Study of fining trend in Frizi River Watershed Northwest of Mashhad

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Abstract

Frizi's river drainage-basin is located in northwest of Mashhad with a surface area of about 333.7 km2.This drainage basin flows from south top branch of Kashafrood
River. It is located in Mashhad-Chenaran plain and its source is in Binalood mountains.
The above- mentioned river is mainly gravelly in the study area with a bed load and single channel and consequent stream types. In many gravel –bed rivers, the grain size changes exponential toward downstream and is mainly related to selective deposition of material on the streambed according to size, distance of transportation, erosion, vertical and lateral sorting. However, most studies on the cause of downstream fining in the rivers emphasize hydraulic sorting as the dominant fining mechanism. Sediments grain size variations and causes for fining downwards were studied at 27 sites. In general, sediments are poorly sorted, positively skewed and mainly platys to mesokuritic. In Frizi river drainage-basin, the rapid reduction of slope is one of the main geomorphologic factors that cause fining toward downstream. Another main factor in downstream fining of grain size is selective transport due to changing hydraulic condition which is controlled by hydrology of drainage basin as well as catchments slope.

Introduction

Rivers are the most important drainage system on the surface of the earth and play a significant role in sediment transition.Therefore, understanding rivers' processes and factors related to their changes receive considerable attention. The substance of stones, tectonic movement, geological structures and weather conditions are the elements that affect the type of river and sediment loads (Di Giulio and et al 2003, Sear, D. A and Newson, M. D., 2003, Vendenberghe, j. 2003).In addition, the slope difference along the river, material, size and sediments' forms, the different conditions of channel forms, entrance of new branches into the main way and human interference in the natural system of rivers are the leading elements in sediment texture change and the situation of rivers' processes(Le Pera and Sorriso-Valvo 2000, Landwehr, K and Rhoads, B. L., 2003,Gomez and et al 2001, Musavi-Harami and et al 2004). Frizi river drainage basin is about 333/7 km2 is one of the south branches of Kashafrood river .Considering geographical situation, it is between 36 20 degree to 36 32 degree north latitude and eastern longitude. Frizi River has gravely bed with single channel as well as load bed. It is a consequent type of river that its gravel sediment is made of Slate and phylite. This is the last sub basin. In Binaloud, by moving toward west, we find carbonic structures related to Jurassic.The main part of Frizi river drainage basin is located on gray shale and phylite. The upper branches of this river after absorbing water from these phylite in

Mooshang hydrology station get together and move on the sand and Shist related to Jurassic .Then in Jam Ab village, it enters Mashhad's plain.

Considering the special situation this drainage basin and the fact that sediment studies haven't been done in depth in this area. This study seeks to investigate the changes in grain size parameters, finding the factors of making them, analysis of downstream fining and determining the effective mechanism. In order to analyze texture parameters and downstream fining trend ,27 sediment samples from major and minor channel's beds were taken and the exact position of sediment was registered by using GPS instrument .Analysis of sediment size in dry sieve method in 0.5 feet distances was done. By obtaining and analyzing the percentage of massive out comings, texture parameter of samples were analyzed by using Folk (1980) formula and graphs and diagrams through Excel software (fig. A).

