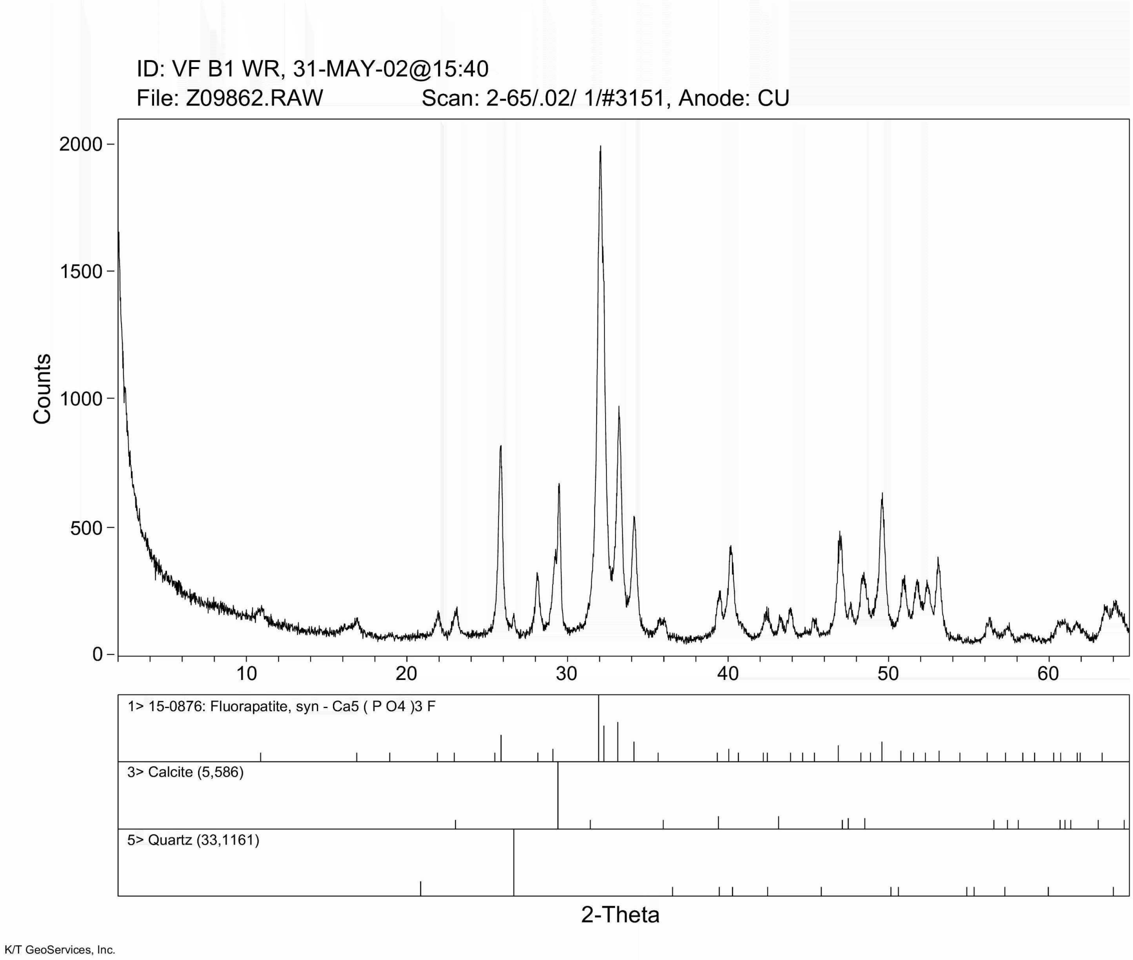
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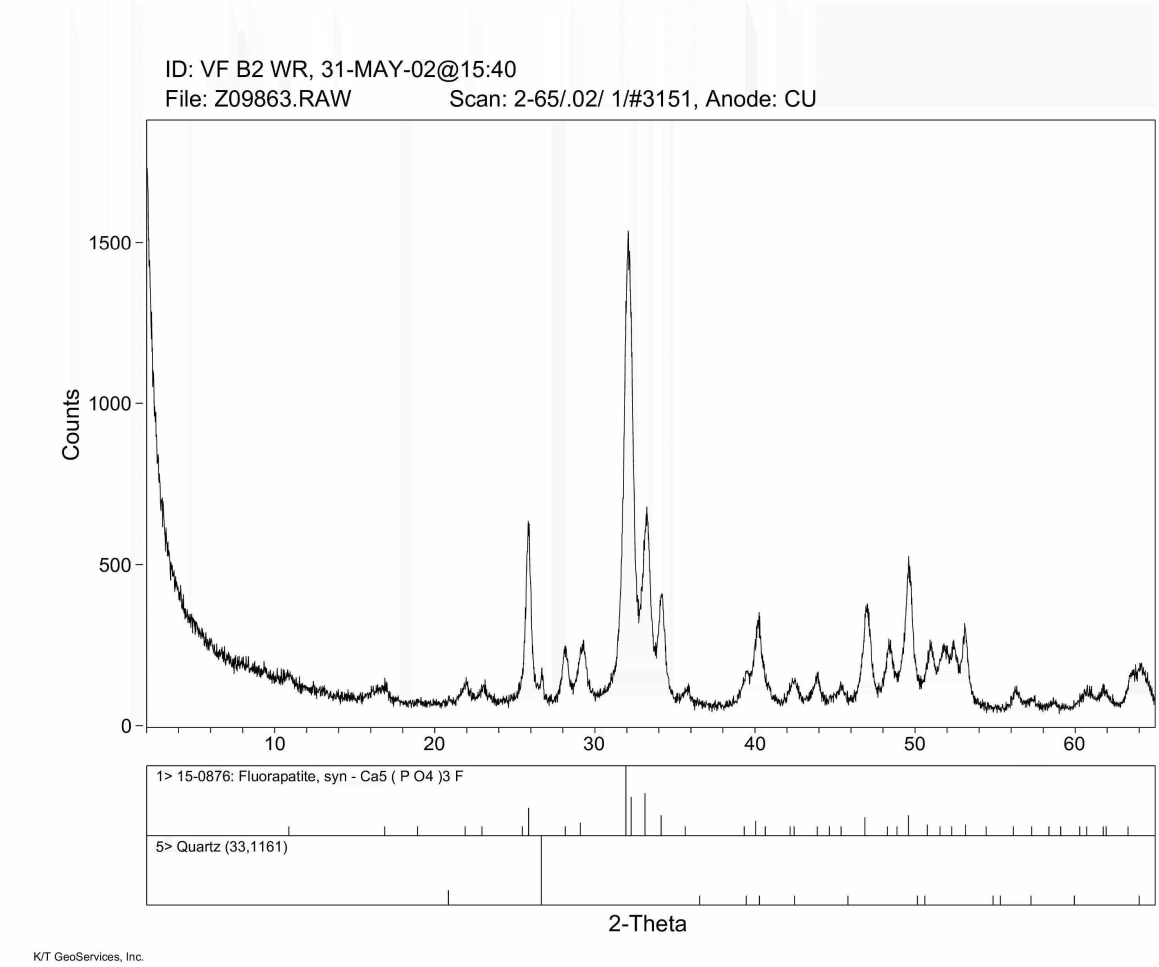
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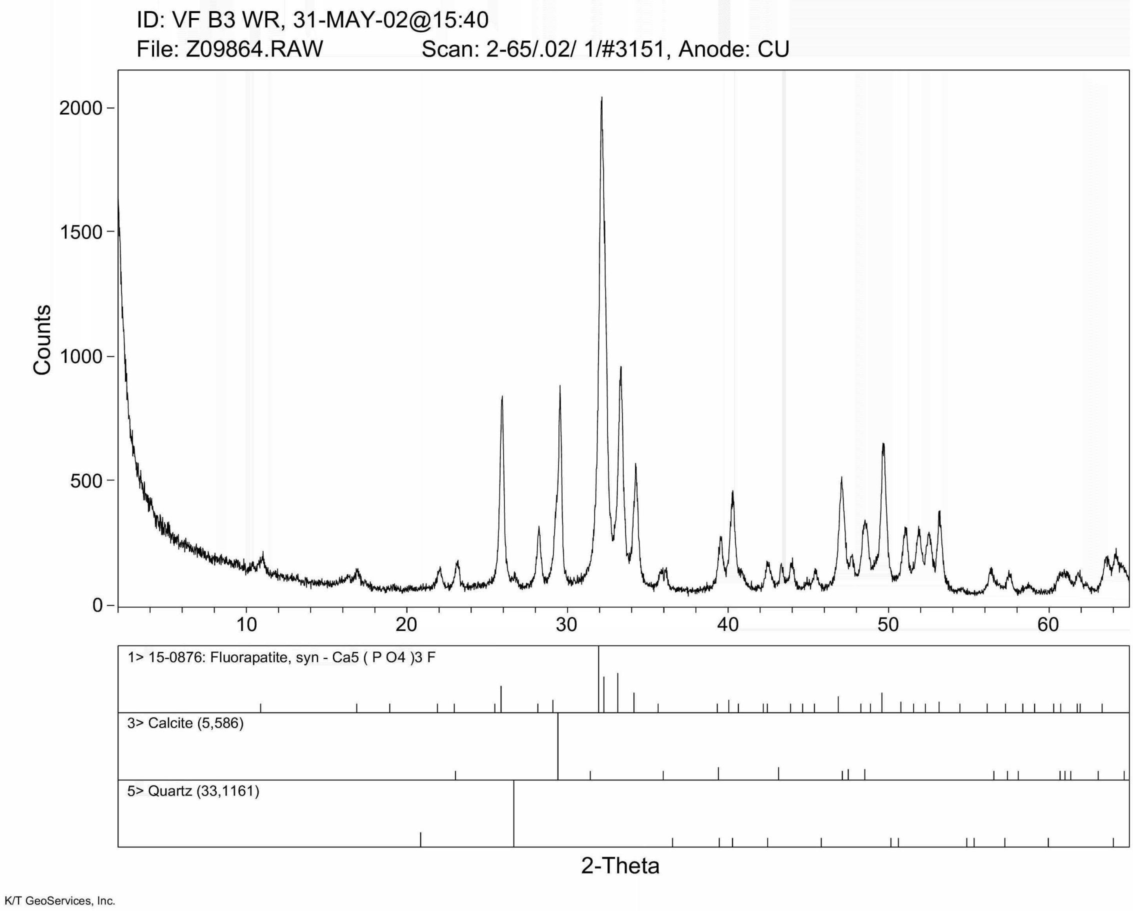
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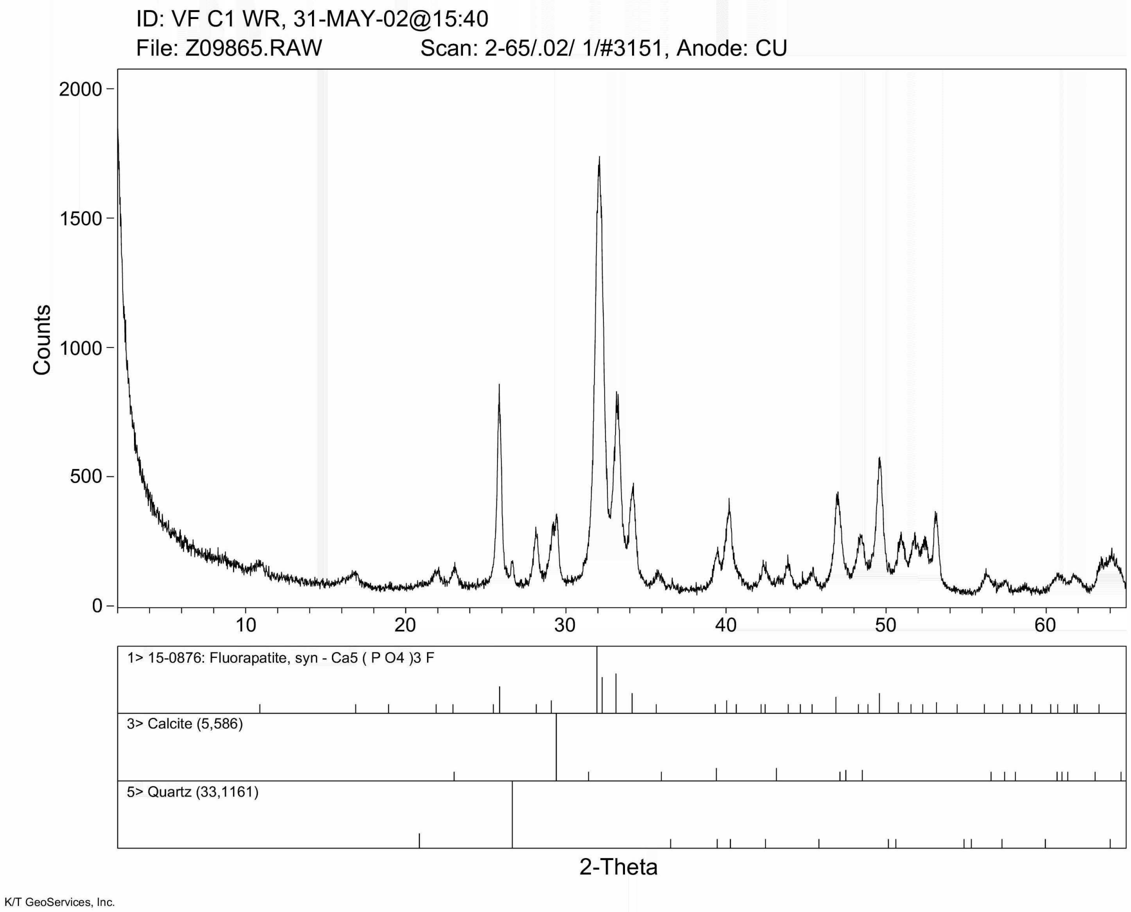
