Liver of sheep as a bio-indicator for Determination of heavy metals (Cd,Cr,Cu,Ni) pollution by geo-origin Based on the study in Urmia, Iran

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Abstract: - Heavy metal compounds of geogenic origin are found in areas where metalliferous veins reach close to the surface, and so metals are effectively complexed to water molecules. according to the geo-botany absorption, metal ions appeared in plants and sheep liver tissue may contain appreciable quantities of heavy metals. The sheep usually can go up to 2Km in all directions and access to an area of about 20 km^2. the liver of sheep would be used as a bio monitor and could be useful toward prospecting geochemical halos and toxic zones. according to AAS analyzes on the collected sheep's liver samples from Urmia area of AzarbayjanGharbi province from Iran, the highest amount of cadmium(33 mg/kg) and copper (98 mg/kg) is reported. Finally by attention to the physiology of the sheep and locating the studied area in polymetal belt of Iran, results shows the high risk pollution of studied area

Key-Words: AAS-bio indicator-Urmia-pollution-heavy metal-sheep liver

1 Introduction

Before we go any further about biogeo-monitoring methods, we need a definition of this kind of scientific theory.The availability of liver nutrients and elemental contents is dependent on chemical processes and factors that determine the actual concentration and speciation of nutrients and trace elements in the soil solution and the ability of the soil solid phase to replenish the soil solution (soil buffer power) [1]. Sheep are able to thrive on marginal areas, using low-quality natural resources which cannot be efficiently used by other domestic ungulates. Due to their anatomic and physiological characteristics, sheep exhibit a very flexible foraging behavior While heavy metal uptake across plants essentially all of the sheep dietary constituents, whether they be metal ions, carbohydrates, fats, amino acids, vitamins, etc, will be effected[2]. The present study was designed to determine the effects of heavy metal intake in the tissues of the liver of sheep. Liver of the sheeps is one of the most important organs of their metabolism and this tissue can concentrate chemical elements at high levels[3]. The concentrations of nickel, cadmium, chromium, and copper would be used to mapping the geo polluted haloes based on the background values.

2 Materials and Methods

The samples of liver from sheeps in Urmia, were collected randomly during February 2010 to February 2011. Samples were taken only from healthy animals in three age groups: less than 2-year-old, 2–4-year-old and more than 4-year-old and all the drugs used for them was checked. The samples of at least 100 gr, were collected from the same part of each organ, namely the lobus caudatus for liver. All the samples were packed in plastic bags and transported to the laboratory.

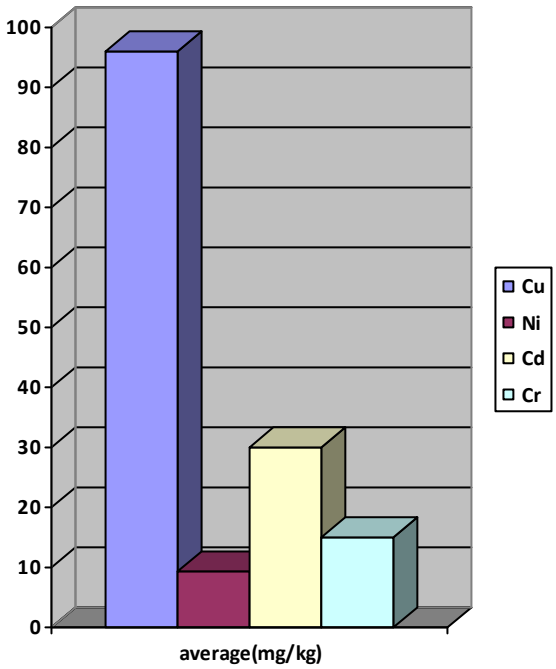
Liver was first cut into fine pieces. Determination of heavy metals was carried out by atomic absorption spectroscopy (AAS, Spectra AA-40,Varian Co.) and computer-controlled autoinjector. 25_50 mg of samples were digested by the mixture of nitric acid and perchloric acid and then diluted to 10 mL. An aliquot from digested samples was taken out and extracted by KI-MIBK organic solvent, and then subjected to AAS determination for their Cd, Ni, Co and Cu contents. The detection limits were 4 ng_L–1 (Cd), 2 ng_L–1 (Ni), 1 ng_L–1 (Co) and 80 ng_L–1 (Cu), respectively. [4].
The standard reference samples were processed and analyzed in five independent runs.sections The average value of each element were calculated. Samples for background value analyzed and finally for comparing the liver results to geo-origin pollution, the pathways sediment geochemical map used. The anomalous samples based on sheep accessing areas, mapped on topographic map in studied area with polygons (see fig 2).

