

## **A STUDY ON SOME RIVER SEDIMENTS, HYDROLOGY AND GEOLOGICAL CHARACTERISTICS IN CHAK SEDIMENTARY BASIN, WARDAK, AFGHANISTAN**

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### **ABSTRACT**

This paper studies different sediments, Pedogenic horizons, hydrology and some surrounding mountains, rock types in Chak sedimentary basin, in Wardak Province of Afghanistan. Chak district is located in Wardak province; in the West of Kabul, which covers an area of 9772 km<sup>2</sup>. Loger river, being the main river flowing through this basin, transports different sizes of sediments from different parts of this basin, especially in summer months due to snow melting. Chak basin is surrounded by Wardak mountain range and divided into two parts, the first is Khawat Olya and the second Khawat Sufla, which dates back to Tertiary (20 - 45) million years ago (Iocene and Oligocene) and Quaternary. The main objective of this research is to select different sizes and types of river sediments from the previous geological periods, hydrology and some types of rocks in the surrounding mountains. This research is therefore essential to explain different Soil Morphology, geological characteristics with scarce or no previous research in this basin. The type of sediments is related to the parent materials that are located in the nearby mountains like Gnaize, Limestone, Granite, different types of conglomerate, slate, schist, reefs, conglomerate and Sandston. Having analyzed the samples in the laboratory, it was found in Jawharkhel soil Profile that, A - Horizon soil type was sandy loam with CaCO<sub>3</sub> 0.434 %, pH 6.50 and EC 961 μs/cm. B - Horizon soil types are loam, CaCO<sub>3</sub> 0.437 %, pH 7.87, EC 920 μs / Cm. C- Horizon with CaCO<sub>3</sub> 0.32 %, pH 6.50, EC, 875 μs /Cm, Soil type, sandy loam. In first Najuya soil Profile, A - Horizon soil type was sandy loam with CaCO<sub>3</sub> 0.35 %, pH 7.75, EC 849 μs/ Cm. B - Horizon soil type was loam having CaCO<sub>3</sub> 0.406 %, pH 7.75 and EC 861 μs / Cm. C -Horizon soil type loam, CaCO<sub>3</sub> 0.474 %, pH 7.75 , EC 870 μs/ Cm. In second soil profile of Nagoya, A - Horizon soil type was loam with CaCO<sub>3</sub> 0.45 %, pH 7.75 and EC 949 μs /Cm. B - Horizon soils type was sandy loam, CaCO<sub>3</sub> 0.304 %, pH 6.75 and EC 861 μs /Cm. C- Horizon type was clayey loam with CaCO<sub>3</sub> 0.379 %, pH 7.75 and 970 μs / Cm. It's transported by water during snow melting season. Also we can see different tectonic structures like Anticlin, Syncline, Graben, types of faults and joints.

**Keywords:** *River Sediments, Geological Periods, Pedogenic Horizons, Munsell Color Company, River Terraces, Hydrology, Chak Basin*

### **INTRODUCTION**

The Chak basin is one of the biggest basins in Afghanistan, which is 9772 km<sup>2</sup> and basin area is surrounded by high mountain ranges. The Loger river is one of the very important rivers passing through this basin and by Loger river from mountain areas transported different sizes and types of sediments during snow-melting season (from April to June),

