

## A comparative XRPD study of Sedimentary Rocks of Pakistan

Dr Muhammad Attique Khan Shahid<sup>1</sup>, Prof. Dr. Khadim Hussain<sup>2</sup>

<sup>1</sup>Department of Physics GC University Faisalabad (Pakistan).

<sup>2</sup>Department of Physics CHEP, Lahore (Pakistan).

### ABSTRACT

The aim of this research project was to study the minerals/phases present in the rocky mountains of Attock, Pakistan. The phases/compounds present in the selected samples were identified by using hanawalt method and confirmed by computer programme “Rool, DQL Analysis” (Verification). The Compound Present in Rocks contained almost all the metallic, non metallic, categories of minerals including the sulphide group, the halide group, the oxide group, the carbonate group, the sulphate group, the phosphate group, along with organic minerals. The major identified phases along with their weight %age in descending order were found to be schauteite(25.97%), Albite(19.82%), illite(13.83%), ferrobustanite(7.55%), calcium led fluride (7.06%), Xonolite (6.74%), Gypsum(5.34%), Kaolonite(4.52%), Talc(2.69%), Dolomite(2.22%), Clinclore(2.08%), Hallite(1.50%) and Davadite(0.52%). These results are in accordance with the international results.

### INTRODUCTION

A rock can be defined as a solid substance that occurs naturally because of the effects of three basic geological processes: magma solidification; sedimentation of weathered rock debris; and metamorphism. Rock, aggregation of solid matter composed of one or more of the minerals forming the earth's crust. The study of rocks is called petrology. Rocks are commonly divided, according to their origin, into three major classes-igneous, sedimentary, and metamorphic.

The solid part of the earth is made up of rocks. Rocks are made up of minerals, and minerals are composed of chemical elements. Minerals may be solid, liquids or gases the

solid ones include minerals coals, metal ores, mineral salts, building material and any other minerals; liquid one's crude oil, brines, and mineral water as an example of gaseous minerals we may cite natural gases recovered through bore holes and subsequently burn or processed on the spot, are transported by pipe line over long distances. As a result of these processes, three main types of rock occur, Igneous Rocks, Sedimentary Rocks, Metamorphic Rocks. The most common igneous rocks are Rhyolite, Granite, Andesite, Diorite, Basalt, Gabbro, Peridotite, Obsidian, Pumice, Scoria. Igneous rocks are produced by solidification of molten magma from the mantle. Magma that solidifies at the Earth's surface conceives extrusive or volcanic igneous rocks. When magma cools and solidifies beneath the surface of the Earth intrusive or plutonic igneous rocks are formed. These form from hot, liquid rock 1500 °C, which cools. When this happens, crystals grow from the chemicals in the liquid. They form both from either Magma [inside the Earth], example Granite or of the Earth], example Rhyolite. These form from hot, liquid rock 1500 °C, which cools. When this happens, crystals grow from the chemicals in the liquid. Typical Felsic (light coloured) Igneous Rocks Granite & Rhyolite: Both of these contain similar chemicals [lots of Silicon, making an acid magma]. This makes them both light colored. Typical Mafic (dark coloured) Igneous rocks. Much like Rhyolite, small crystals - cooled quickly on the surface of the earth, so the crystals did not have much time to grow. Unlike Granite & Rhyolite, contain different chemicals [much less Silicon, making an alkaline magma]. This makes it very dark coloured. The most common sedimentary rocks, Shale, Sandstone, Conglomerate, Limestone, Tillite. Sedimentary Rocks, Sedimentary rocks are formed by burial, compression, and chemical modification of deposited weathered rock debris or sediments at the Earth's surface. Most of these are made from Sediment- bits of rock fragments, which have sunk to the bottom of rivers, or more usually the sea. They then get buried & squashed. Over time the fragments get stuck together to form rock. This happens because water also gets trapped with the sediment. Chemicals dissolved in the water make a form of 'glue, Chalk & Limestone, however, are made from the shells of Dead Sea animals, Conglomerate Made from gravel, cemented together, Sandstone, Made from sand, cemented together, Shale, Made from mud, cemented together. Chalk Limestone Both of these are rich in Calcium carbonate [Ca CO<sub>3</sub>]. This comes from the animal shells that these rocks contain. It is an alkali, and so these rocks effervesce - or fizz with dilute acid. Chalk is made from almost pure animal shells, and so tends to be white in colours. Limestone is a mixture of both animal shells and mud. This gives it its gray colour. The most common metamorphic