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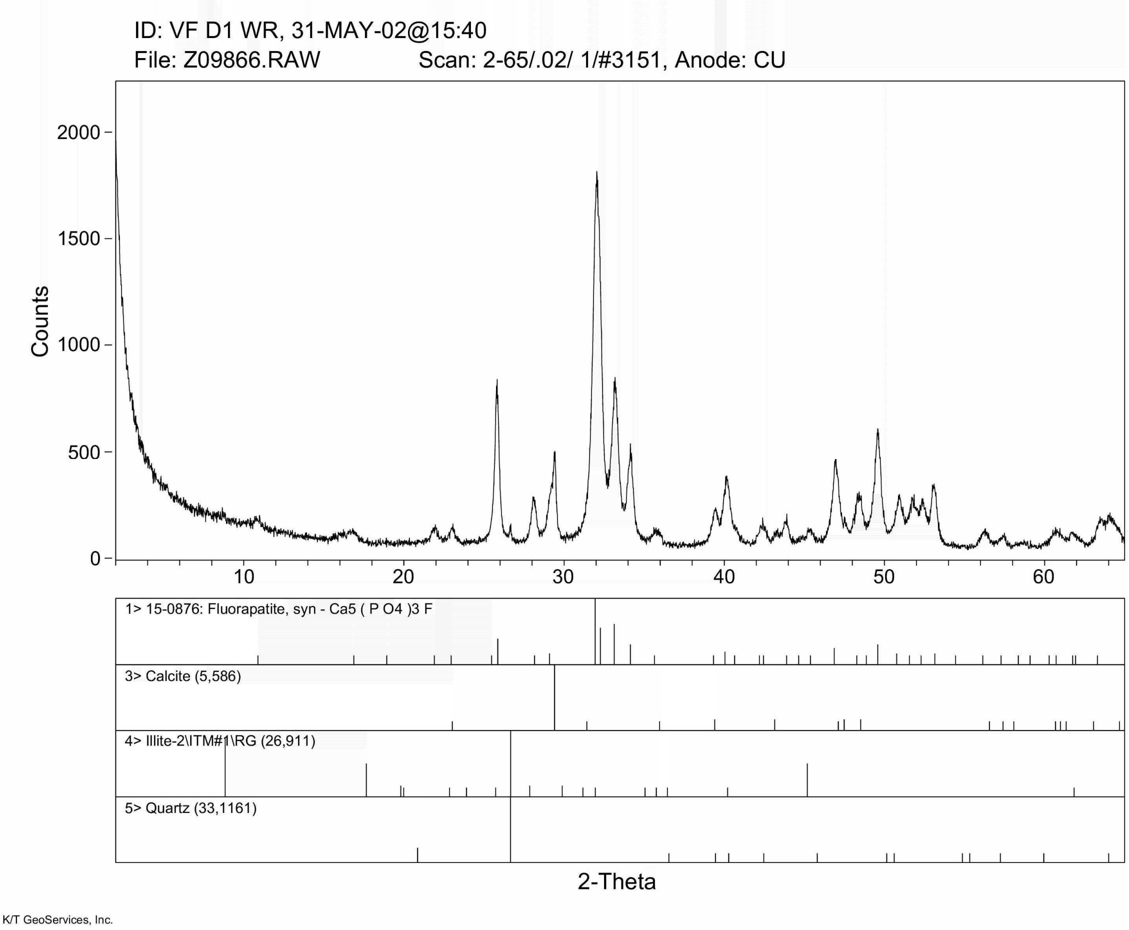
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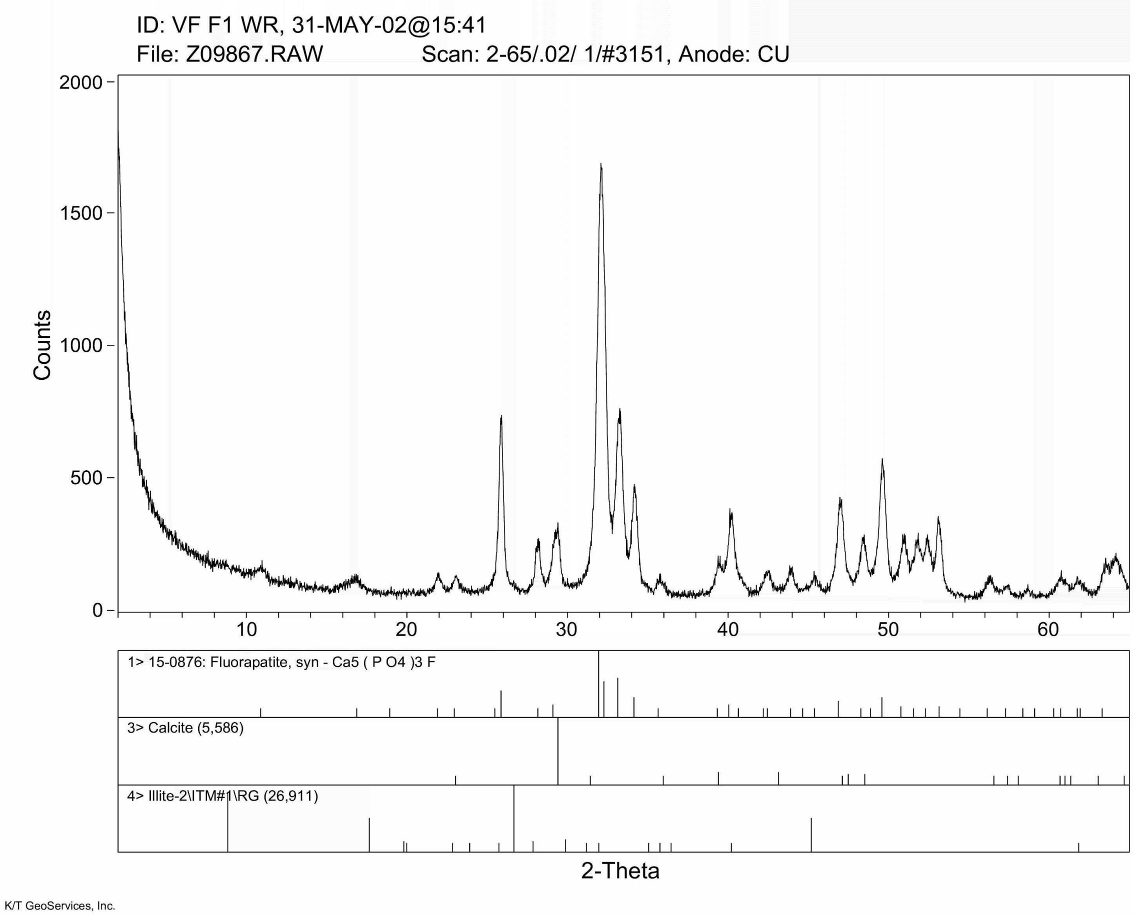
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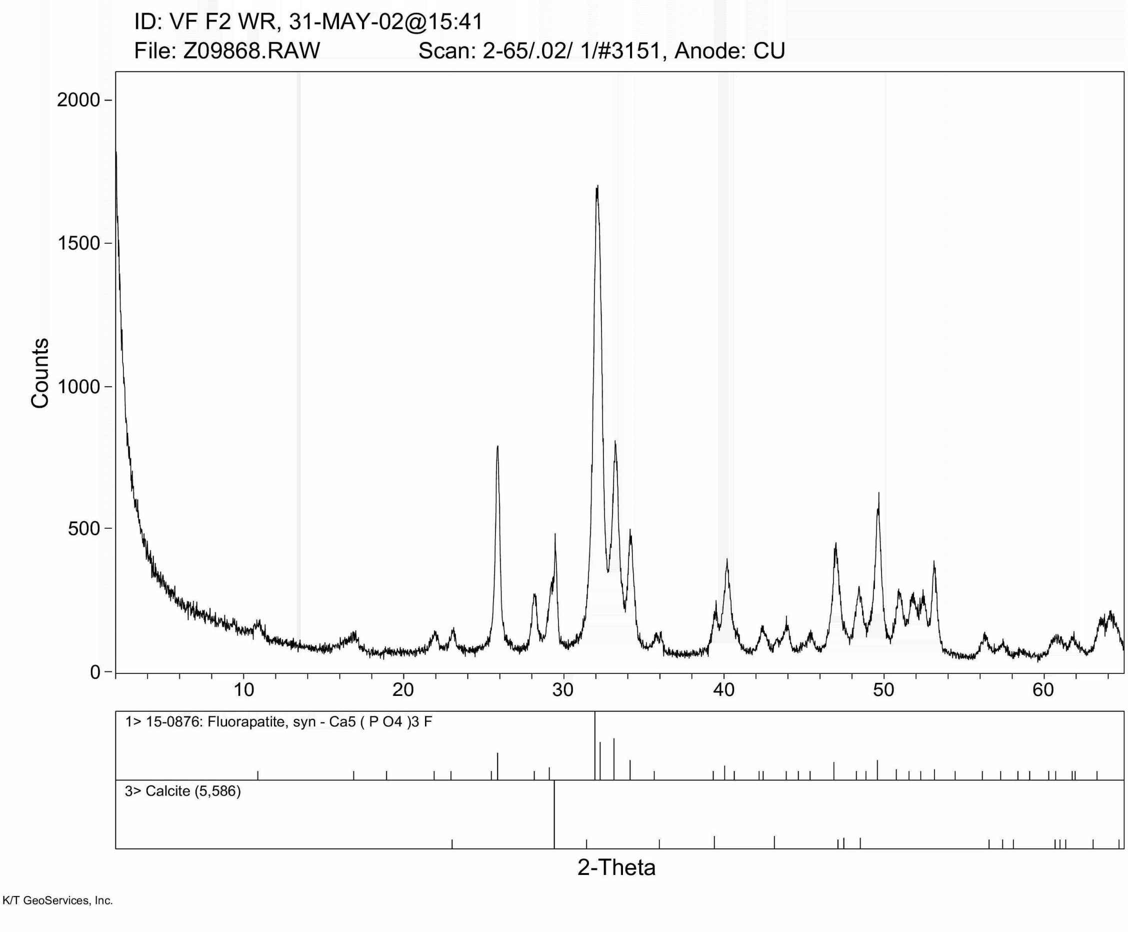