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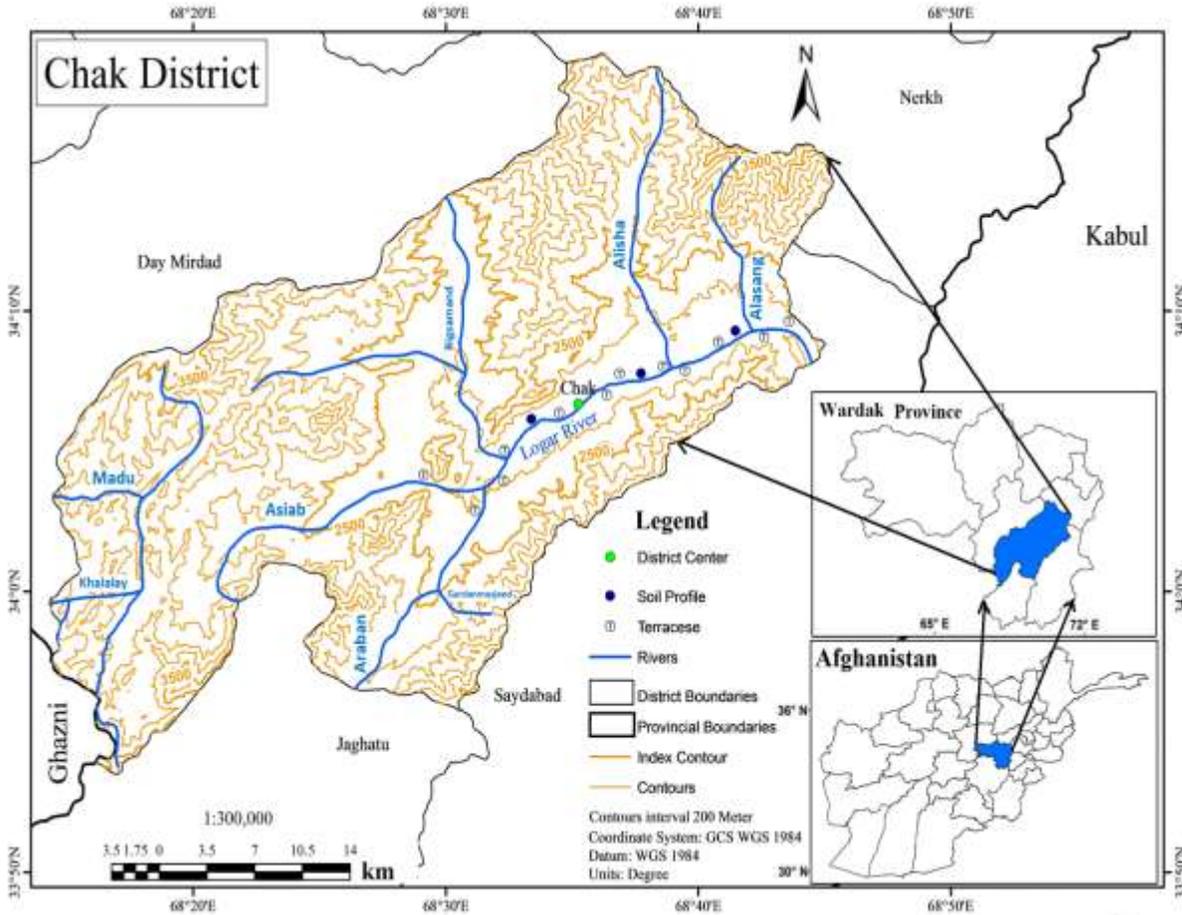
sometimes during sudden flooding seasons (May to August) transport different sizes of sediments and making different layers and terraces. The type of sediments is related to the rocks that are located and broken by different types of exogenetic forces in the Surrounding Mountains and transported by streams at the previous geological periods. The Chak district strike is like longitudinal valley and it's parallel with the mountain regions. Younger sediments from different parts of this basin based on their depth and composition are different according to the locations, for example the upper and steep areas of this basin are not very thick and they belong to the Quaternary period and generally consist conglomerate but the lower basin consisting of young tertiary sediments and generally consisting of different clay, silt, sand and gravels. This research is about different soil profiles, river sediments and geology of surrounding mountain rocks. The landforms within the Chak Basin are typical arid to semiarid with tectonically active regions. In the central plains of the Chak basin are local depositional centers for sediments derived from the surrounding superficial deposits and bedrocks outcrops. The central plains gently slope up to the adjacent mountains and hills to piedmonts. Alluvial fans have developed on the flanks of the mountains surrounding the Chak Wardak basin and on interbasin ridges (Broshears *et al.*, 2005). The alluvial fans generally can be graded from coarse materials near the source to finer materials at the distal edge. Physical weathering induced by extreme temperature fluctuation has produced pronounced breaks in slope at the edge of the basin (Houben and Tunnermier, 2005). This continuing weathering process maintains the steep, rugged mountain slope. The Chak basin is part of the tectonically active Kabul block in the transpressional plate boundary region of Afghanistan (Wheeler *et al.*, 2005). The North eastern edge of Chak basin is defined by Paghman fault system (Ruleman *et al.*, 2007). The Paghman fault trends north to northeast and is evident in the continuous fault scarp and piedmont alluvium along the north eastern boundary of Chak basin. The Chak basin can be described as a valley fill basin and range setting where the valleys are filled with Quaternary and Tertiary sediments, and the ranges are composed of uplifted crystalline and sedimentary rocks (Bohannon *et al.*, 2007). Quaternary sediments are typically less than 80 m thick in the valleys (Böckk *et al.*, 1971). The underlying tertiary sediments have been estimated to be as much as 800 m thick in the city of Kabul (Broshears *et al.*, 2007) maybe more than 1000 m thick in some areas of the valley (John San Felipo, 2007). The Quaternary and Tertiary sediments and rocks have been classified by Böckk, *et al.*, (1971) who divided the sediments into younger and older basin deposits. The younger deposits, reworked loess series, are described as reworked loess, gravel, sand and talus. The gavels were deposited mainly in the river channels.

### **Description of the Study sites**

This research is carried out in the some geological characteristics and three different terraces (upper, middle and lower) of Chak district (figure 1). This is located at the south west of Kabul on Hindu Kush Mountain range in Afghanistan. The Chak Wardak basin covers an area of 9772 km<sup>2</sup> with a maximum elevation of 3500 m in Wardak Daimirdak mountain range and minimum elevation is 2092 m located in Ambokhak. Loger river is one of the very important rivers of this district and it's started from (3500 meter average sea level) Daimirdad mountain (Wardak range related Hindu Kush mountain range in Afghanistan) belong to Wardak province (Zarif, 2010). At the first stage this river flows from west to east, and pass from Chack and Saidabad districts in Wardak province and then enters into Loger province and it joins with Charkh River in Barakibarak District of Logar

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Province. After that, it enters to Kabul province and joins with Kabul River at the Sheena village of Bagrany district (Zarif, 2010).



**Figure 1: Location map of Chak district with the study sites, Wardak, Afghanistan**

**MATERIALS AND METHODS**

Generally this research included two parts:

**A. Field work**

- 1- Determination of Loger river channels profile according to the river bed relief and its Tributaries in Chak basin,
- 2- Selecting location of soil profiles and terraces by using topographic map and recording coordinate points by GPS at the relative locations in Chak district,
- 3- Excavation of soil profile to the relative depth and explanation of soil layers in the relative profiles,
- 4- Selecting various rocks and studying their characteristics by geological instruments like hummer, compass, HCL at the relative locations and collection samples, determination of soil color by Munsell color chart,

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- 5- Collecting, from every relative layers of soil profile, 1Kg of soil samples and transporting for laboratory analysis and
- 6- Exploring different type of rock samples for laboratory.