rocks are Slate, Phyllite, Schist, Gneiss, Marble, Quartzite Metamorphic rocks are created when existing rock is chemically or physically modified by intense heat or pressure. Metamorphic rocks originate from the alteration of the texture and mineral constituents of igneous, sedimentary, and older metamorphic rocks under extreme heat and pressure deep within the earth. Some (e.g., marble and quartzite) are massive in structure; others, and particularly those which have been subject to the more extreme forms of metamorphism, are characterized by foliation (i.e., the arrangement of their minerals in roughly parallel planes, giving them a banded appearance). A distinguishing characteristic of many metamorphic rocks is their slaty cleavage. Among the common metamorphic rocks are schist (e.g., mica schist and hornblende schist), gneiss, quartzite, slate, and marble.

## **MATERIALS AND METHODS:**

### **MATERIALS:**

### **SAMPLE PREPARATION:**

The collected samples were strained with the help of muslin cloth to remove the fibrous and undesired straws etc. These strained samples were ground in order to obtain the fine powder and heated up to remove humidity because the humidity affects the result very badly.

These samples were filled in a rectangular hole of a rectangular disc by pressing it gently with the help of smooth mirror slit. One side of the sample holder was provided with a small dot indicating the front of the slit. The front side of the sample holder was placed on the mirror slit and the hole was filled with the powder sample and then pressed it gently with an other mirror slit, until the whole was completely filled with the powder and the surface of the powder was exactly in line with the surface of the sample holder.

The extra powder was removed. This method was repeated for all the other samples. The sample holder was washed with the acetone, cleaned and dried before filling each sample.

### **PRINCIPLE OF X-RAY DIFFRACTOMETER:**

X-ray diffractometre works on the principle that when sample is irradiated by the x-rays, is diffracted in such a way that is characteristic of compound present in the sample.

### **X-RAY POWDER DIFFRACTION METHOD:**

(X-Ray powder diffraction (XRPD) method has proved very useful in study of atmospheric aerosols Ballantyne, C.K.. 1994, Baron, Dirk, Palmer, D- Card, Stanley and T. James. 1996, Cullity. B.D. 1978, Davis, B.L,1989, Esteve, V.J., L.E. Rius and J.M. Amigo. 1997, Fanziah, L., S. Zanyah and T. Jamal. 1996, Fayyaz, Q.M., 2001 etc.). In this technique the crystal to be examined must be in the form of fine powder. The incident monochromatic radiation strikes the finely ground powder specimen contained a thin walled capillary tube held at a certain angle to the incident X-Ray beam. Only those planes diffract the X-Ray for which the Bragg's law is satisfied. Hence, X-ray powder diffraction (XRPD) method is of course the only method that can be used when a single crystal is not available. It is specially suited for the determining the lattice parameters with high precision and for the identification of phases.

### **MATRIX FLUSHING METHOD:**

This method provides the exact relationship between intensity and concentration free from matrix effects. This method is very useful because amount of amorphous phase content present in the other crystalline phases can also be detected. The maximum error is quantifying a phase in a mixture by the matrix flushing method had been estimated to be 80% relative. This method was applicable when all phases in the mixtures were in crystalline form. In this method, a fundamental matrix flushing concept was introduced. Let  $x_i$  be the weight fraction of a component "i" in the mixture of "n" components then basic intensity equation could be written as:

$$I_i = K_i X_i \dots\dots\dots (1)$$

Where K is a constant.

