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Research Article

ZONING THE LEAD CONTAMINATION AT THE SOIL OF ARDABIL AGRICULTURAL LAND BY USING REMOTE SENSING

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ABSTRACT
Manual measurement of heavy metals at wide-areas is very difficult and it's with a lot of errors and it costs a lot of money. So remote sensing with monitoring points is an appropriate practical knowledge. The goal of this research was to evaluate the density of lead at the agricultural land of the input of Ardabil such as (Abi Beyglu, Khalkhal, Sarcham, Sareyn, Astara and Arjestan). And also the sampling of soil, preparing satellite images (landset 8) (2013), statistical analysis, Geostatistics and geographic information system. The result of this research showed us that the most of the lead density at that region was at the input of Abi Beyglu. So that the class 3 with the lead density of 3 to 3.50 had the most space and class 1 with the density of 2.10 to 2.50 had the least space at the region. And also, totally band 7 had the most space and band 5 had the least space between the lead floors. The result of measuring the lead and also analyzing the remote sensing showed us that the maximum of the lead density is at the east and south of Ardabil and remote sensing has a meaningful solidarity for estimating the lead density.

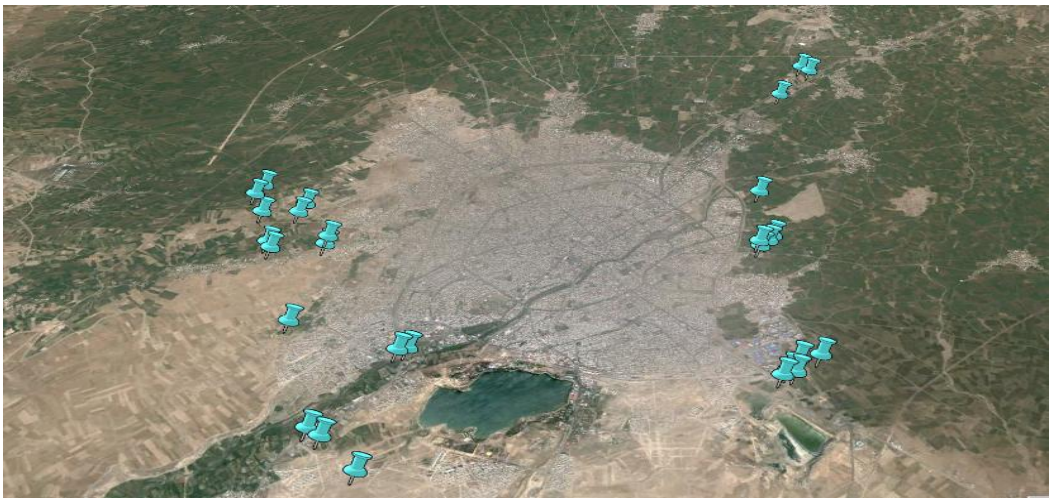
Keywords: *Lead, Remote Sensing, Agriculture, Ardabil*

INTRODUCTION
Expressing the Problem
Soil is one of the most important and worthwhile resources at the nature. Soil is the origin of the universe and human heritage for posterities. Without the healthy soil, living on the earth will be impossible. 95 percent of the human foods come from the soil. Planning for having a healthy and productive soil is essential for human survival. Soil pollution causes from the industrial and productive activities. These items which import pollution to the environment can be classified like this: industries and factories, productive and household resources, agricultural resources, motor vehicles, building and road. Many heavy metals especially lead; can be find at the soil and water in small amount. These rare elements naturally go to the environment as a result of air stone damage. They can be laundered and go to the surface water or groundwater or they can be absorbed by plants. They can go to the atmosphere like a gas or they can link up with the soil components such as clay or organic matter. The behavior of the heavy metals is important, because it can make groundwater pollution or surface water pollution and they can also go to the food chain (Noroozi, 2007). Heavy metals and especially lead are from different resources. At last, they may arrive to the surface soil, and their next destination is related to their physicochemical characteristics and the soil. Soil main variables which are involvement of mobility of contaminants include: PH values, regenerative and oxidation potential, organic matter, clay minerals, carbonates and salt (Probest, 2005) and also geostatistics is a branch of statistics that can study the coordinate data which are related to the under study population and consequently study the spatial structure of related data In many common methods of classic statistics like analysis of variance and geographical and spatial location of environmental samples, in addition to obtain values of the desired characteristics. They should pay attention to the geographical location views concurrently (Hassani, 2011) heavy metals are a kind of metals which have relatively high density. And they are toxic at low concentrations. Pollution by heavy metals, in addition to its effect on food chain, it can cause the change of physical and chemical characteristics, reduction of physiological activity and reduction of assessment to the soil nutrient and changes the environment security by infiltration in groundwater (Bioson, 1999). Heavy metals are evaluated as dangerous factors and environmental pollutants. These metals go to the cycles of nature from water, soil and air, by different natural and agricultural resources. And they can cause dangerous short-