### **B. Laboratory works**

The laboratory work included following steps:

- 1- The collected sediment samples were air dried at 30°C in oven for 24 hrs.
- 2- Second step was sieving out the rocks to remove large debris, stones and pebbles.
- 3- Analysis of the soil sample was done by Hydrometer and different size of Soil fractions were selected.
- 4- Gravel analysis was done where different types of Gravels were selected between Sediments and
- 5- We selected different types of rocks based on their characteristics and minerals composition using microscope.

### **RESULTS AND DISCUSSION**

Different tributaries at the different locations of Chak join with Loger River and generally these flow from west to east. As well as different types of Sediments enter mountain backing basin deposition, the sediments between mountain basin belong to the tertiary Iocene and Oligocene and it is about 20 – 45 million years old. At the upper part of these sediments are located different types of terraces related to the lower tertiary (Pleistocene) and are younger than other sediments (Sahak, Naqebullah, 2012). The slopes of Chak basin is North west to South east and belongs to the relief of this basin from Daimirdad 3500 m to Ambokhak 2092 m (Taniwal M. Zarif, 2010). The thickness of younger sediments between mountains basin in Chak Wardak depends on the shape of basin and distance from mother rocks. Generally the thickness of sediments are near to the source consolidated gravels and at the plains areas is generally soft materials like clay, silt, sand and some gravels. The thickness of sediments at the plain areas is more than source areas and generally in Chak basin the sediments made horizontal profile. All sediments in Chak basin belong to the surrounding mountains and are weathered by exogenetic force like gravity. Water made different types of terraces and sediment layers at different locations of this basin.

### **Morphology and Topography**

The study area, which encompasses about 9772 km<sup>2</sup>, is primarily composed of tertiary and Quaternary valley fill sediments, filling fault bounded structural basin. The Chak Wardak region from the point view of Geomorphology or relief is divided into three parts, first one is steep mountains (upper course), it consists of all slopes mountains, second one is middle slopes (middle course) it consists of all hills and the third one is plain areas (lower course) it consist of Loger river bed and laterals. In the steep regions rocks are seen breaking away by physical weathering and so different sizes of talus and clastic materials can be seen accumulating. It consists of boulder, cobble and different gravels. These materials are continuously transported by gravity and streams to the various distances. Pebbles and granules are carried to the middle of the slope. Slowly and steadily all the materials are accumulated at the plain areas including sand, salt and clay. The size of materials belong to the distance and hardness that are located in the mountain regions. The names of main Mountain in Chak district include Bome, Alishang, Gurbat, Konghar, Speenkay, Alisha, Darshali and Dowshakh. The morphology of Chak Wardak area is generally divided into ten main regions consisting of Gardan Mausjeed, Araban, Abkazar, Asiab, Khawat Olya and Khawat Sufla, Alisha, Bigsamand,

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Ambukhak and Alishang. The Loger River originates from Daimirdad mountain range Wardak province (3500 m). At the first stage from Chake Wardak enter to the Sheikhabad, then to Loger Barkybark, then to west to east and at Loger province join with charkh river at Sheena and join with Kabul river (Taniwal M. Zarifi, 2010). In Chak it consists of different hills belonging to Neogene which belongs to those mother rocks that are located in the mountains. The topography of the Chak basin is strongly influenced by regional and local tectonic activity and by fluvial processes. The basin is bounded by mountain ranges, the highest range reaching 3500 m in altitude, is the Gurbat mountains range to the south west of the study area (Taniwal M. Zarifi, 2010). The Alishang range to the west of study area is as high as 3500 m, and most of the range with slopes of the study area are North West to south east (Taniwal, M. Zarifi, 2010). The inter basin ridges generally rise about 200 to 500 m above the adjacent valley floors. The central plains range from around 1800 m in the Kabul and Loger subbasins to 2200m in the Paghman and upper Kabul subbasins (Sahak Naqebullah, 2012). Several ephemeral streams flow from the west, North West and south west and Join with Loger River at the different parts of inter basin. Active stream channels generally flows from Gardan Mausjeed, Sabaka, Araban, Asiab, Abkazar, Nekpaycol, Alisha, Madu and Bigsamand its narrow and shallow and at the snowmelting season acceding 8 m width and 1.5 m depth. The Loger River is one of the rivers that flows at different velocities and carries different size of sediments. Generally here are three kinds' of courses (Upper, meddle and lower) and size of sediments depends upon the slop and relief of area. This makes different horizontal profiles.

**1. Upper course**

This area belongs to the mountain areas and the slope of the river bed is very high, the water flows in very high velocity and transport gravels with it. The water flow is generally turbulent type and transport different type of gravels at the different parts of river profiles. This area is from source to the end (Mandukhel village) and the mean velocity of river is 6 m/sec.

**2. Middle course**

Here is the mean velocity of river is slower and transports middle sized sediments like granule and course sand. The types of flows are laminar and turbulent and form different types of meanders. The middle parts of river is turbulent but in the later part it is laminar. This part lies between Madukhel village to Baghcha. The velocity of river is 1.2 m / sec. The river sediments consist of granules, sand and silt.