For quantitative analysis of mixture of n components the above equation became a matrix equation:

$$[I] = [KX] \dots \dots \dots (2)$$

The equation had a unique solution if the rank of K was equal to the rank of the (K, 1) matrix. The equation will be of the form:

$$X_i = [K_i / I_i ( \sum_{j=1}^n I_j / K_j )]^{-1} \times 100 \dots \dots \dots (3)$$

The above relation gave the percentage composition of a component i in mixture of n components. In equation (3) I<sub>i</sub> is integrated intensity and K<sub>i</sub> is relative intensity ratio given by

$$K_i = [I_j / I_{kcl}]_{50/50}$$

This ratio can be calculated by mixing the component i with the standard material KCl in the ratio 1:1. The relative intensity calculated for the seven minerals are shown in a table:

In the present study, quantitative phase analysis of solid aerosols was carried out by powder x-ray diffraction method to identify the phase of the compounds.

**QUALITATIVE PHASE ANALYSIS:**

Each crystalline material gives a unique X-ray diffraction pattern. Qualitative phase analysis was used for study of crystal structure and unknown phases of material. In XRPD pattern there were two parameters (Bragg's angle and integrated intensities). Bragg's equation is used to find the d-value corresponding to Bragg's angles. The d-values which were obtained from samples were compared with standard values. This was done by employing the Joint Committee Powder Diffraction Standard (JCPDS) file

method. With the help of JCPDS, the existence of different minerals in the sample was confirmed.

### **THE HANAWALT METHOD:**

The principle of identification of substances by powder x-ray diffraction is based on the fact that every crystalline material gives its own characteristics pattern. This pattern of material in a mixture form is independent of others. The powder data of crystalline material is now published by ICDD (International Center for Diffraction Data) in the form of cards. Each card contains the name of material studied by the powder x-ray diffraction and corresponding miller planes of reflections belong to the materials. A search manual (index book) is also published by the ICDD which contains maximum intensity reflections of all the identified crystalline materials.

## **RESULTS AND DISCUSSION**

**Table 2K01: Identified Phases for Rock Sample-1**

<b>Peak No.</b>	<b>2θ(Degree)</b>	<b>d- value(A<sup>0</sup>)</b>	<b>Cps</b>	<b>Wt/ % age</b>	<b>Identified Phases</b>
1	6.251	14.1285	7.01	3.10	Cl
2	8.854	9.9787	20.17	8.92	ILL
3	10.500	8.4183	18.83	8.33	N.D
4	12.507	7.0713	12.44	5.50	Kn
5	13.835	6.3954	11.16	4.94	N.D

6	15.101	5.8622	8.75	3.87	N.D
7	17.802	4.9784	6.49	2.87	ILL
8	18.883	4.6958	7.06	3.12	N.D
9	19.711	4.5003	5.05	2.23	ILL
10	20.887	4.2495	41.60	18.39	QZ
11	22.062	4.0257	17.95	7.94	N.D
12	23.576	3.7705	11.22	4.96	N.D
13	25.182	3.5336	8.65	3.82	Cl
14	25.566	3.4814	12.83	5.67	Kn
15	26.668	3.3399	226.18	100.00	Sch, ILL
16	27.521	3.2383	10.58	4.68	ILL
17	27.951	3.1895	26.58	11.75	Cl, Fr
18	29.501	3.0254	22.39	9.90	Sch
19	31.899	2.8031	7.90	3.49	ILL
20	33.618	2.6636	6.06	2.68	Da, Cl, CLF
21	36.552	2.4563	13.44	5.94	QZ
22	39.509	2.2790	23.68	10.47	Cl, Fr,
23	40.329	2.2345	5.51	2.44	ILL
24	42.466	2.1269	12.11	5.36	Gyp
25	50.127	1.8183	16.34	7.22	Sch