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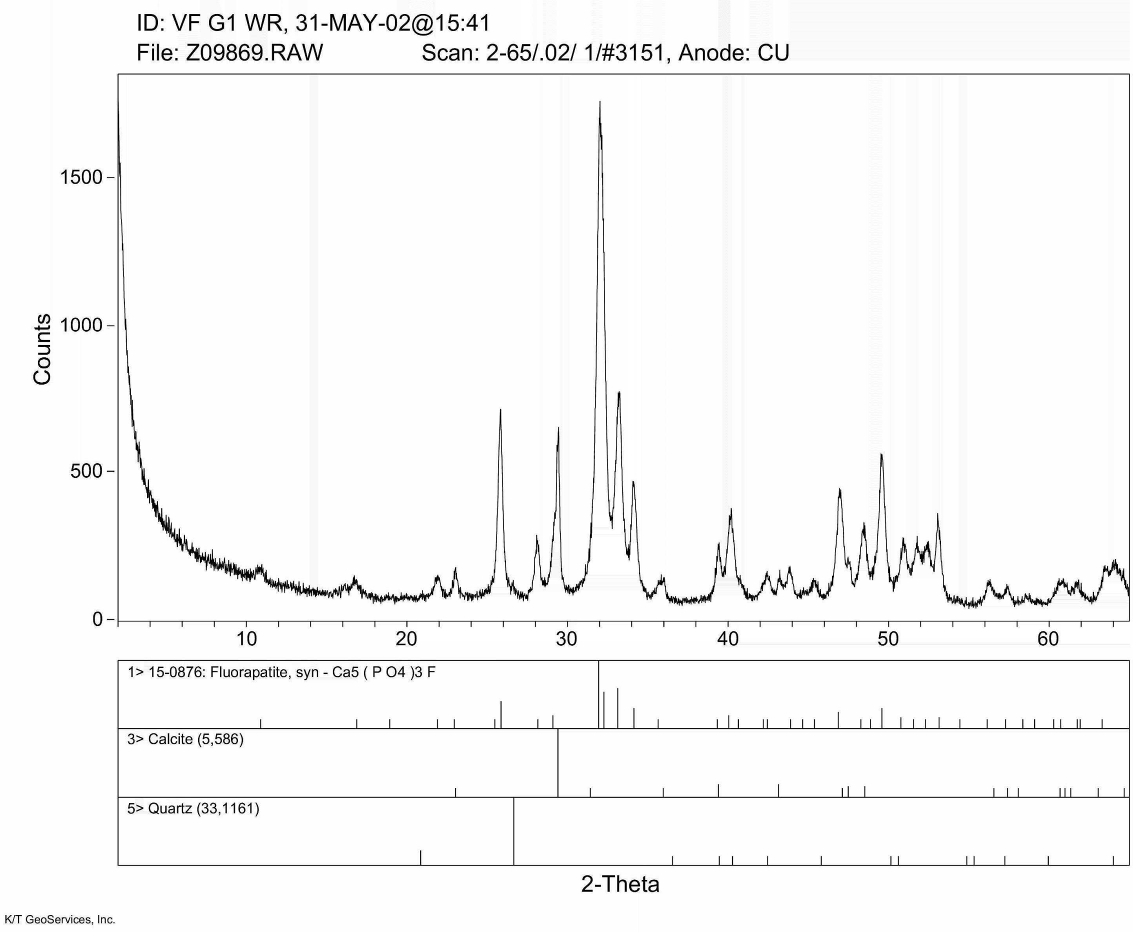
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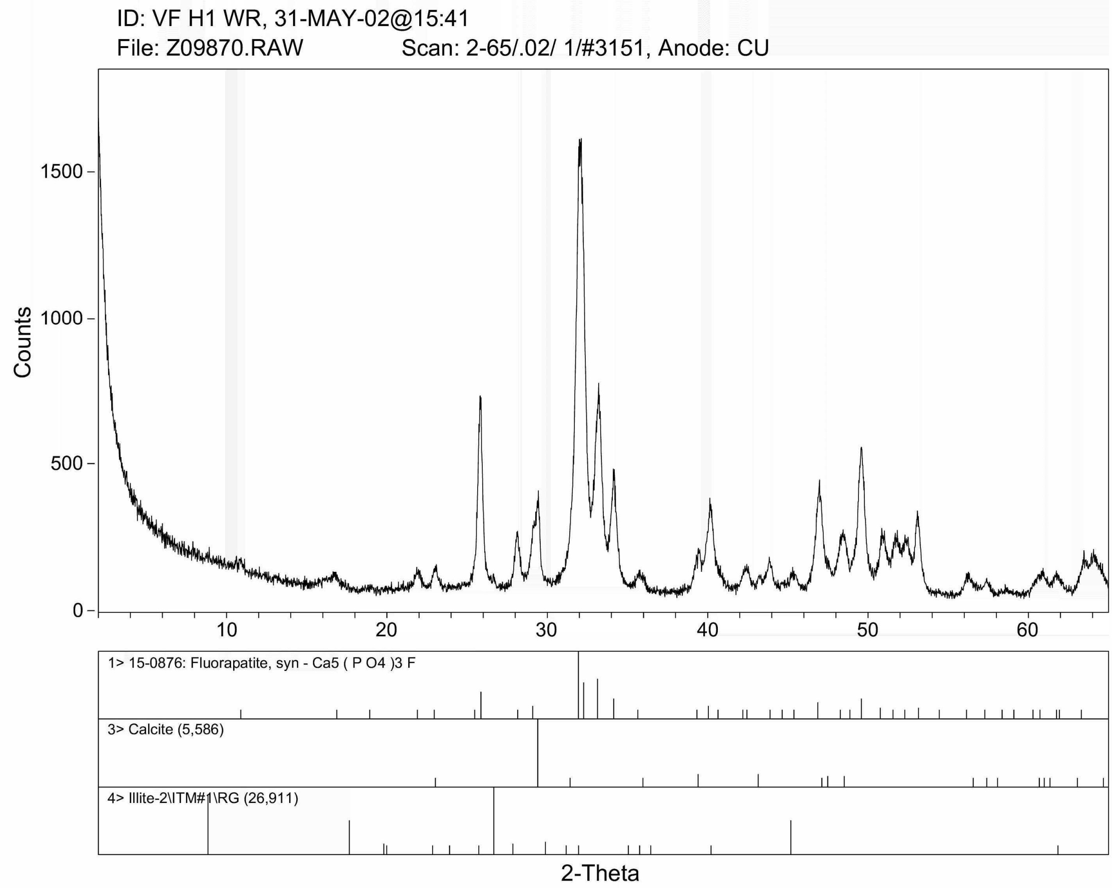
5> Quartz (33,1161)
2-Theta
K/T GeoServices, Inc.