Results and Disscussions

Observing grain size parameter in Frizi River displays four discontinuities in the basin. Also, the sudden change of bed slope due to tectonic factors, entrance of side sediment from minor branches, human factors and activity are the main elements in sediment texture of the bottom of the channel and the main factors of causing discontinuity of sediment .Studies in this area show that the main changes of the channel's bed slope has an organized pattern and just in 2/8 km from the source and at the end of the way, the slope has a sudden increase and then decrease (fig.B). Considering diagrams related to changes of statistical parameters and the percentage of grains demonstrate that changes of mean and median are almost in harmony to the extend that in most cases ,mean is lower than median. Considering the sorting pattern displays the increase of this parameter from upper part to downstream. This is due to the difference in grain size as a result of decrease in the environmental energy .It is so much that we can find coarse grain gravel sediment in upper part and in down stream the grains are in the size of sand. The pattern of changes is observed in the form of increased skewness and kurtosis support such a pattern. Now, considering the analysis, each of the sediment discontinuity is going to be investigated separately. Discontinuity No.1 is in upper part and in about 3 km from the source .This part is as a part of Binaloud Mountains. Coarse gravel sediment are gravel and disky form .In this part, the mean and median are quite similar to each other .This is because of the fact that this part is closer to the source; therefore, the distance of transition and hydraulic separation of sediments are less (Hoey and Bluck., 1999). It is worth mentioning that the slope changes shouldn't be ignored in this part because they show the occurrence of tectonic movement again. In the upper part of this section, due to hydraulic separation, less sorting in comparison with lower part is observed.Maybe one of the reasons in this regard is the decrease of coarse grains .mostly due to the decrease of water flow speed and slope changes. Changes in diagram of skewness could be related to slope changes .As a whole, the pattern of changes of sorting in this part is decreasing but in downstream it is increasing. This shows the increase of fine grain sediment to the downstream. This incident is because of the decrease in the environmental energy and sedimentation fine grain sediment. Kurtosis has a common and equal process and in this most of the grains most of the grains are in platy forms.

Discontinuity No2 is in 14 km from the source .The reason of discontinuity in this part could be part could be related to human beings' activities which disturbed the organization of the

main element channel of Frizi river. As a result, the textures of sediments were changed, a new continuous system was formed and sediments of different size were mixed together. Due to the changes in the size of bed grains, mean and median were also decreased. Considering the general pattern, this decrease could be related to the sudden decrease of water flow which leads to the changes of slope decrease (Musavi-Harami,R and et al 2007). In this part, the pattern of sorting changes is in the decreasing form which shows better sorting in the downstream. Due to the slope changes and human beings activities, this pattern wasn't homogenous (fig.B). Changes in the speed of water flow would change bed slope.

Skewness in this section is to some extend positive and increasing .This implies that in the downstream, finer grain could be found. Also, in this parameter, slope changes and human being's activities which disturb the channel organization lead to changes and differences in the skewness .process. Kurtosis is also increased which is the result of better sorting in the downstream. It is worth mentioning that the process of kurtosis changes is somehow similar to skewness. Third discontinuity is from 17.5 km from the source .The reason of this discontinuity is the entrance of minor channels and existence of new sediment in the main channel. This is also accompanied by the decrease of bed slope (Fig B).This minor channel causes changes in the sediment texture of the channel and leads to a new sediment continuity. In this part, changes of slope reduction were observed which itself is a factor in changes of texture parameter. Mean and median were decreased .Sorting becomes somehow better skewness and kurtosis were also reduced. Discontinuity No.4: It is in the last stages on the way of taking samples. It is in 21 km of the source. The reasons of such a discontinuity are changes and decrease of bed slope extracting sand and gravel from the side of the channel. These changes affect texture parameters in a way that mean and median were decreased in this part. Sorting follows mean and median changes and decreases in this section. Skewness and kurtosis have an increasing mode. It could be concluded that, in general, grain size to the downstream in gravely bed rivers decrease in a figurative form. The reasons of fining in lower parts of river are: sedimentation and selective sorting (selective transition of grains) that are effective due to the high slopes which are controlled by hydrodynamic situations. The sudden change of the bed slope and decrease of height as a result of tectonic factors, entrance of minor branches, human being's activities abrasion of gravel grains and subsidence rate of basin are the main elements of changes in the texture .Sediments on the study in this basin have the very bad to the bad sorting, very positive to the positive skewness and mostly have average or metsokortic kurtosis. Bad sorting is because of high energy in a short duration that carry a large amount of sediment with reduction of small and big grains: they fall down together .Positive skewness of sediment is because of decrease in the river's alternative flow. The difference between mean and median decrease to the lower part of the river; therefore, the amount of asymmetry would be decreased .Texture parameters to the lower part don't have a specific trend .The result of this goes to the hydrodynamic situation of the rivers and entrance of minor branches.

Finally, considering the high slope of Frizi basin, hydraulic sorting affect grain's fining in the lower part of the river. In addition, grains' sensitivity of slate and phylit or grains to the abrasion play an important role in fining in the lower part.