26	54.887	1.6714	8.35	3.69	Da
27	55.352	1.6584	5.25	2.32	Cl

Peak No.	2 $\theta$ (Degree)	d-value(A <sup>0</sup> )	Cps	Wt/ % age	Identified Phases
1	6.251	14.1285	5.92	2.33	T
2	8.854	9.9775	13.78	5.43	ILL
3	10.557	8.3725	7.30	2.87	
4	12.442	7.1081	11.25	4.43	CLF
5	13.932	6.3512	8.52	3.36	Xn
6	17.746	4.9939	8.82	3.48	
7	19.832	4.4731	10.77	4.24	
8	20.843	4.2583	44.84	17.66	CLF, Sch, Xn
9	20.005	4.0361	12.23	4.82	Do
10	22.925	3.8760	4.96	1.96	Cl 22
11	25.665	3.4682	6.25	2.46	



12	26.621	3.3457	253.87	100.00	Sch, ILL
13	27.921	3.1928	28.52	11.23	Fr, ILL
14	30.393	2.9385	6.29	2.48	
15	31.209	2.8636	7.64	3.01	Da, Gyp
16	35.940	2.4967	7.26	2.86	Gyp
17	36.552	2.4563	18.65	7.35	CLF, K
18	39.447	2.2824	10.76	4.24	Cl, Fr
19	40.242	2.2392	8.09	3.19	Gyp
20	42.484	2.1260	15.35	6.05	Cl, Fr
21	45.937	1.9798	10.80	4.26	H, Gyp
22	50.138	1.8179	45.11	17.77	ILL, Gyp, K
23	56.496	1.6275	4.19	1.65	

**Table 2K02: Identified Phases for Rock Sample-2**

Peak No.	2 $\theta$ (Degree)	d-value(A <sup>0</sup> )	Cps	Wt/ % age	Identified Phases
1	5.753	15.3500	14.45	6.61	
2	6.226	14.1848	10.21	4.67	T
3	8.864	9.9683	25.45	11.65	ILL
4	12.482	7.0858	13.09	5.99	Cl
5	13.070	6.7684	9.08	4.15	Kn
6	15.995	5.5366	6.29	2.88	
7	17.687	5.0105	5.95	2.72	ILL
8	19.370	4.5788	6.51	2.98	T, ILL
9	19.897	4.4586	8.51	3.90	ILL
10	20.861	4.2547	68.81	31.49	Xn, CLF, Sch
11	22.029	4.0316	8.82	4.04	Do
12	22.989	3.8655	6.71	3.07	Cl
13	23.582	3.7695	17.06	7.81	Xn
14	25.152	3.5377	13.32	6.10	K <sup>24</sup>
15	25.481	3.4928	12.08	5.53	

16	26.643	3.3430	218.52	100.00	Sch, ILL
17	27.962	3.1882	86.56	39.61	Al, Gyp
18	29.456	3.0299	10.60	4.85	Cl, Fr
19	32.756	2.7318	5.36	2.45	Da
20	35.040	2.5587	10.07	4.61	Cl
21	36.541	2.4570	14.55	6.66	Gyp, CLF, K
22	39.479	2.2806	24.59	11.25	Cl, Fr
23	40.349	2.2334	13.09	5.99	Gyp
24	42.463	2.1270	18.68	8.55	Sch
25	47.284	1.9208	5.30	2.43	Da, Cl, CLF, K
26	50.159	1.8172	34.17	15.64	Gyp, K
27	52.368	1.7456	3.90	1.79	

**Table 2K03: Identified Phases for Rock Sample-3.**

Peak No.	2 $\theta$	d-value	Cps	%	Phase Identification <sup>25</sup>
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1	5.962	14.8117	17.90	7.15	CL
2	8.835	10.0001	24.31	9.72	ILL
3	12.491	7.0806	8.46	3.38	Kn
4	13.778	6.4217	5.99	9.39	
5	17.798	4.9793	6.93	2.77	T, ILL
6	20.845	4.2579	54.55	21.80	Xn, CLF, Sch
7	22.989	3.8654	8.22	3.29	CI
8	26.646	3.3426	250.16	100.00	Sch, ILL
9	28.139	3.1685	30.54	12.21	Cl, Fr
10	29.707	3.0048	18.00	7.19	CAL
11	31.289	2.8564	5.70	2.28	ILL
12	34.907	2.5682	8.01	3.20	ILL
13	36.560	2.4558	20.86	8.34	QZ
14	39.465	2.2814	17.09	6.83	QZ
15	40.295	2.2363	9.28	3.71	CI
16	42.449	2.1277	20.95	8.37	QZ