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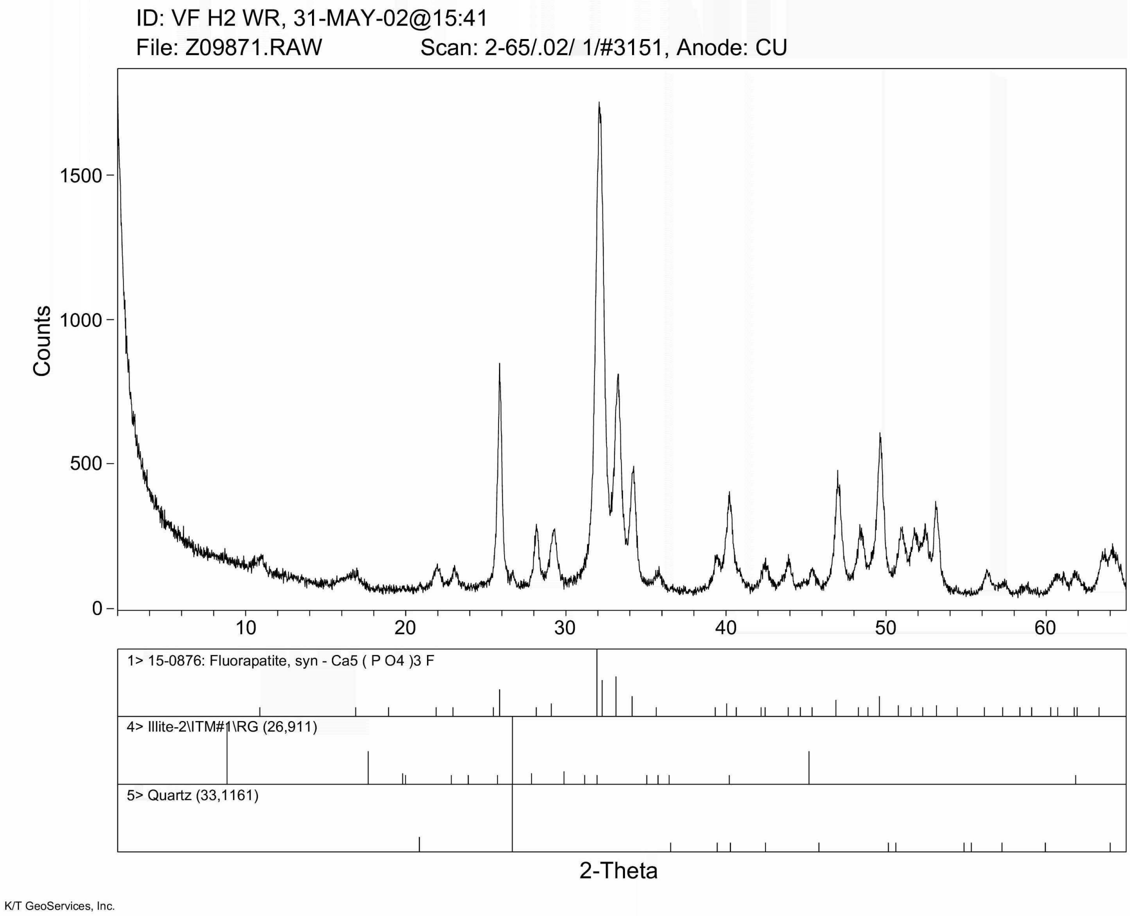
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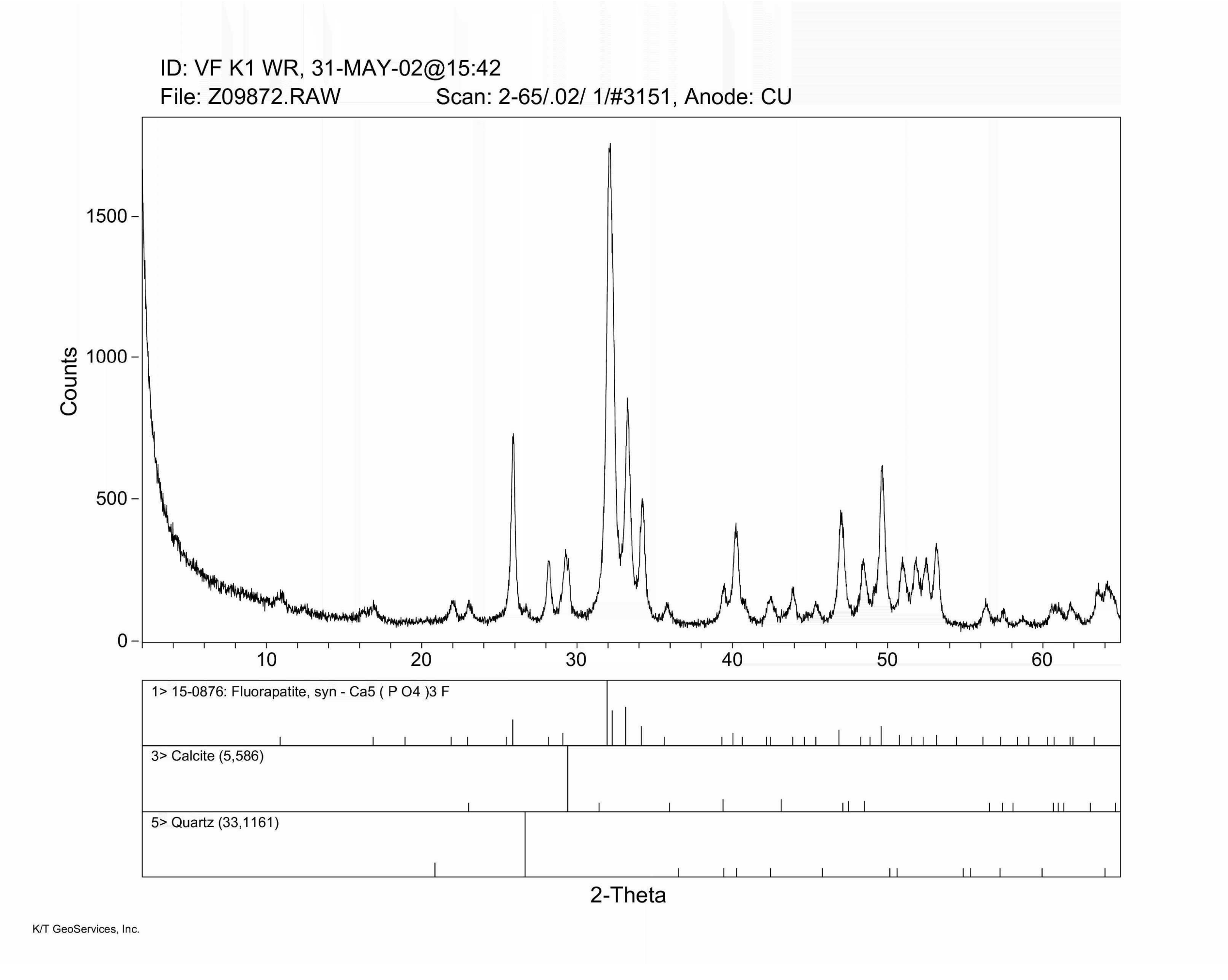
4> Illite-2\ITM#1\RG (26,911)
5> Quartz (33,1161)
2-Theta
K/T GeoServices, Inc.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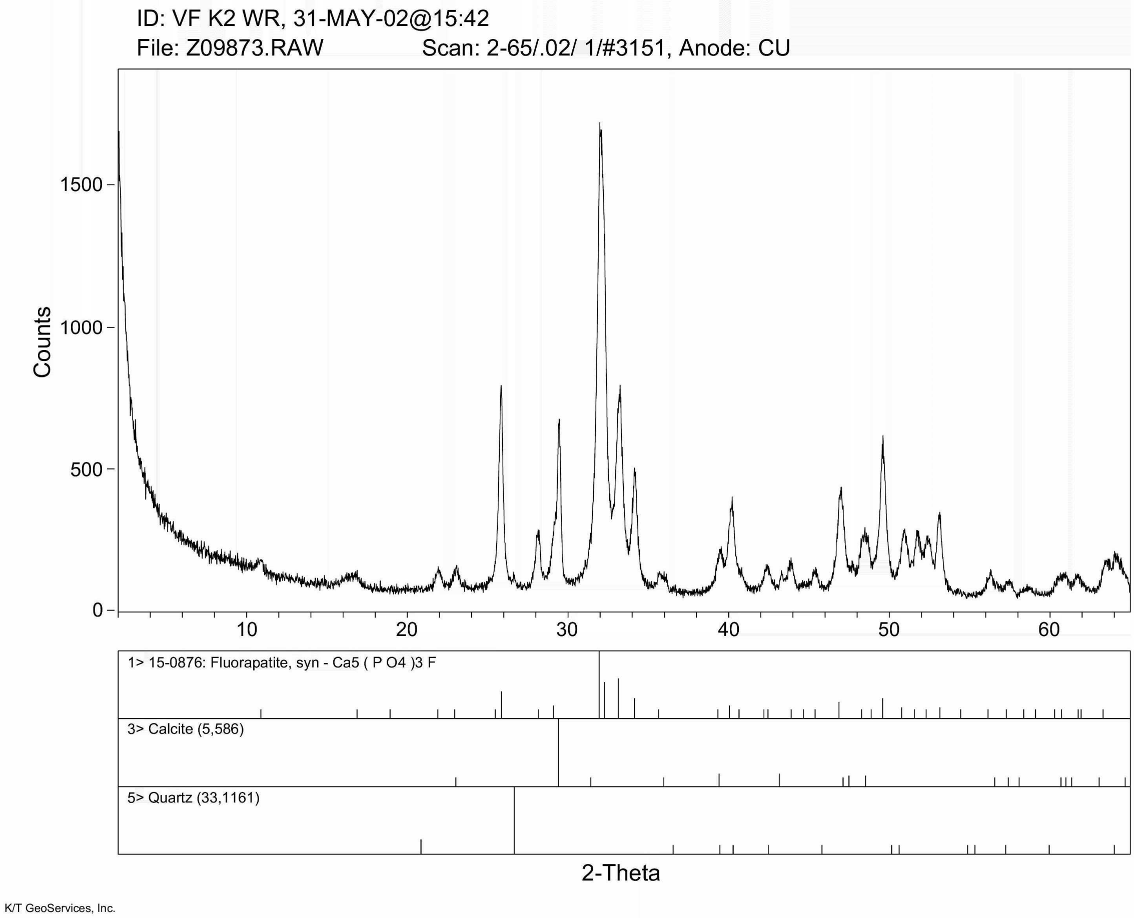
5> Quartz (33,1161)
2-Theta
K/T GeoServices, Inc.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1> 15-0876: Fluorapatite, syn - Ca5 (P O4)3 F
3> Calcite (5,586)
5> Quartz (33,1161)
2-Theta
K/T GeoServices, Inc.