3 Results

The uptake of heavy metals by plants depends on soil Ph. Heavy metals uptake increases in acidic soils when compared to alkaline soils (keikens, 1990). The intake of metals in liver is well known in past decades.
Correlation between the concentration of heavy metals in soil, feed and liver tissue due to geochemical exploration and prospecting was found. However, the Cd and Cu content in tested animals was high. . All metals caused similar changes in various parameters used to describe general toxicity but only copper significantly increased the tissue malondialdehyde content. Lipid peroxidation is induced by Cu-overload in liver of sheep (Sansinanea et al., 1997).[5]
see table1 and fig 1.
Table 1 elements

Element	Average	Mean	SD
Cd mg/kg	30	36.3	32
Cu mg/kg	98	111	99
Ni mg/kg	9.3	12	8
Cr mg/kg	13.3	22.2	15

fig 1, the average value of heavy metals (mg/kg)in samples



The hygienic limit of Cu concentration was exceeded (with maximum 111 mg/kg)
The values of Ni concentrations did not exceed the hygienic limits in any tissue except one area. On the other hand, samples with above-limit Cr concentrations came particularly from liver tissues. 32.2% of liver samples (with maximum 0.94 mg/kg) were higher than hygienic limits and would be referred to the geology origin. .The hygienic limit of Cr concentration was exceeded in five samples (with maximum 0.63 mg/kg)

4 Conclusion

Actually, sheeps are not considered as exclusive browsers but mainly as ‘opportunistic feeders’ that have a selective foraging behavior affected by the interactions among animal, environmental and plant characteristics .therefore copper and cadmium by sheep liver in relation to soil metal concentration has been studied in two ways: from the point of view of the comparing geobotany monitoring or from the point of view of the pathways sediment geochemistry to find of the origin of pollution.
In sheep liver samples in the Urmia cadmium, copper, and chromium are definitely high but nickel is normal. On topographic map high risk polluted zones are showed by polygons. The fig 2 shows the pollutions for Cd, Cu, Ni and Cr based on sheep accessing areas.

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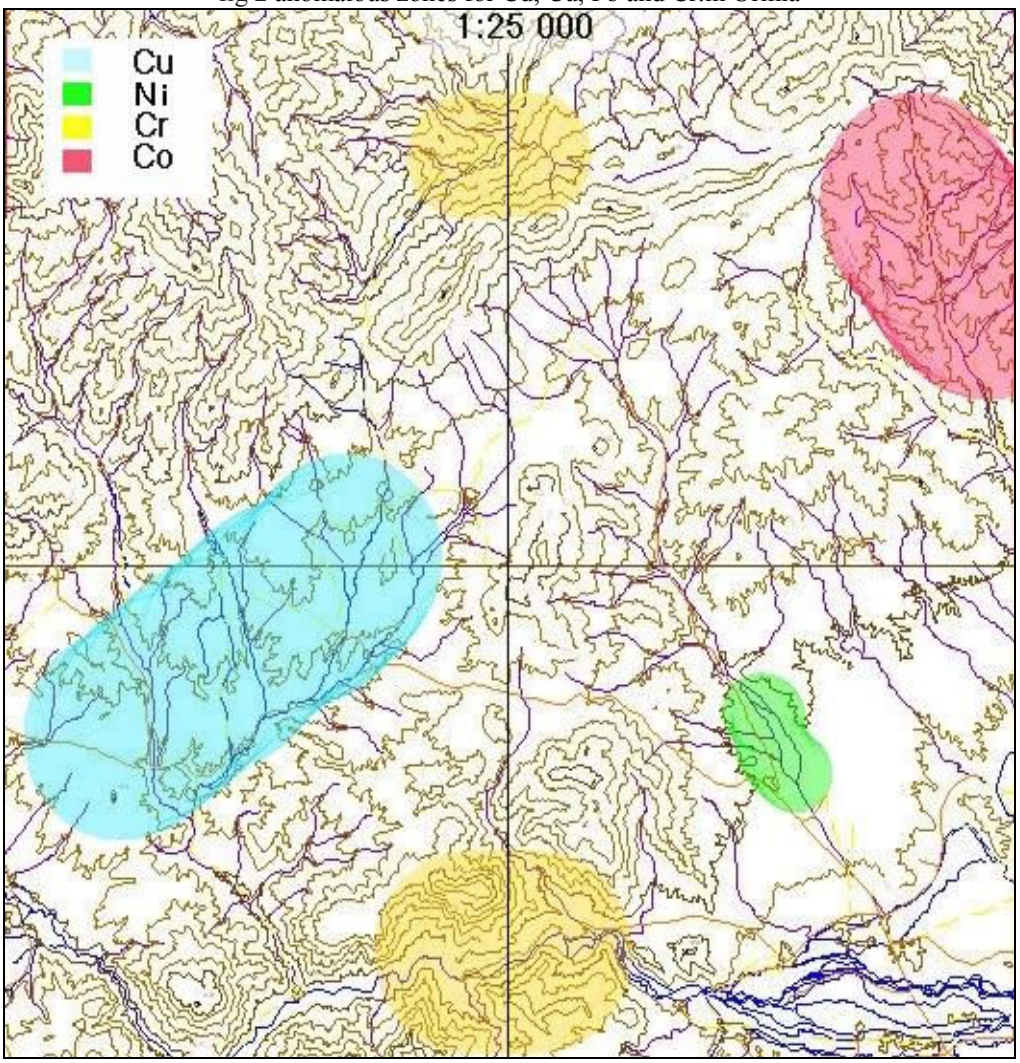
fig 2 anomalous zones for Cd, Cu, Pb and Cr.in Urmia



The comparing of obtained results with geochemistry map, shows the anomalous areas finely the same. Collectively, this study shows that high concentration of Cd, Co, Ni, Cu and As accumulated in the liver due to prospecting geo origin pollution. Consequently sheep are a unique bio indicator for geo chemical pollution.

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