**3. Lower course**

This belongs to the area of Chak hydropower; the river velocity is very slow and stops at the dam area. In this area generally we can find clay and silt sediments and the velocity of river is 0.2 m/s.

**Geology of the Chak district**

The surraounding Mountains of Chak are made from different rocks like Gnaize, Limestone, Granite, different type of conglomerate, slate, schist and reefs. The type of rocks different according to the location for example those rocks located in the Bome and Araban which belong to the reefes and they are the remanents of Tythes river in Afghanistan. The rocks of Jawharkhel, Ghanikhel is Limestone, surraounding mountains of Guldán, Ambokhak, Alikhani, Kacakhel are belong to the Gnaize, Shist, Granite, slate as well as those rocks located in Bigsamand, Alisha consist of Gnaize, Shist, Granite and some sedimentary rocks like conglomerate, Sandston. Those rocks located around Chak dam are generally basal and basment canglomerates as well as there is some teracese and molaces like Jawharkhel, Mandukhel, Faqeri, Asyab.

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In Chak Wardak mountains regions we can see different tectonic structures like Anticlin, Syncline, Graben, different types of faults and joints. As well as we can see another structures of different type of Valleys like longitudinal, diagonal, transverse, faults valleys .

**Terracese**

In Chak we can find different types of Terracese which consist of Lower terrace of Najuya, Middle terrace of Baghcha, Terrace of west side dam, Upper terrace Nurghar, middle terrace and upper terrace of Najuya, upper, middle and lower terrace of north east side of chake dam and middle terrace of Faqiri.

**a) Lower terrace of Najuya**

This terrace is located at the 34°.05' 56" latitude, 68°.33' 13" longitude and 2211 meter average sea level. According to the gravel analysis there are different sizes of sediments; the biggest size is 35 Cm and the smallest size is that of silt. If we see exactly the gravel slope, it is to the west side from that we can find the flow of that time. It came from west side and it made different layers according to the velocity of flow of water. Ancient time the flow would have been turbulent. In this terrace is found different types of sediments like Quarsite, Limestone, Gnaize and transported by waters by longer distance. As well as according to the hardness its different because some are smaller and some quarsite are consolidated. As well as the upper part is consolidated cemented that consist of Clay and CaCO<sub>3</sub> and it's like roof but in the lower section the cementation is silt and it's more weathered.

**b) Lower terrace of Baghcha**

In this terrace also we can find different sizes of particles, the biggest size is 65 Cm and the smallest size is that of a silt. This terrace is located at the 34°.06' 13" latitude, 68°. 33' 51" longitude and 2205 meter average sea level. As well as here is boulder, coubble, pebble, granule, sand and silt. From this terrace the slope of sediments particles towards south west we can find the ancient flow was from south west to south east. As well as here is different type of sediments like Gnaize, Quarsite, Limestone. According to the size it belongs to the hardness of sediments and distance transported by water at the ancient times and geological periods. The matrix and cementation materials consist of silt, fine sand and CaCO<sub>3</sub>.

**c) Middle terrace of Baghcha**

We can find different sizes of particles in this terrace the bigger size are 53 Cm and the smaller size is silt. This terrace is located at the 34°.06' 10" latitude, 68°.33' 29" longitude and 2207 m. As well as there is coubble, pebble, granule, sand and silt. From this terrace the slope of sediments is to south west from that we can find the ancient flow was from south west to south east. As well as here is a different type of sediments like Gnaize, Quarsite, Limestone. According to the sizes it belongs to the hardness of sediments and distance that it was transported by water at the ancient times and geological periods. The matrix and cementation materials consist of silt, fine sand and CaCO<sub>3</sub>.

**d) Lower Terrace (molase) of west side dam**

This terrace is located at the 34°.06' 08" latitude, 68°.34'16" longitude and 2196 meter average sea level. This terrace is located at about 1Km towards far west side of Chak Hydropower. As we can see this terrace is different in terms of hardness and it belongs to the matrix of locations. The cementation is due to CaCO<sub>3</sub> and clay. When we see the layers of this terrace its different from other in terms of size and it is due to the velocity of ancient water flows which transported these materials.

**e) Upper terrace of Nurghar**

This is very important terrace of Loger river, maybe this terrace at the ancient period of geology the river bed here and after down cutting its came down and maybe at the anciant time here lake and river pass from lake. This terrace is located at the 34°.05' 05" latitude,

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68°. 31' 58" longitude and 2237 m a, s, l. There are also found different caves here. At the slope of this terrace we can see different sizes of gravels and around them we can find Quarsite and limestone transported by waters of ancient times.

**f) Upper and Middle terraces of Najuy**

These terraces came one after another and they are due to the cutting of river bed and high velocity of water flow. May be the width of valley is very narrow because in narrow valley the velocity is very high. This terrace is located at the 34°. 05' 04" latitude, 68°. 31' 37" longitude and 2243 meter average sea level. If we see, these terraces are very steep. We can find that hardness of matrix materials is very high and this has made different stapes or causta landscapes.

**g) Upper, middle and lower terrace of north east side of chake dame**

There is also different terraces (upper, middle and lower) made after one another. This terrace is located at the 34°. 06' 25" latitude, 68°. 34' 37" longitude and 2202 meter average sea level. When we see, there are matrix materials different at the near space and we can see different caves at the near spaces. These terraces came after one another and they belong to the valley width and slope of river bed at the ancient geological periods.