WHOLE ROCK XRD

Three sediment samples were analyzed for whole rock mineralogy, labeled as 1, 2 and 3.

Sample 1.- Sediment sample from locality LEF-9 Upper Britton, Camp Wisdom Mbr. (non-calcareous unit of the Britton Fm., black shale).

Sample 2.- Sediment sample from locality LEF-4 Lower Britton, Turner Park Mbr. (calcareous unit of the Britton Fm., tan mudstones).

Sample 3.- Sediment sample from locality LEF-4 Lower Britton, Turner Park Mbr. (dark grey mudstones).

The results are shown here as well as the diffractometer patterns.

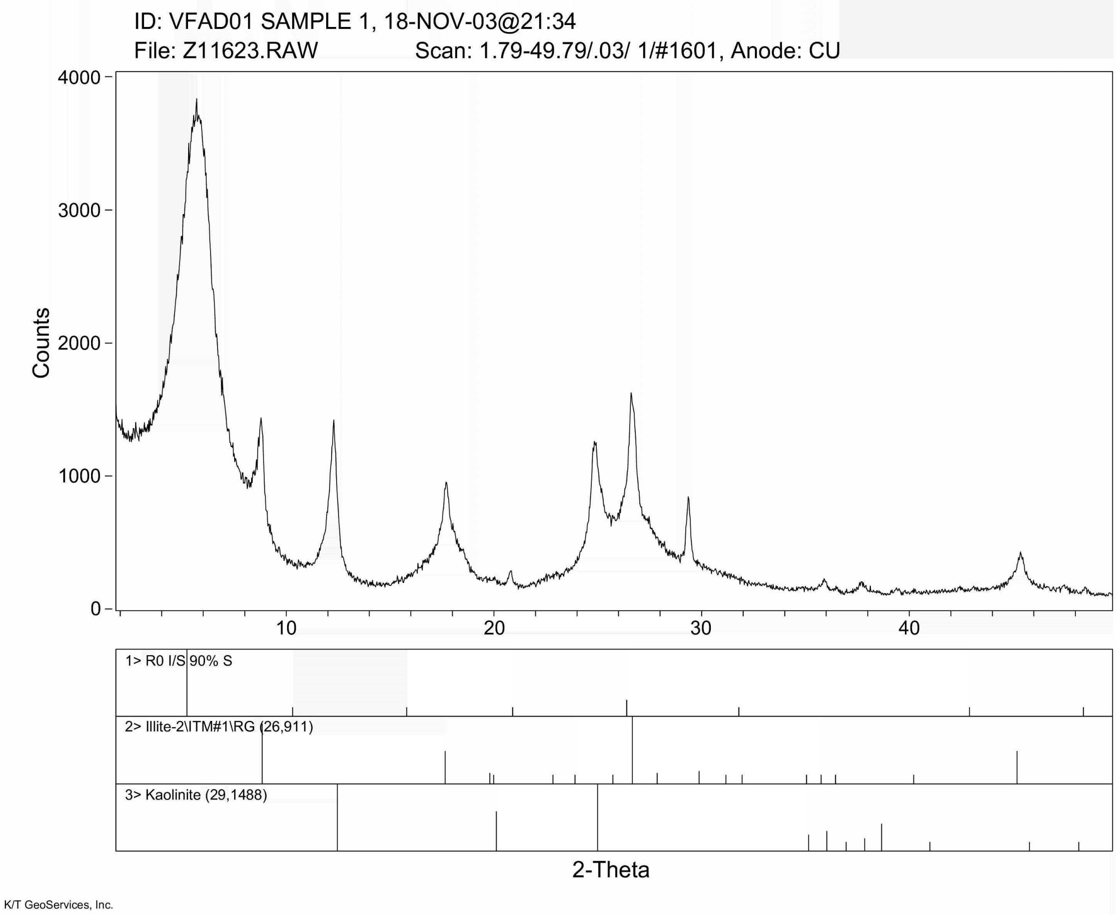
All XRD analyses were performed by K/T GeoServices, Inc.

Sediment Samples:

1	2	3	XRD#
Z11617	Z11618	Z11619	Whole Rock (WR) raw
Z11626	Z11627	Z11628	Ethylene Glycol (EG) solvated clay fraction
Z11623	Z11624	Z11625	Air Dried (AD) clay fraction

Sample	1	2	3
Whole Rock Mineralogy			
(Weight Percent)			
Quartz	19 %	4.5%	15 %
Calcite	5.3%	57 %	37 %
Pyrite	2.2%	0%	6.0%
Total Phyllosilicates	74 %	38 %	42 %
TOTAL	100%	100%	100%
Phyllosilicate Mineralogy			
(Relative Abundance)			
R0 M-L I/S*	70 %	81 %	57 %
Illite & Mica	16 %	7.8%	14 %
Kaolinite	12 %	10 %	25 %
Chlorite	1.8%	0.7%	3.5%
TOTAL	100%	100%	100%
% S in M-L I/S**	90%	90%	80%
Summary Mineralogy			
(Weight Percent)			
Quartz	19 %	4.5%	15 %
Calcite	5.3%	57 %	37 %
Pyrite	2.2%	0%	6.0%
R0 M-L I/S*	51 %	31 %	24 %
Illite & Mica	12 %	3.0%	5.9%
Kaolinite	8.8%	4.0%	11 %
Chlorite	1.3%	0.2%	1.4%
TOTAL	100%	100%	100%