17	45.457	1.9937	10.00	4.00	QZ
18	45.803	1.9794	11.02	4.41	QZ
19	46.647	1.9455	4.32	1.73	ILL
20	49.273	1.8478	4.67	1.87	QZ
21	50.162	1.8171	19.99	7.99	Xn, K
22	54.879	1.6716	10.34	4.13	QZ

**Table 2K04: Identified Phases for Rock Sample-4.**

**Table 2K05: Weight %age of Identified Phases**

<b>Phases</b>	<b>Weight / %age</b>
Talc	2.69
Schauteite	25.97

Illite	13.83
Albite	19.82
Chlinclore	2.08
Gypsum	5.34
Calcium Lead Fluoride	7.06
Xonolite	6.74
Dolomite	2.22
Davadite	0.52
Kaolonite	4.52
Ferrobustamite	7.55
Hallite	1.50

**Table 2K06: Quantitative Phase Analysis of the Identified Phases from Kirana Hills (Attique. 1995-1997 M.Phil Thesis).**

Phase	K01	K03	K05	K07	K08
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A	60%	N.D	9%	N.D	24%, 10%
G/IL	16%	17%	10%	05%	08%
Q/SODD	12%	13%	N.D	30%	N.D
A/CA/Zr	08%	10%	N.D	04%	08%
XEN/Cart	04%	N.D	12%	N.D	N.D
SODD	N.D	50%	60%	50%	16%
Cart	N.D	19%	09%	N.D	N.D
Th	N.D	N.D	N.D	05%	09%
Q/Cart	N.D	N.D	N.D	06%	07%
CH	N.D	N.D	N.D	N.D	18%

The phases/compounds present in the selected samples were identified by using hanawalt method and confirmed by computer programme “Rool, DQL Analysis” (Verification). The diffraction pattern was obtained in the range of 2θ this analysis showed the presence of Schaurteitc, Gypsum, Calcite, Calcium Lead Fluoride, Halite, Clinchlore, Dolomite, Davadite, Ferrobustamite, Xonotlite, Kaolonite, Albite, Talc, Quartz, Dolomite and Illite. In all these samples Schauteite, Calcium Lead Flouride, Xonotlite, Illite, Ferrobustamite, Talc, Gypsum, Pottasium major minerals and Hallite, Dolomite, Clinchlore, Davadite, Kaolonite, Calcite, Albite were dominant minerals present in the rocky mountains of Attock. The quantitative analysis of the identified phases was carried out by matrix flushing method. The Compound Present in Rocks contained almost all the metallic, non metallic, categories of minerals including the sulphide group, the halide group, the oxide group, the carbonate group, the sulphate group, the phosphate group, along with organic minerals. The major identified phases along with their weight %age in descending order were found to be schauteite(25.97%), Albite(19.82%), illite(13.83%), ferrobustanite(7.55%), calcium led fluride (7.06%), Xonolite (6.74%), Gypsum(5.34%), Kaolonite(4.52%), Talc(2.69%), Dolomite(2.22%), Clinchlore(2.08%), Hallite(1.50%) and Davadite(0.52%). These results are in accordance with the results of Schroeder, P.A. and J Shiflet. 2000, Serge, J, S.P, Idefonse and M. Boucharel, 2000, Wang WM, Yeh H.W.,

P.Y. Chen, MK Wang. 1998 etc and slightly disagree with the findings of Bhatti, T.M. et al, Boliver, J.P. et al, Gosh, A et al, Hamid B.N.,M et al.Hussein, A et al.