**h) Middle terrace of Faqiri**

This terrace is hard from view point of cementation and there we can not find more caves. It belongs to the basal conglomerate. This terrace located at the 34°. 04' 53" latitude, 68°. 31' 12" longitude and 2233 meter average sea level. Here are found different size of sediments the biggest size is 35Cm, smallest consists of silt and clay.

**Soil Morphology and Explanation of soil Profile**

In this study we excavated three profiles. It consist of profile of Jawharkhel, profile of Najuya and second profile of Najuya and we defined different layers between these profiles. We did some laboratory works like Mechanical analysis by Hydrometer, CaCO<sub>3</sub> by Calcimeter and pH and EC by pH meter.

**I. Profile of Jawharkhel**

**Field works:** This soil profile is located at the 34°. 06' 09" latitude, 68°. 34' 05" longitude and 2095 meter average sea level. The total depth of this profile is 1.10 m in this profile generally we found three types of Pedogenic horizons which consist of A- Horizon, B- Horizon and C- Horizon. A- Horizon is from earth surface to 15 Cm, in this profile we can find some roots of plants, some caves of worms, as well as in this horizon some crumbling structures could be seen. According to the Munsell color chart the color of soil in the wet condition is reddish gray (2.5YR5/1) and at the dry condition the color of soil in this horizon is very pale brown (10 YR 8/2), (Munsell, 1999). The B- Horizon is 15 – 50 Cm depth according to the Munsell color chart in wet condition the color of soil is strong brown (7.5 YR 5 / 6) and at the dry condition the color of soil is Pinkish white (7.5 YR 8/2) in this horizon we can find some particles of organic matter and rocks and in this we can find some caves of worms. C - Horizon is 50 -110 m + depth from earth surface. When compared with Munsell color chart at the in wet condition the color of soil is Reddish black (10 YR 2. 5 /1) and in the dry condition the color of soil is Yellowish brown (10 YR 5 /6). In this Pedogenic horizon we can found some particles of organic matters and rocks.

**Laboratory works**

*Relative instruments that we used in this research at laboratory and field:*

In this research we used some laboratory instruments like Hydrometer, Calcimeter, pH meter and Munsell color chart. We did chemical, physical, microscope study of the soil and we found

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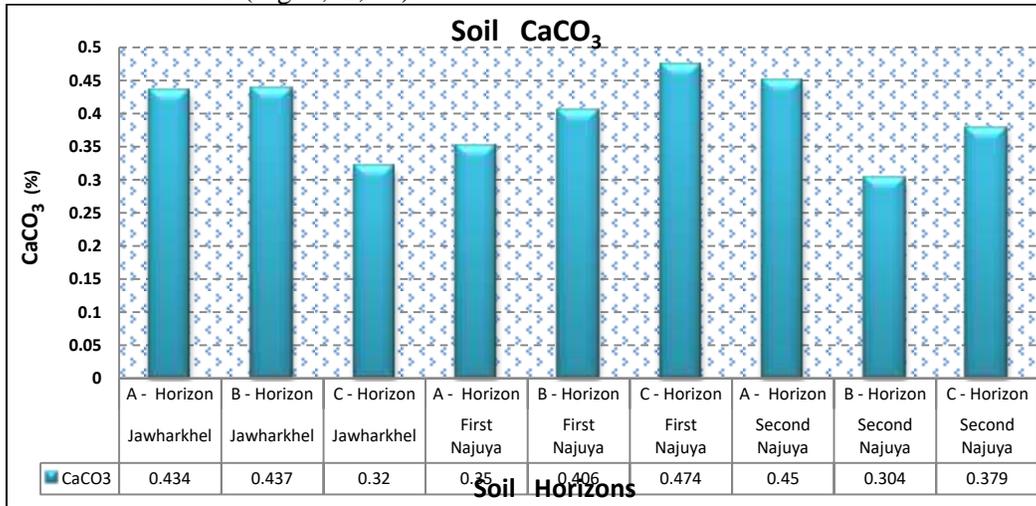
different Characteristic of soil and sediments and rock type in Chak Wardak sedimentary basin.

**1- Mechanical analysis**

In this research we did some laboratory works like Mechanical analysis by Hydrometer. According to the Hydrometer analysis we found the type of soil fraction is sandy Loam. B - Horizon when we analyzed the soil sample by Hydrometer we found the soil type was Loam. In the C-Horizon according to the mechanical analysis by Hydrometer or Areyometer the texture of soil was Sandy Loam.

**2- Chemical analysis**

Chemical analysis of the samples were done at chemical laboratory. The samples were analyzed,  $\text{CaCO}_3$  by Calcimeter and pH and EC by pH meter. In A-Horizon we found the amount of  $\text{CaCO}_3$  by Calcimeter, it was 0.434 %, pH is 6.50 and the EC are 961  $\mu\text{s}/\text{Cm}$ . In in this B- Horizon the amount 0.437 % , pH is 7.87 and EC is 920  $\mu\text{s}/\text{Cm}$ . C -Horizon the amount of  $\text{CaCO}_3$  is 0.32 %, pH is 6.50 and EC is 875  $\mu\text{s}/\text{Cm}$ , from here we can find the of  $\text{CaCO}_3$  from all horizons (Fig. 2, 3, 4).