*R0 M-L I/S - Randomly Ordered Mixed-Layer Illite/Smectite
**% S in M-L I/S - Percent Smectite in Mixed-Layer Illite/Smectite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30
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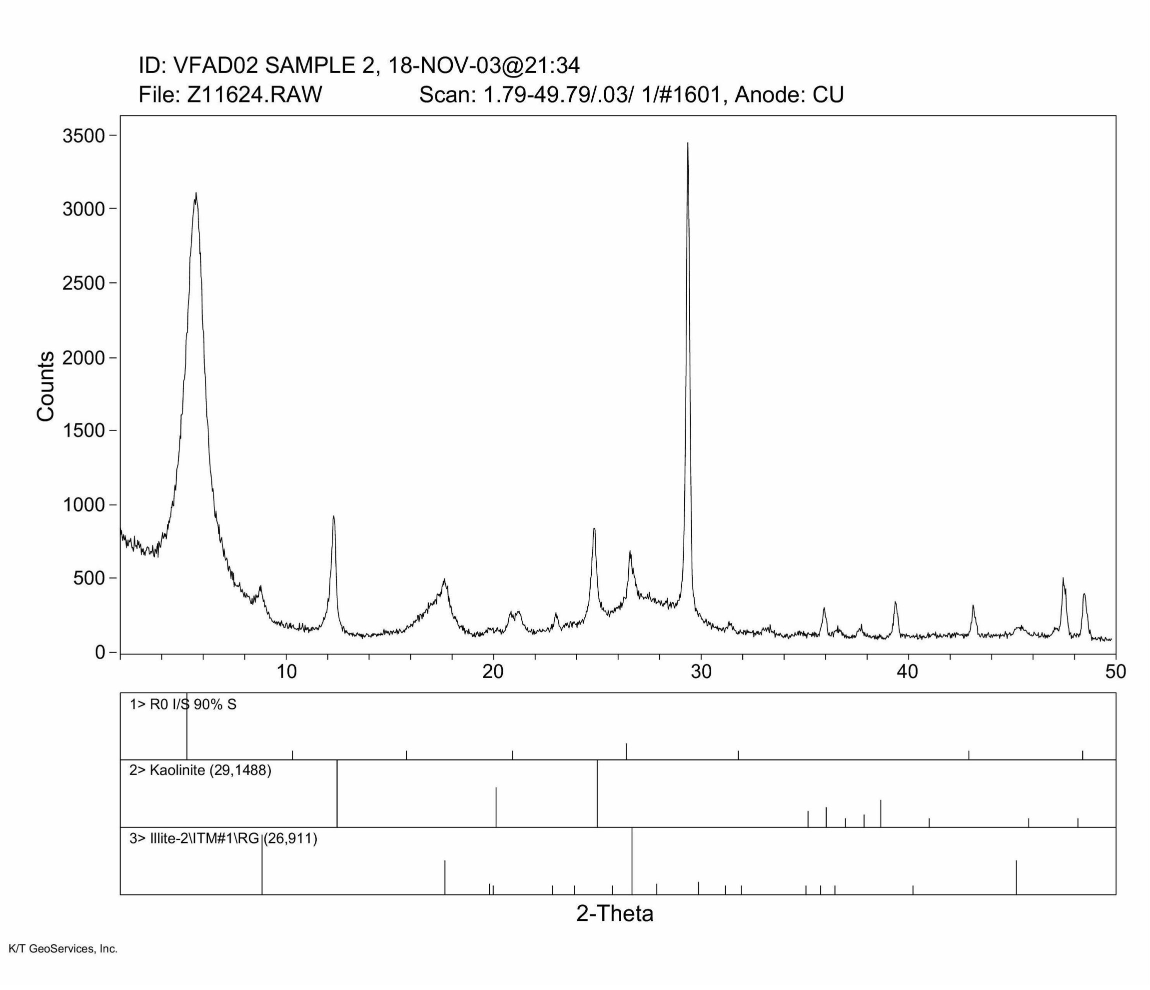
3> Kaolinite (29,1488)
2-Theta
K/T GeoServices, Inc.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40
50
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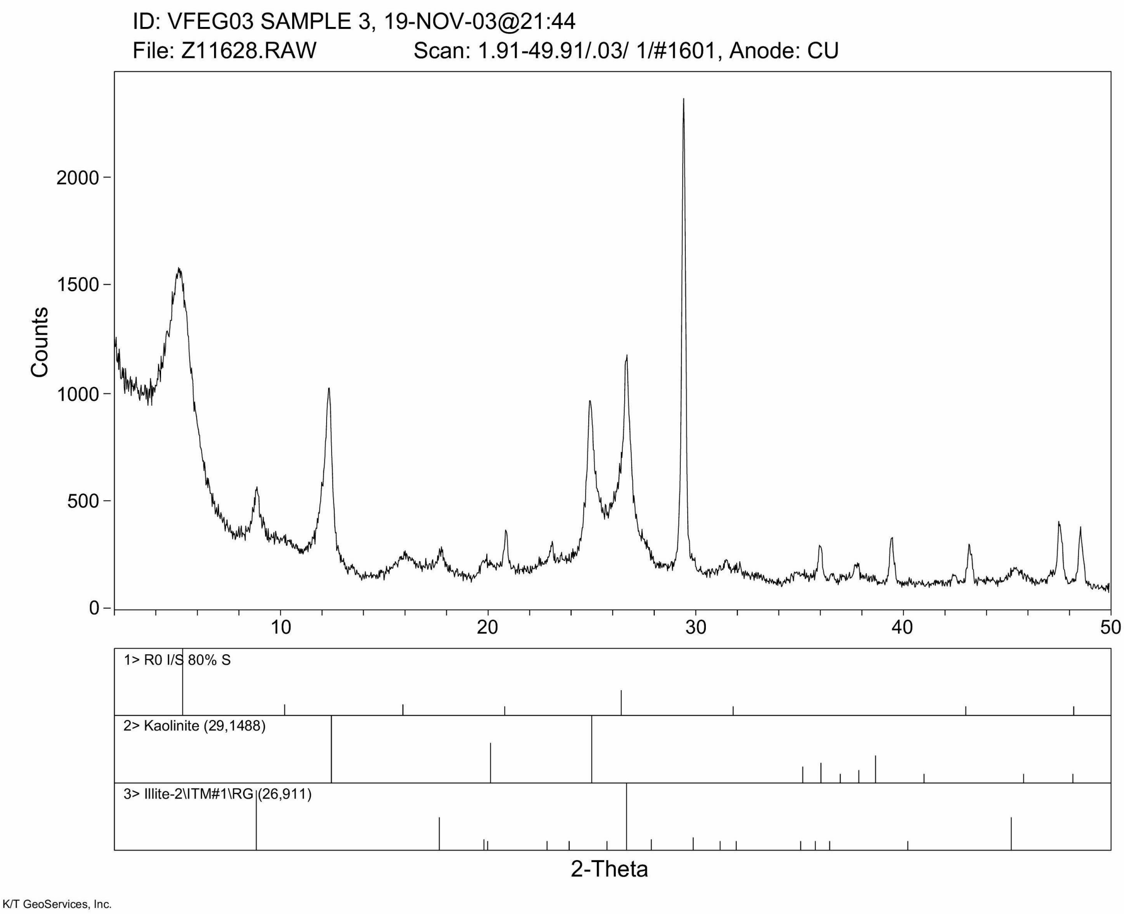
2> Kaolinite (29,1488)
3> Illite-2\ITM#1\RG (26,911)
2-Theta
K/T GeoServices, Inc.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20
30
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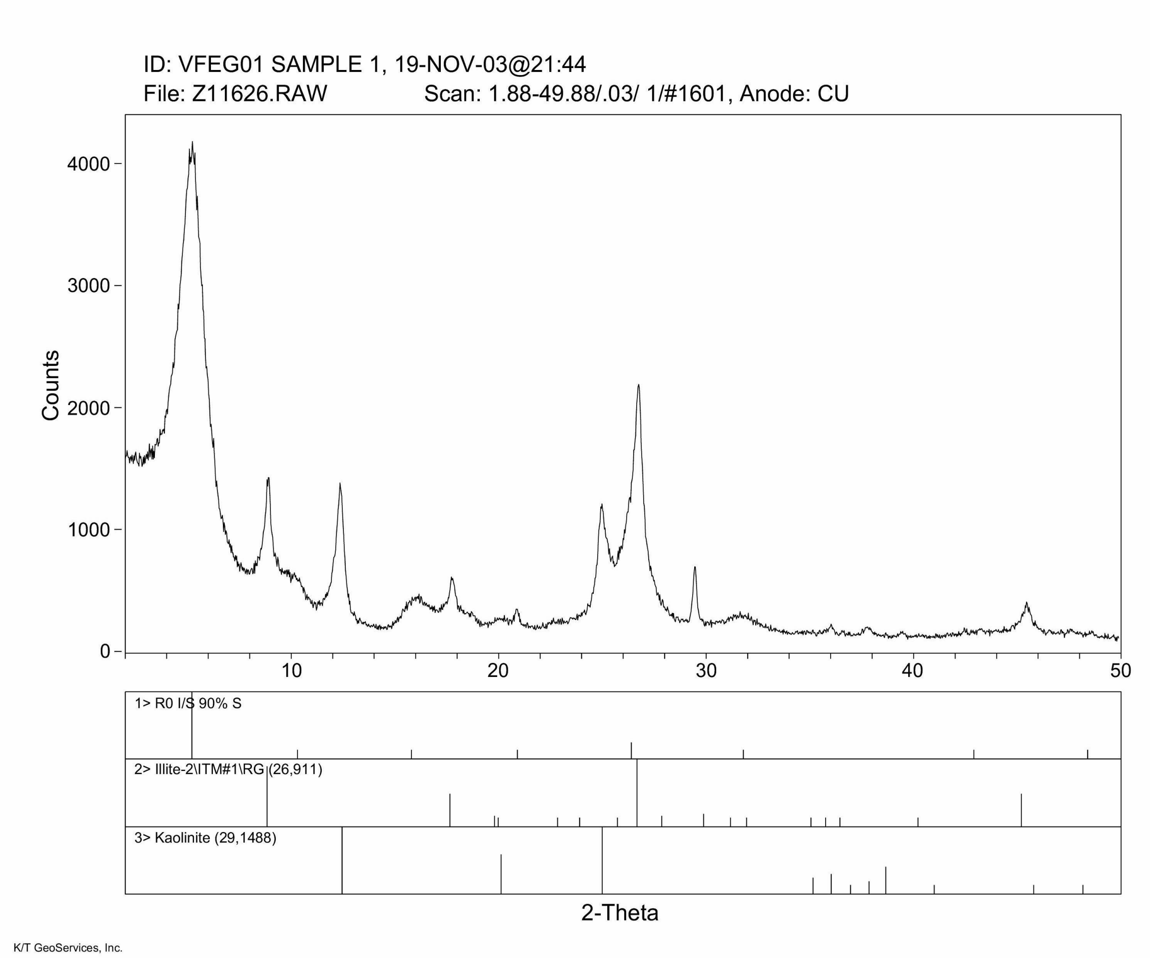
2> Kaolinite (29,1488)
3> Illite-2\ITM#1\RG (26,911)
2-Theta