## REFERENCES

- Ansari, T.M., L.L.Marr and A.M. Coats, 2001. Characterization of mineralogical forms of barium and trace heavy metal impurities in commercial barytes by EPMA, XRD and ICP-MS. *J Environ Monit*; 3(1): PP 133-138.
- Ballantyne, C.K.. 1994. "Gibbsitic soils on the Nunatals - implication for ice sheet reconstruction." *Quaternary science* 9(1): PP 73-80.
- Baron, Dirk, Palmer, D- Card, Stanley and T. James. 1996. "Identification of two iron-chromate precipitates in a Cr (VI) contaminated soil." *Environmental science & technology*. 30: PP 964-968.
- Bhatti, T.M., and K.A. Malik, 1994. Phosphate fertilizers a potential source for uranium recovery as by product. A Technical Report No PAEC/NIBGE-2/1994, National Institute for Biotechnology & Genetic Engineering (NIBGE) Faisalabad, Pakistan atomic energy commission.
- Bhatti, T.M., A. Mateen, M. Amin, K.A. Malik, A.M. Khalid. 1999. Spectrophotometric determination of uranium (VI) in bacterial, 18:1672-1691.
- Bigi, Simona Brigatli, U, Maria and France, 1994. Crystal chemistry and microstructure of blutonic biotite. *The American Mineralogist*. 79:PP 63-72.
- Bish, D.L. and J.L. Aronson. 1993. "Pale geothermal and pale hydrological conditions in silicate tuff from Yacca Mountain, "Navada". *Clays and Clay minerals*. 41(2): PP 148-161.
- Boliver, J.P., R. Garcia-Tenoxo and M. Garcia-Leon. 1994. "On the fractional of natural radioactivity in the production of phosphoric acid by the wet acid method." *Journal of Radio analytical and Nuclear Chemistry*. 214(2): PP 77-88.
- Burnelt, A. D. 1995. "A quantitative XRD technique for analyzing sedimentary rocks and soil". *Journal of testing and evaluation*. 23:PP 111-118.



- Buschert, J.R, J.Z. tischler, D.B. Mills, Q.Zhqo and R.Colella, 1989. Time resolved X-ray diffraction study of laser annealing in silicon grazing incidence, J. Appl. Phys. 66(8): PP 3523-3524.
- Cullity. B.D. 1978. "Elements of x-ray diffraction", 2<sup>nd</sup> Ed. Assison-Wesley publication company p: 407-415.
- Davis, B.L, 1989. Semi-quantitative X-ray diffraction analysis of particle sampling techniques for direct analysis of size fractionated atmospheric particles times. Environ. 23(1): PP 55-57.
- Esteve, V.J., L.E. Rius and J.M. Amigo. 1997. "Quantitative X-ray diffraction phase analysis of coarse airborne particulate collected by cascade impactor sampling". ATMOS ENVRION. 31(23): 3963-3967.
- Fanziah, L., S. Zanyah and T. Jamal. 1996. "Characterization and land application of red gypsum". A waste product from the titanium dioxide industry. Sci. Total Environ. 188(2-3): 243-251.
  
- Fayyaz, Q.M., 2001. Elemental constituents of virgin soil of biosaline research station-II (Pakka Anna) in different depths by X-ray diffraction technique. M.Sc. thesis, Department of Physics University of Agriculture Faisalabad.
  
- Gosh, A, Upadhyaya, D, Dharni and R, Prasad, 2002. Primary crystallization behavior of Zro-Yo powders. Journal of the AMERICAN CERAMIC SOCIETY. 23 (4): PP 345-347.
  
- Hamid, B. N., M. I. Chowdhury, M. N. Aslam and M. N. Islam, 2002. Study of natural radionuclides concentration in area of elevated radiation background in the northern districts of Bangladesh. Radiation Protection and Dosimetry. 98(2): 227-230.
- Hussein, A. 1994. "Determination of uranium and thorium concentration in rock samples". J. of Radio analytical and Nuclear Physics, 188(4):255-265.
- Jabbar. A., M. Aslam, S. D. Orfi and A. Rashid, 2001. Be<sup>7</sup> concentration in some vegetation samples collected from southern Punjab. The Nucleus 38(2) 111-113.