**Figure 2: Comparison of  $\text{CaCO}_3$  content in three soil profile (Jawharkhel, first and second of Najuya).**

**II. Profile of Najuya:**

**Field works:** in this soil profile we also explain three types of Pedogenic horizons (A - Horizon, B - Horizon and C-Horizon) and the total depth of soil profile is 115 Cm (figure 18). This soil profil is located at the 34°. 05' 58" latitude, 68°. 33' 21" longitude and 2198 m a, s, l. The depth of A-Horizon is 0-16 Cm, when we compare with Munsell color chart in wet condition in this condition we found Greyish brown (10 YR 5 /2) and at the dry condition the soil color is Reddish brown (10 YR 8 /2). In this horizon we can find roots of dissolute plant and crumbling structures. The depth of B-Horizon is 16 -30 Cm and when we compared with Munsell color chart in this case we found at the wet condition the color is Yellow brown (10 YR 5/6) and at the dry condition the color was Pinkish white (7.5 YR 8 /2). As well as in this horizon we could found some rock, organic matter particles and roots of plants. The depth of C - Horizon was 30 - 115 Cm + and after comparing with Munsell color chart in wet condition the soil color was found Dark grey (10 YR 4/1) and at the dry condition its color was Yellowish brown (10 YR 5/6 ). In this

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horizon also we found some rock particles and tree roots as well some particles of organic matter.

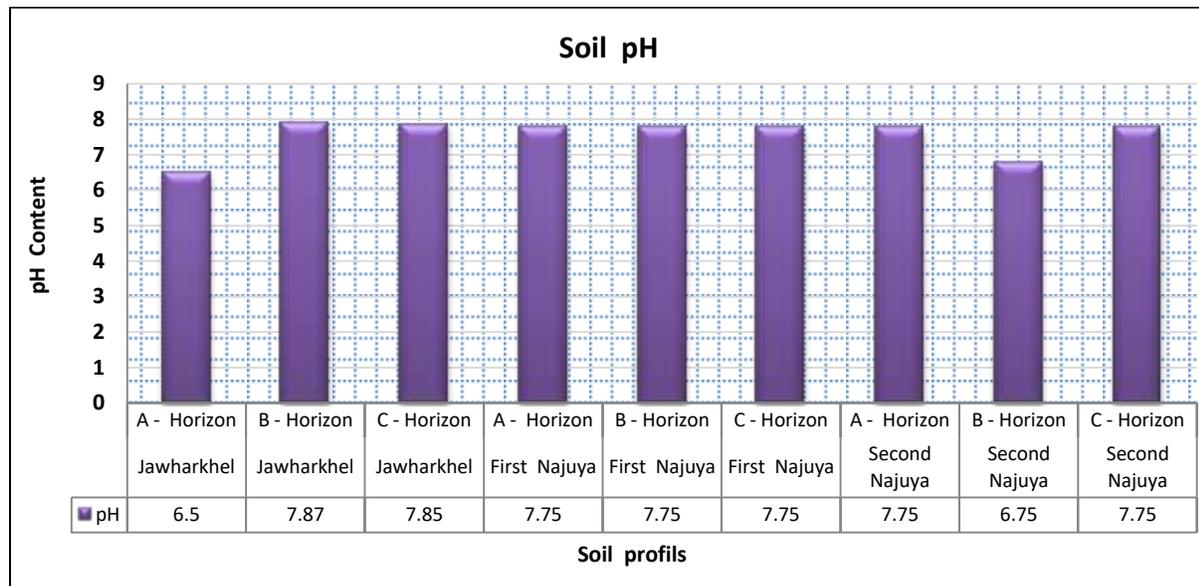
**Laboratory works**

**1- Mechanical analysis**

In this horizon when we analyzed the sample in the department of geology Kabul university by Hydrometer we found the type of soil to be Sandy loam. B- Horizon - when we analyzed the soil sample by Hydrometer in this case we found the type of soil was Loam when we did Mechanical analysis on the soil sample by Hydrometer or Areyometer we found the texture of Loam soil type.

**2- Chemical analysis**

When we did the chemical analysis of calcium carbonate by Calcimeter we found the amount of CaCO<sub>3</sub>, in A- Horizon as 0.35 %, pH was 7.75 and EC was 849 μs /Cm. In B-Horizon the amount of CaCO<sub>3</sub> was 0.406 %, pH was 7.75 and EC was 861 μs /Cm. In the C- Horizon the amount of CaCO<sub>3</sub> was 0.474 %, pH was 7.75 and EC was 870 μs /cm(Fig. 2, 3, 4).



**Figure 3: Comparison of pH content in three soil profile (Jawharkhel, first and second of Najuya).**

**III. Second soil profile of Nagoya**

**Field works**

This soil profile is located at the 34°. 05'56" latitude, 68°. 33' 11" longitude and 2220 meter average sea level. The total depth of this profile is 2 m, in this soil profile also we found three type of Pedogenic horizons and it consist of A-Horizon, B- Horizon and C-Horizon (figure 19). The A-Horizon is from 0 - 90 Cm and according to the Munsell color chart at the wet condition we found the soil color as very pale brown (10YR 8/2) and at the dry condition the soil color is Greyish brown (10YR 5/2). The depth of B- Horizon is 90 -125Cm, and according to the Munsell color chart in dry condition the soil color is Pinkish white (7.5 YR 8 /2) and at the wet condition the soil color is Yellow brown (10 YR 5/6). As well as in this horizon we can found some gravel, roots of plants and insect caves. The depth of C- Horizon is 125 - 200 cm and when we compare the soil sample in the dry and wet condition in this case in dry condition we found the soil color is Yellowish brown (10 YR 5/ 6) and in wet condition the soil color is

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dark grey (10 YR 4/1). In this horizon we can found some particles of rocks, insect caves and some roots of plants.