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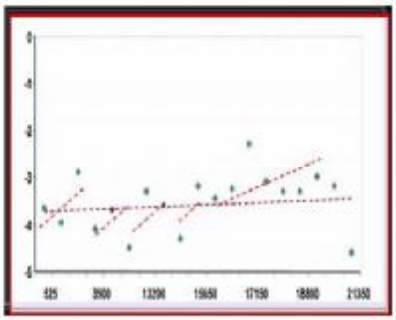
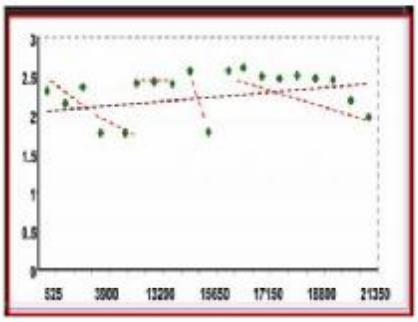
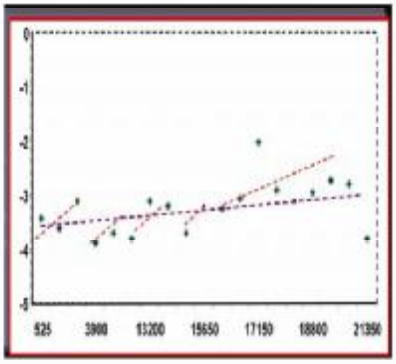


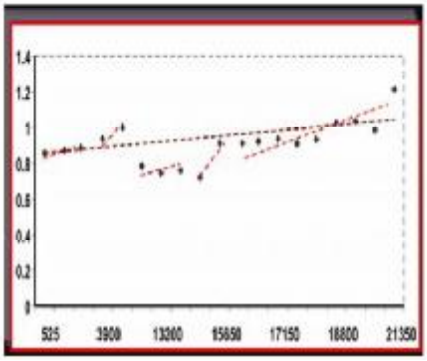
Median parameter in Frizi River



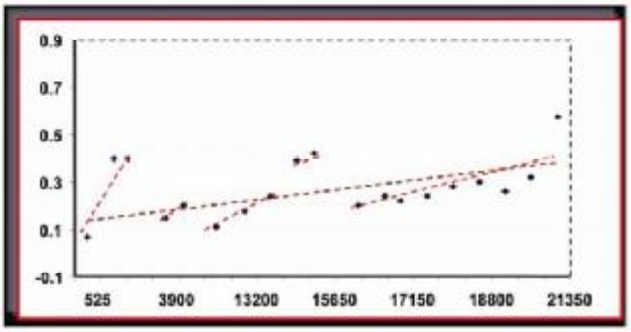
Sorting parameter in Frizi River



Mean parameter in Frizi River

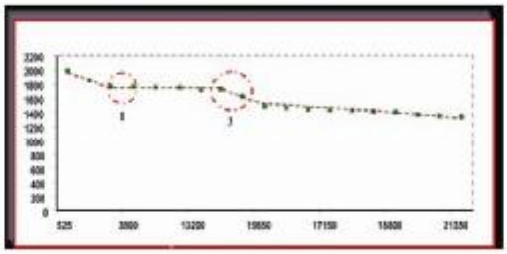


Kurtosis parameter in Frizi

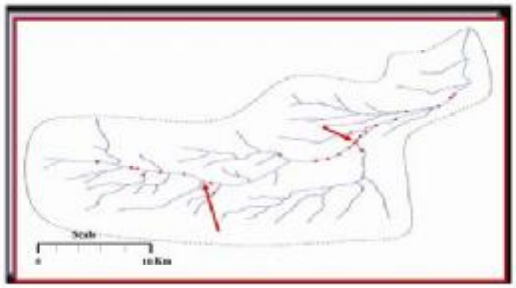


Skewness parameter in Frizi River

Fig (A): Texture Parameters



Sudden changes in slope gradient as one of the main factors for



Tributaries as one of the main factors for creation of

Human parameters in creation of discontinuities

Fig (B): The effective factors on changes of texture