- Kohler, K, B. Gleisberg and S. Niece, 2000. Investigation of soil plant transfer of primordial radionuclides in tomatoes by low level  $\gamma$ -ray spectroscopy. Applied radiation and isotopes. 53(1-2): 203-220.
- Mai, Z.H, J. T. Onyang, S.F Cui, J.H.Li, C.Y.Wang and C.R.Li.1991. X-ray diffraction analysis of Si 1-x Ge x/Si Supper lattice, J.Appl. Phys. 72(8): PP 3474-3475.
- Markewityz, D and D.D. Richter, 2000. "Long-term silo potassium available from a kanhapludnlt to an aggrading loblolly pine ecosystem. Forest ecology and Management, 130(1-3): PP 109-129.
  
- Miah, F.K., S. Roy, N. Touhiduzzaman and B. Alan, 1998. Distribution of radionuclides in soil samples in an around Dhaka city. Applied Radiation and isotopes. 49 (1-2): 133-137.
  
- Raziq, D., 2001. Elemental analysis of cultivated saline soil of BSRS-11 (Pakka Anna) in different depths by X-ray diffraction technique". M.Sc Thesis. Department of Physics University of Agriculture Faisalabad.
  
- Rao.V.V.S and H.C. Dasgupta, 1997. Clay mineralogy of Agrillites of the Precambrian Iron Ore Group, Noamundi Society of India, 49(2): PP 179-192.
  
- Rocha, F.and C.Gomes. 1995. "Palaeoenvironmental of the aveiro region of Portugal during the Cretacetaceous, based on clay mineralogy ". Cretaceous research. 16(2-3): 187-194.
  
- Schroeder, P.A. and J Shiflet. 2000. Bearing phases in the Huber Formation, an east Georgia kaolin deposit. Clays & Clay Minerals. 48(2): 151-158.

- Serge, J, S.P, Idefonse and M. Boucharel, 2000. Kaolinite and gibbsite weathering of biotite within saprolites and soils of central Virginia. Soil-Science-Society of American Journal, 64(3): PP 1118-1129.
- **Wang WM, Yeh H.W., P.Y. Chen, MK Wang. 1998. Kaolin mineralogy of clays in paleosol profiles on the late Miocene sediments in Penghu Islands Taiwan. Clays and clay minerals. 46(1): 1-9.**
- Wood, J.L, R.R. Benke, S.M. Rohrer and K.J. Kearfott, 1999. A comparison of minimum detectable and proposed maximum allowable soil concentration cleanup levels for selected radio nuclides. Journal of University of Michigan, Health Physics, 76(4): 413-417.
- Zahid, C.S., M.K. Hasan, M.Asalam, K.Khan, A.Jabbar and S.D. Orfi, 1999. Measurement of radioactivity level in soil samples of eastern salt range. The Nucleus. 36(3-4) 201-204.

#### **Author,sProfile.**

**Dr Khan** has received his M.Phil Degree in Solid State Physics from CSSP (PU) Lahore Pakistan with research project entitled “Radioactive Pollution and its Health Hazards, a Study by SSNTDs and XRD analysis” and Master Degree in Physics with specialization in “Advance Electronics” from G.T.I.College (new Campus) Rabwah, PAKISTAN affiliated with PU, Lahore. Recently has completed his PhD Degree with project in Solid State Physics entitled “A Comprehensive Investigation of Solid Aerosols Using XRD and ASS Techniques” He has completed other relevant Post graduate training courses as participant, presenter and as a faculty member in his areas of specialization from PINUM, NIAB, PNRA, NIFA, EPD etc the well reputed institutions of Pakistan Atomic Energy Commission and Environmental Protection Department along with his Professional in service training. Recently He is working as Associate Professor of Physics in the Department of Physics GCU (UDC/CC) Faisalabad. As for as his research Experience is concerned it is multidimensional, He has more than 30 years of academic and research experience at graduation and post graduation level, his areas of interest are Solid state Physics, Surface Physics, Aerosol Physics, Thin Film Technology,



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