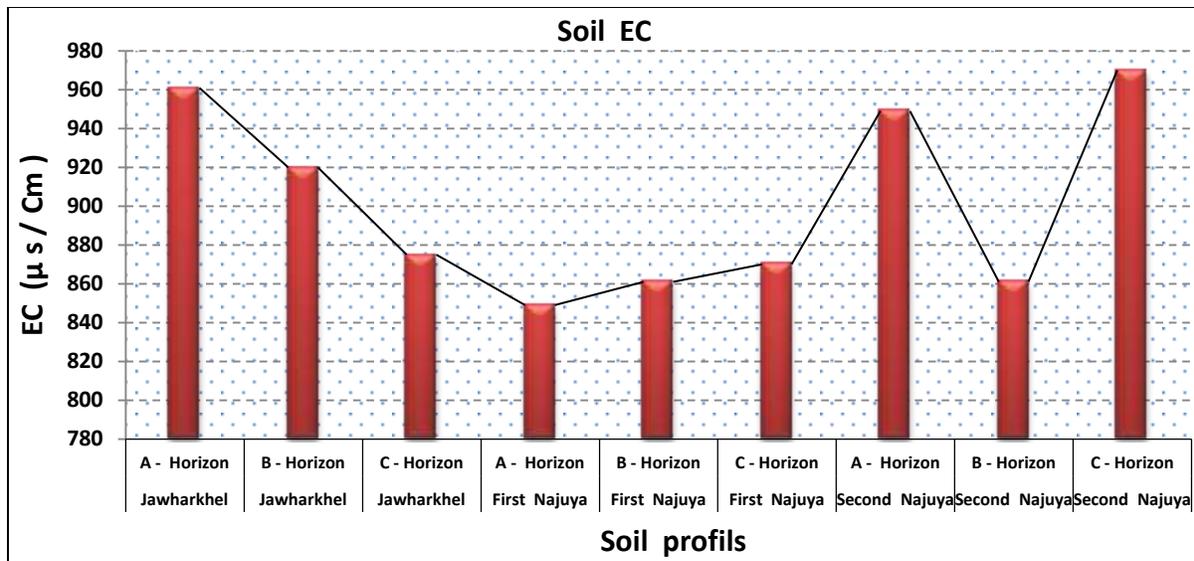
**Laboratory works**

**1- Mechanical analysis**

A-Horizon- when we analyzed the soil sample by Hydrometer in this case we found the type of soil Loam as well as here is rock particles, roots of plants, insect caves and crumbling structures. B-Horizon- When we analyzed the soil sample by Hydrometer we found the texture of Sandy Loam soil type. C-Horizon- When we done Mechanical analysis on the soil sample by Hydrometer or Areyometer the soil type was clayey loam.

**2- Chemical analysis**

In A -Horizon the amount  $\text{CaCO}_3$  is 0.45 %, the pH is 7.75 and EC is 949 s/cm. In B-Horizon the amount of  $\text{CaCO}_3$  is 0.304 %, pH is 6.75 and EC is 861  $\mu\text{s}/\text{cm}$  and in C -Horizon the amount of  $\text{CaCO}_3$  is 0.379 %, pH is 7.75 and 970  $\mu\text{s}/\text{Cm}$ (Fig. 2, 3, 4).



**Figure 4: Comparison of EC content in three soil profile (Jawharkhel, first and second of Najuya).**

**CONCLUSION**

This soil and Sedimentological research is used to explain the soil profiles, selection of different size of river sediments that transported by Loger discharge in snow melting season at the different parts of Chak basin for the previous geological periods. As well as selected different types of rocks that are located in the surrounding mountains and mother rocks of these sediments that accumulated in Chak Wardak district. The surrounding mountains of Chake Wardak made from Gneiss, Limestone, Slate, Schist and reefs. As well as some mountains are made from granitic rocks. These Parent rocks weathered by physical weathering and made different types and sizes of clastic sediments, after these clastic sediments by different type of phenomenon's transported (gravity and water flow) at the ancient geological periods (Iocene and Oligocene) to the basin and made one by another's different type of layers and river terraces. The thickness of these sediments is belonging to shape and relief of sedimentary basin. For selecting different size of fine materials we excavated at the differernt locations soil profiles to for choosen the size of fine