K/T GeoServices, Inc.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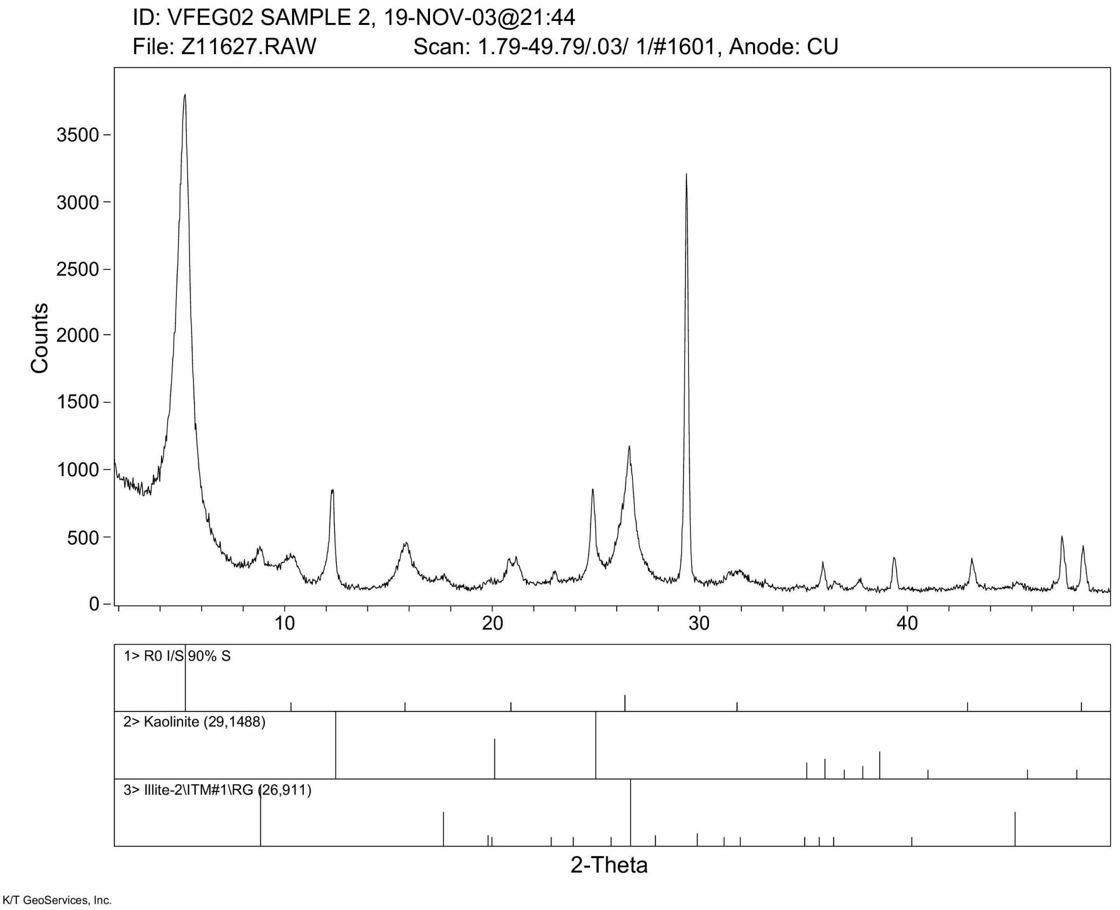
2> Illite-2\ITM#1\RG (26,911)
3> Kaolinite (29,1488)
2-Theta
K/T GeoServices, Inc.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10
20
30
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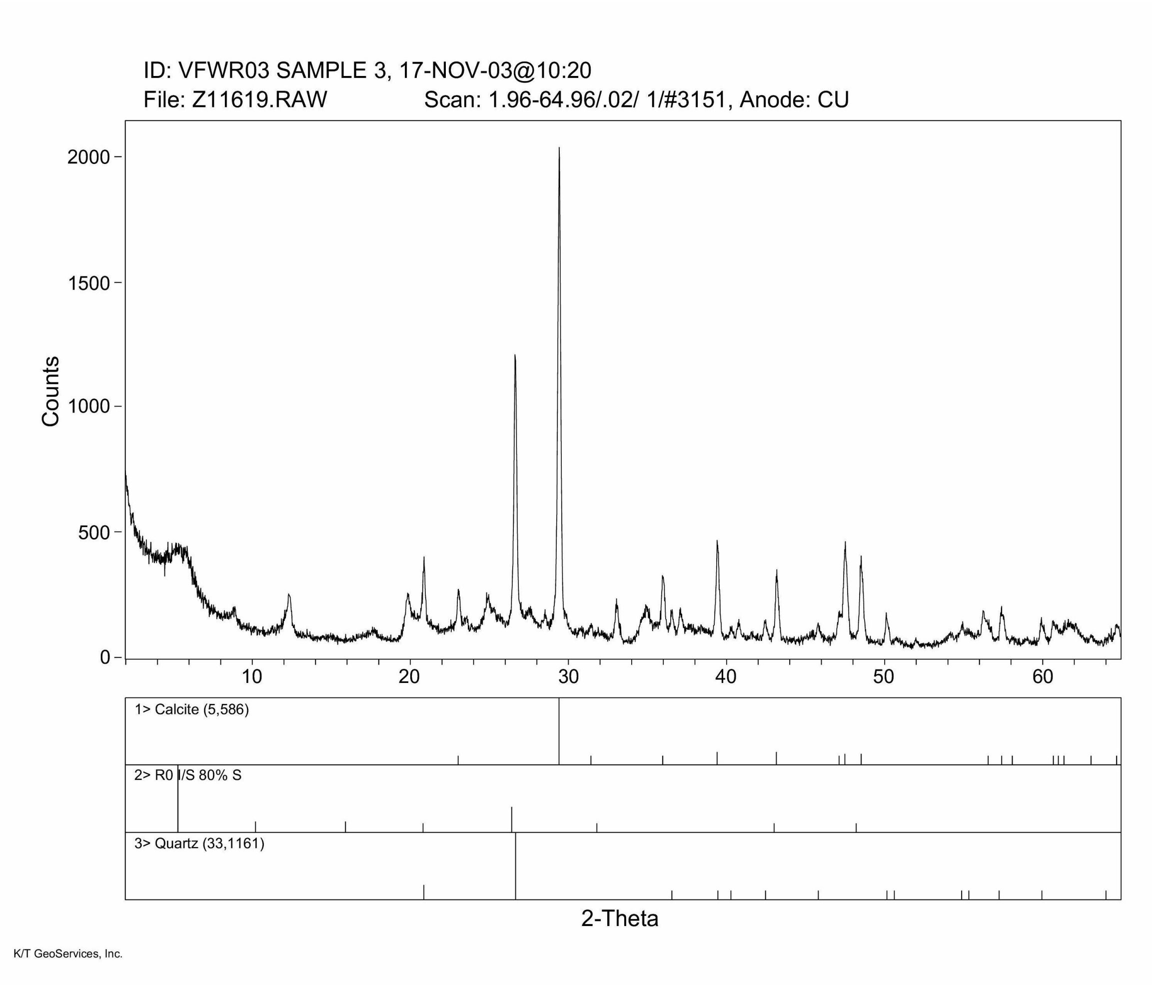
1> R0 I/S 90% S
2> Kaolinite (29,1488)
3> Illite-2\ITM#1\RG (26,911)
2-Theta
K/T GeoServices, Inc.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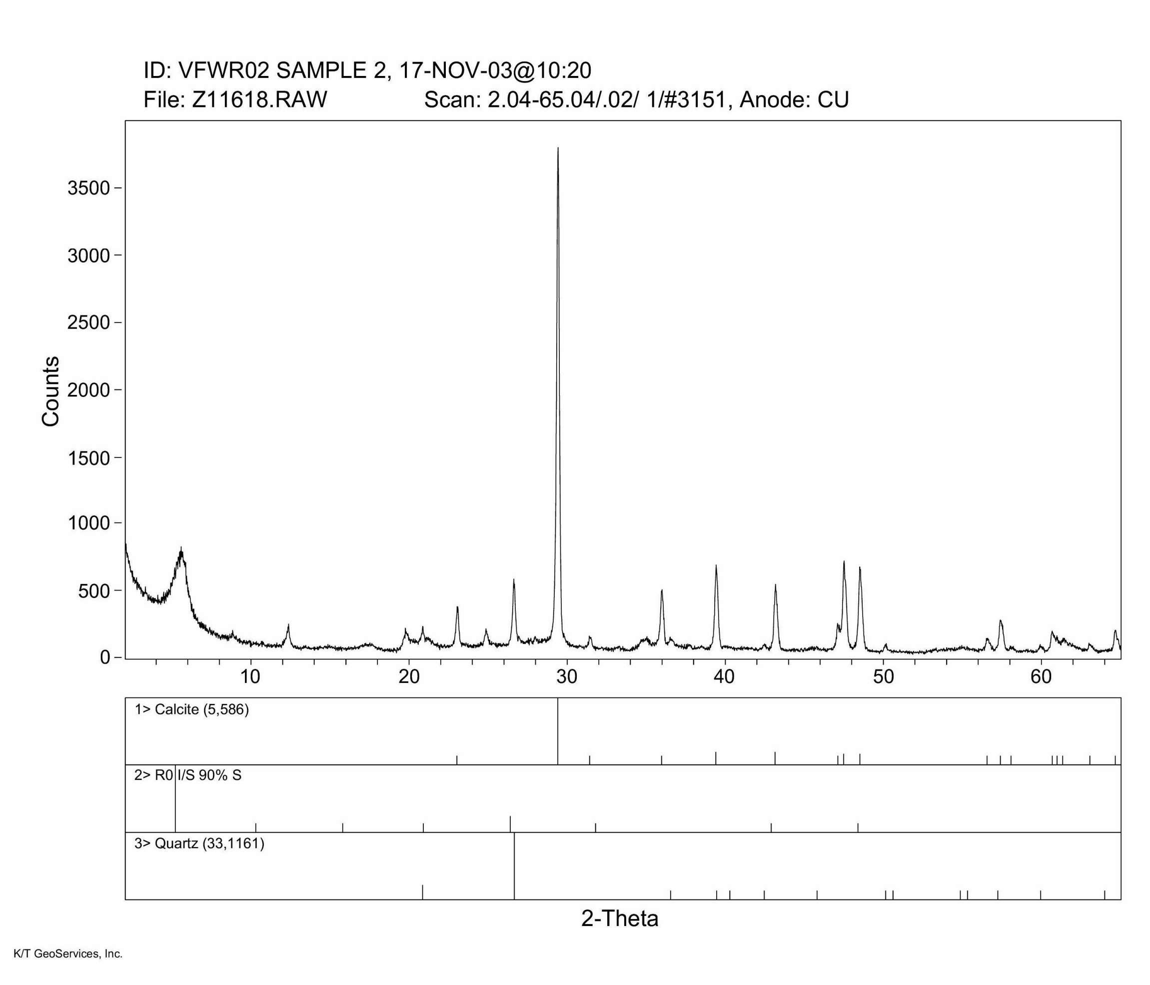
2> R0 I/S 80% S
3> Quartz (33,1161)
2-Theta
K/T GeoServices, Inc.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10
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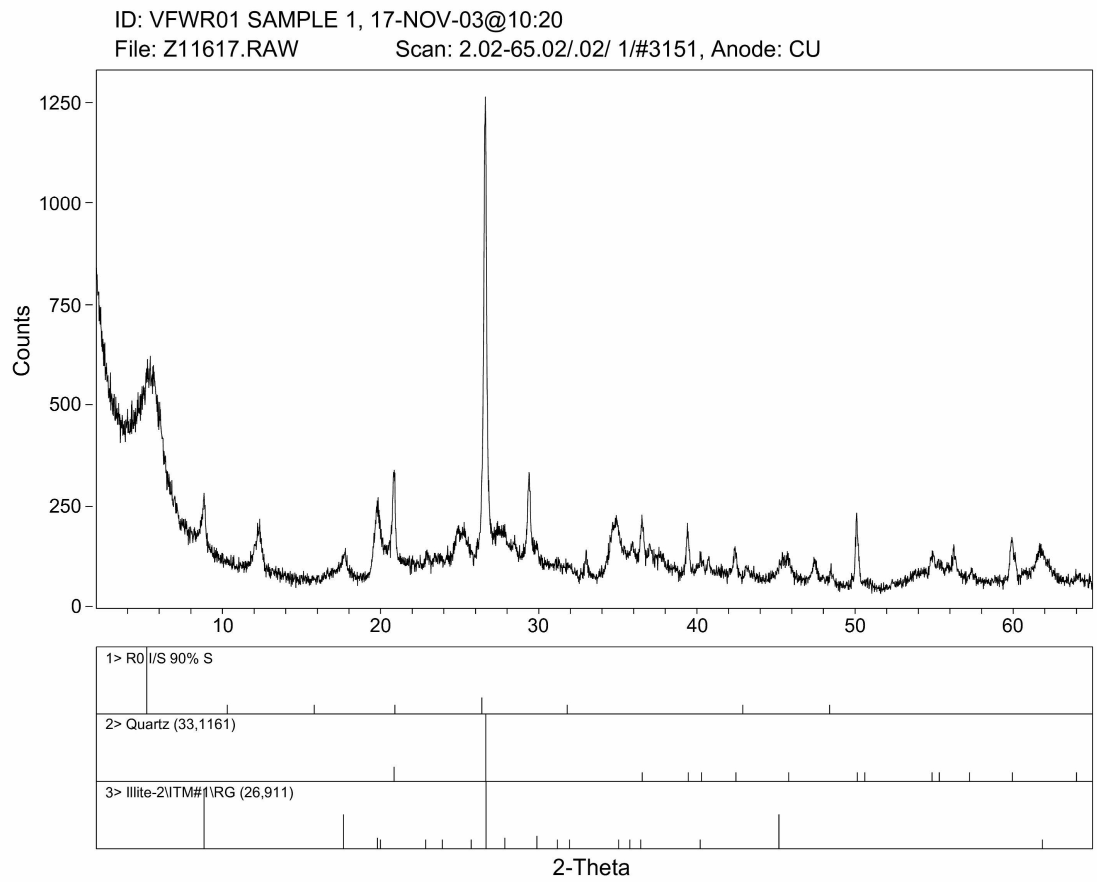
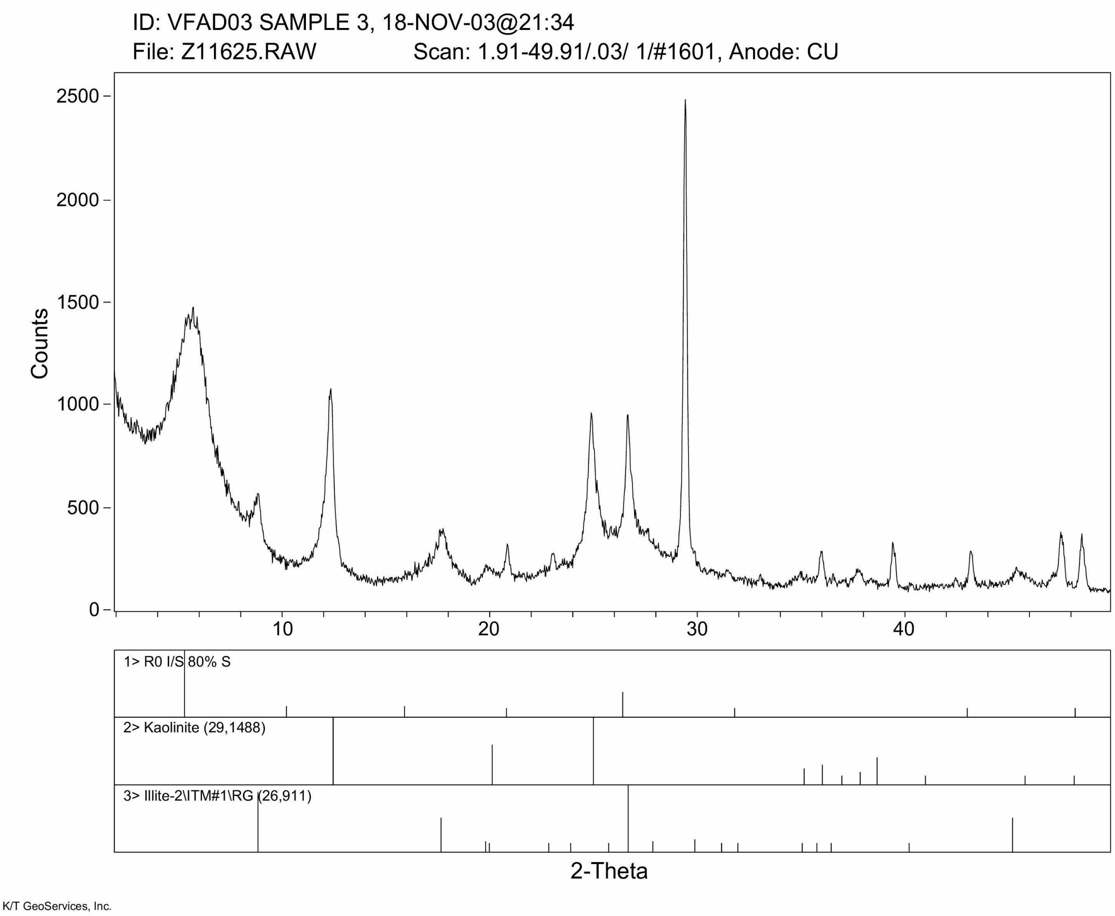
2> R0 I/S 90% S
3> Quartz (33,1161)
2-Theta
K/T GeoServices, Inc.