term and long- term effects at them. So they are called as a serious risk for continuation of living organisms. Heavy metals are called as environmental stable and durable pollutants. Because they cannot disintegrate at the nature like organic pollutants by chemical and biological processes. One of the important results of the stability of these metals is bioaccumulation of metals at the chain food. As a result of this process, the level of metals in higher members of the chin food can be found several times more than them which are found at the air or water. And so they can be dangerous for the health of the plants and the beasts that use this food (Tavakoli, 2011). Ben and Banin (1995) studied about NIRS as simultaneous and fast methods of evaluating some of the soil component. 91 sample of soil gathered from Israel and were analyzed at the labratoary. Near infrared reflectance is measured for the samples of the regions of 1000 to 2500 nanometer, is because of the relation between absorption intensity in 1400, 1900 and 2200 nanometer, clay, the absorption in 2300 and carbonate components. They conclude that NIR is a hopeful method for the soil. Virad and his coworkers in 2004 investigated the pollution of the highways adjacent lands with heavy metals (lead, Zink, Cadmium) in France, several further reading were done at 2 regions with different traffic intensity for analyzing pollution by traffic. The density of zinc, lead and cadmium was measured in the sediment and the soil of the roadside and the plants (grasses) beside the highways. (the distance of 0 to 320 meter) by this results, highways are polluted as a result of road traffic to the distance of 320 meter, but the maximum effect of that, was at the distance of 5 to 50 meter that the density of these pollutant reduced by getting away from the highway. So, for reaching the goals of sustainable development, the the basic environmental data should be collected for vital resources like soil.

Program

This research has been done by library studies at region or other's research methods. Sampling from the soil was done in autumn. At first the location of the sampling points from the road that was ended to Ardabil was determined at agricultural lands, which are included: Astara, Abi Beyglu, Khalkhal, Sarcham, Sareyn, Tabriz, Arjestan, Sardabeh. At the next step, sampling from the surface soil was taken at the depth of 0 to 30 centimeters. This means those 4 samples at the distance of 10 meter around each road and 4 samples at the distance of 150 to 300 meter around each road and 6 samples at the distance of 1 kilometer around each road. As a result, in altogether 30 samples were taken.



Picture 1: Satellite images from the place of study

For preparing of essential variables, in order to use in the models which are related to the hypothesis testing, it has been used wide screen application (Excel). At first, the collected data which were created at the working pages, transferred to the software and after that the essential calculations for reaching to the variables of this research were done. After measuring all the essential variables for using at the models of this research, these variables combined at the unity working pages in order to be transferred electronically to the software which is used at the last analyzing, that is called remote sensing software (Beheshti, 2014).