**Research Article**

materials we did some soil tests in the laboratory of geology department like mechanical analysis by Hydrometer and for explanation of soil horizons we compare with Munsell color chart. In this research we selected three different locations for soil profile and its consisting of Profile of Jawharkhel, profile of Najuya and second soil profile of Nagoya. In soil Profile of Jawharkhel The total depth of this profile is 1.10 m in this profile generally we found three type of Pedogenic horizons which consist of A-Horizon, B-Horizon and C- Horizon and the following explains: A- Horizon is from earth surface to 15cm, according to the Munsell color chart the color of soil in the wet condition is reddish gray (2.5YR5/1) and at the dry condition the color of soil of this horizon is Very pale brown (10YR 8/2). From Hydrometer analysis we found the soil type of Sandy Loam. The B-Horizon is 15 – 50 cm depth according to the Munsell color chart in wet condition the color of soil is Strong brown (7.5 YR 5/6) and at the dry condition the color of soil is Pinkish white (7.5YR8 /2), in this horizon we can find some partials of organic matter and rocks and in this we can find some caves of worms. When we analysis the soil sample by Hydrometer we found the soil type Loam, in this research from chemical laboratory works we done some tests that we did throughout this research consists of  $\text{CaCO}_3$  by Calcimeter and pH and EC by pH meter. In A- Horizon we found the amount of  $\text{CaCO}_3$  by Calcimeter its 0.434 %, pH is 6.50 and the EC are  $961 \mu\text{s} / \text{Cm}$ . In B - Horizon the amount 0.437 %, pH is 7.87 and EC is  $920 \mu\text{s} / \text{Cm}$ . C – Horizon the amount of  $\text{CaCO}_3$  0.32 %, pH is 6.50 and EC is  $875 \mu\text{s} / \text{Cm}$ , from here we can find the of  $\text{CaCO}_3$  from all horizons. The depth C - Horizon from earth surface is 50 –110 m+. When compared with Munsell color chart at the wet condition the soil color is black Reddish (10 YR 2.5 /1) and the dry condition the soil color is Yellowish brown (10 YR 5/6) and according to the Mechanical analysis by Hydrometer or Areyometer the texture of soil is Sandy Loam. In this Pedogenic horizon we could found some particles of organic matters and rocks. In the soil Profile of Najuya we also explained three type of Pedogenic horizons (A - Horizon, B - Horizon and C - Horizon) and the total of soil profile is 115 Cm. The depth of A- Horizon is 0 - 16 Cm, When we compare with Munsell color chart in wet condition we found Grayish brown (10YR 5/2) and at the dry condition the soil color is Reddish brown (10 YR 8/2), when we analyzed the soil sample in the laboratory department of geology Kabul university by Hydrometer we found the type of soil Sandy loam. In this horizon we can find roots of dissolute plant and crumbling structures. The depth of B- Horizon is 16 -30 Cm and when we compare with Munsell color chart we found at the wet condition soil color Yellow brown (10YR 5/6) and at the dry condition soil color was Pinkish white (7.5 YR 8 /2) and when we analyzed the soil sample by Hydrometer in this case we the type of soil was Loam. As well as in this horizon we can found some rock, organic matter particles and roots of plants. The depth of C - Horizon was 30 -115 Cm+ and according to the compare of Munsell color chart in wet condition soil color was Dark gray (10 YR 4/1) and at the dry condition its color was Yellowish brown (10YR5/6). When we done Mechanical analysis on the soil sample by Hydrometer we found the texture of Loam soil. In this horizon also we found some rock particles and trees roots as well as some particles of organic matter. When we conducted the chemical analysis of calcium carbonate by Calcimeter in this case we found the amount of  $\text{CaCO}_3$ , in A - Horizon is 0.35 %, pH is 7.75 and EC is  $849 \mu\text{s} / \text{Cm}$ . In B - Horizon the amount of  $\text{CaCO}_3$  is 0.406 %, pH is 7.75 and EC is  $861 \mu\text{s} / \text{Cm}$ . In the C - Horizon the amount of  $\text{CaCO}_3$  is 0.474 %, the pH is 7.75 and EC is  $870 \mu\text{s} / \text{Cm}$ . Second soil profile of Nagoya the total depth of this profile is 2 m, in this soil profile also we found three type of Pedogenic horizons and it's consist of A - Horizon, B - Horizon and C-Horizon. The A - Horizon is from 0 - 90 Cm and according to

### **Research Article**

the Munsell color chart at the wet condition we found the soil color very pale brown (10 YR 8/2) and at dry condition the soil color is Greyish brown (10 YR 5/2). When we analysed the soil sample by Hydrometer in this case we found the soil as Loamy. Here we could see the rock particles, roots of plants, insect caves and crumbling structures. The depth of B - Horizon was 90 -125 Cm, and according to the Munsell color chart in dry condition the soil color is Pinkish white (7.5 YR 8/2) and during wet condition the soil color is Yellow brown (10YR/5/6). When we analyzed the soil sample by Hydrometer we found the texture similar to Sandy Loam soils. As well as in this horizon we could found some gravel, roots of plants and insect caves. The depth of C- Horizon is 125 - 200 Cm and when we compared the soil sample in the dry and wet condition in this case in dry condition we found the soil color Yellowish brown (10 YR 5/6) and in wet condition the soil color was Dark gray (10 YR 4 /1). When we did Mechanical analysis of the soil sample by Hydrometer the soil type was clayey loam. In this horizon we could found some particles of rocks, insect caves and some roots of plants. In A - Horizon the amount  $\text{CaCO}_3$  is 0.45 %, the pH is 7.75 and EC is 949  $\mu\text{s}/\text{Cm}$ . In B - Horizon the amount of  $\text{CaCO}_3$  is 0.304 %, pH is 6.75 and EC is 861  $\mu\text{s}/\text{Cm}$  and in C-Horizon the amount of  $\text{CaCO}_3$  is 0.379 %, pH is 7.7 and 970  $\mu\text{s}/\text{Cm}$ .

The results obtained suggested that further research should be done on topics such as soil physical and chemical properties by different laboratory tests, detail another sedimentological, Geochemical, engineering geology, hydrogeology (Ground water modeling section), hydrology, petrography, tectonic and geological mapping. As well as the Sedimentological research can be used efficiently in the other catchments of basin and other mountain basins in Afghanistan, at the end I would request international organizations to promote research programs in above areas.

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