K/T GeoServices, Inc.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2000
1500
1000
500
0
10
20
30
40
1> R0 I/S 80% S
2> Kaolinite (29,1488)
3> Illite-2\ITM#1\RG (26,911)
2-Theta
K/T GeoServices, Inc.

TOC%

Sequence/	01	02	03
Sample ID	Subsample 1	Subsample 2	Subsample 3
Locality:	LEF-9 Upper Britton Fm. Camp Wisdom Mbr. (black shales)	LEF-4 Lower Britton Fm. Turner Park Mbr. (tan mudstones)	LEF-4 Lower Britton Fm. Turner Park Mbr. (dark gray mudstones)

Carbonate C--% - - - - - 0.56 - - - - - - - - - - 6.11 - - - - - - - - - - 2.83

Total Carbon --% - - - - - 1.77- - - - - - - - - - 6.31- - - - - - - - - - 7.48

Organic C -- - -% - - - - - 1.21- - - - - - - - - - 0.20- - - - - - - - - - 4.65

The samples were ground prior to analysis.

Results by Huffman Laboratories, Inc.
4630 Indiana St. Golden, CO 80403
Date 12/2/03

APPENDIX III

REPOSITORIES

The fossils collected in this study have been deposited in the collections of the Natural History Museum of Los Angeles County, California (Saurodontid fish), the New Mexico Museum of Natural History and Science, Albuquerque, NM. (shark and other fish coprolites), Museum of Paleontology Berkeley, California (shark and other fish coprolites) and in the private collection of the Friedman family.

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VITA

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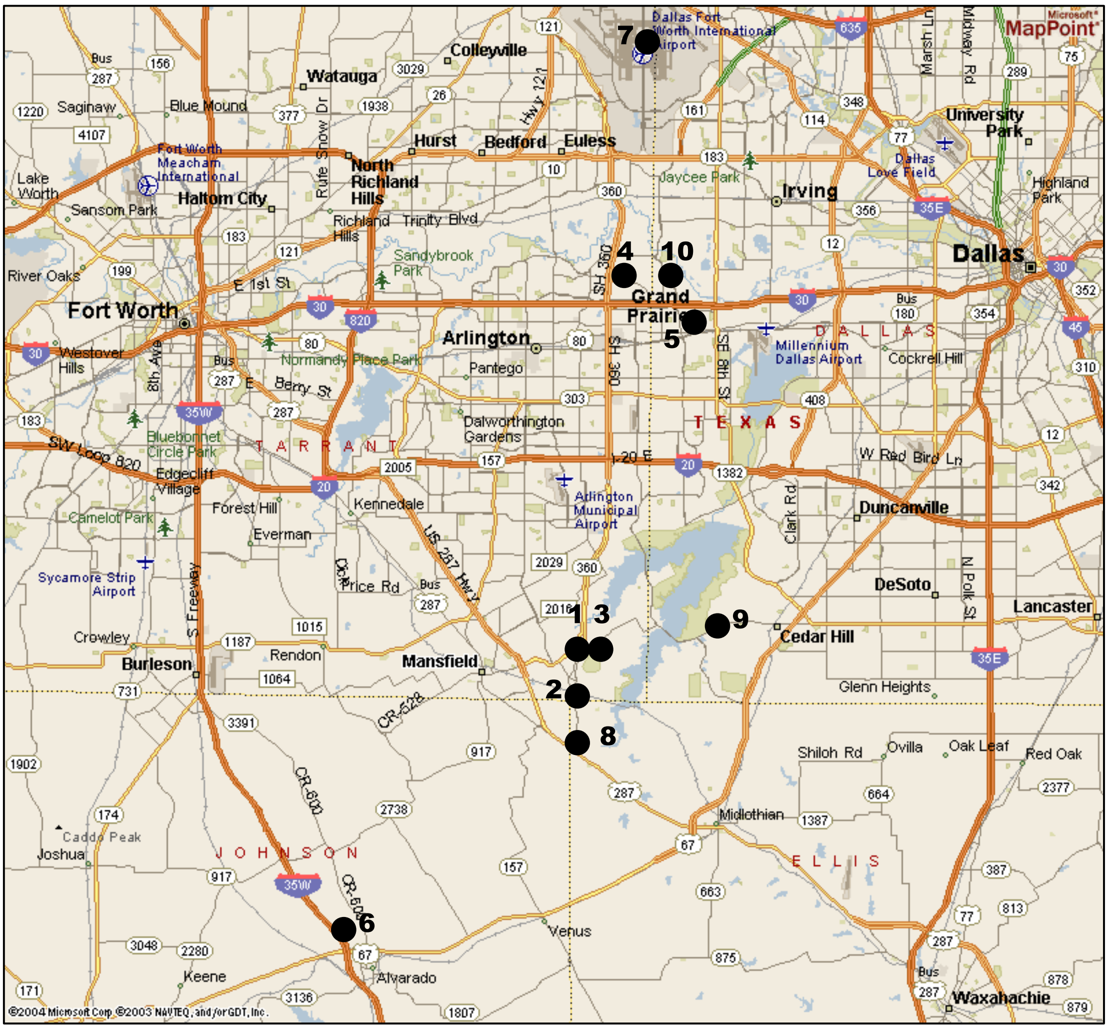
Modern flora at locality LEF-2.

Modern flora at locality LEF-2.

Locality Map



Legend

1. Locality designated LEF – 1
2. Locality designated LEF – 2
3. Locality designated LEF – 3
4. Locality designated LEF – 4
5. Locality designated LEF – 5
6. Locality designated LEF - 6
7. Locality designated LEF - 7
8. Locality designated LEF - 8
9. Locality designated LEF – 9
10. Locality designated LEF - 10