RESULTS AND DISCUSSION

Results

Remote Sensing

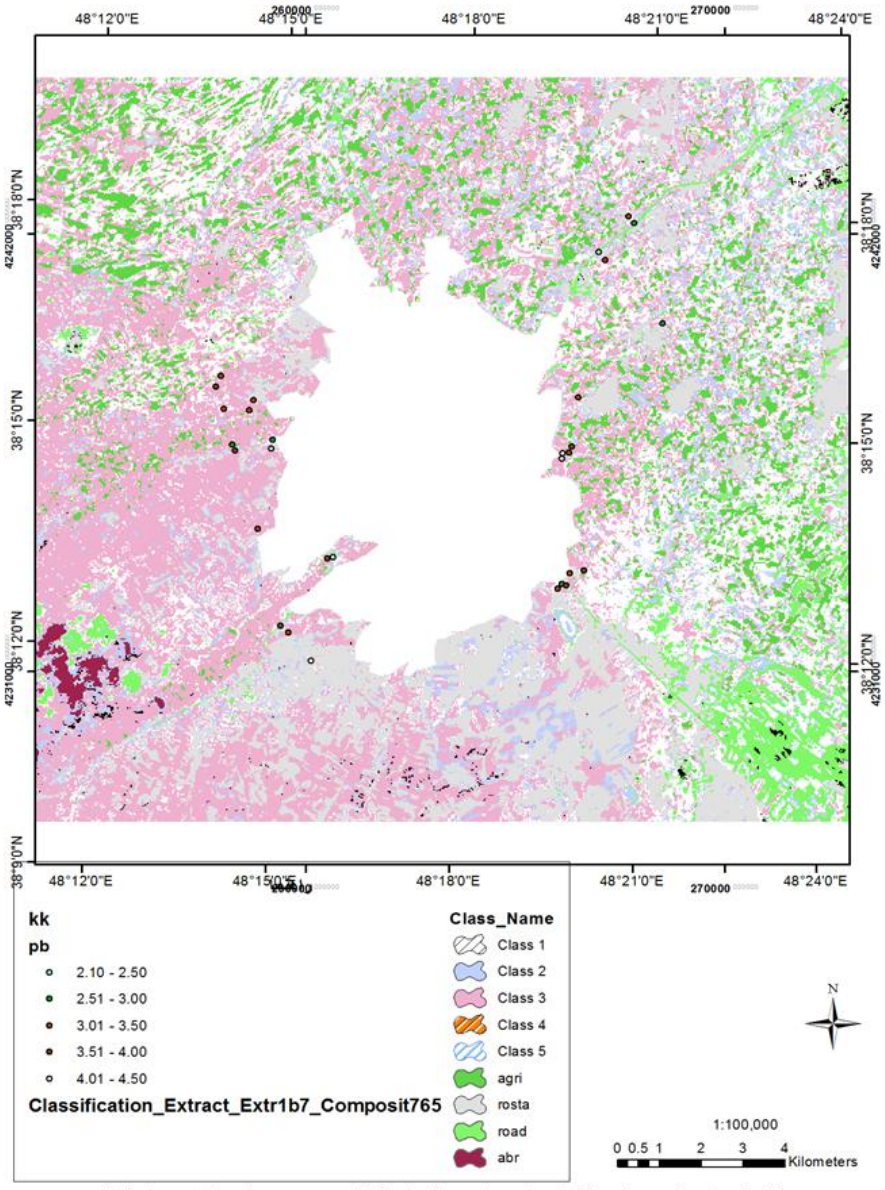
At first satellite images of landset 8 was chosen and then slightly range of Ardabil were choosen and were separated and the preparation steps and location correction with sampling points that had GPS, were done from stretched. And after that the combinations of the band (5, 6, 7) and (2, 5, 7) were found. File signature was prepared for classification with supervision which for it's preparation, the sampling points were used. Next by the ML method or the maximum limit, the possibility of classification with supervision on satellite images was done and it's floors were extracted in the images. Because the goal of this research was the measurement of lead in agricultural land, so the other limited users of Ardabil separated from that regions by village, road and cloud classes. And the lead floors separated into particular classes that you can see on the below maps.

The Bands of Images who explain the Satellite Characteristics of Land Set 8

Band 1 is related to the coastline band and air aerosol, and its spectral range is 0.43 to 0.45 micrometer, and its location accuracy is 30 meter. Band 2 is related to blue range of 0.45 to 0.51 micrometer. And its location accuracy is 30 meter. Band 3 is related to the green range and its spectral range is 0.53 to 0.59 micrometer and its location accuracy is 30 meter. Band 4 is related to the red range, and its spectral range is 0.64 to 0.67 micrometer and its location accuracy is 30 meter. Band 5 is near-infrared band and its spectral range is 0.85 to 0.88 and its location accuracy is 30 meter. Band 6 is SWIR 1 band. Its spectral range is 1.57 to 1.65 micrometer, and it's accuracy location is 30 meter. Band 7 is SWIR 2 band. Its spectral range is 2.11 to 2.29 micrometer and its accuracy location is 30 meter. Band 8 is panchromatic band. Its spectral range is 0.50 to 0.68 micrometer. And its accuracy location is 15 meter. Band 9 is circus band. Its spectral range is 1.36 to 1.38 micrometer and its accuracy location is 30 meter. Band 10 is thermal and infrared band. Its spectral range is 10.60 to 11.19 micrometer, and its accuracy location is 100 meter. Band 11 is infrared band. Its spectral range is 11.50 to 12.51 micrometer, and its accuracy location is 100 meter.

Table 1: With the temperature images which explain the satellite characteristics of land set 8

The cell dimension of images	Wavelength(micrometer)	The name of the band
30	0.43 – 0.45	Band 1 - Coastal aerosol
30	0.45 – 0.51	Band 2 – Blue
30	0.53 – 0.59	Band 3 – Green
30	0.64 – 0.67	Band 4 – Red
30	0.85 – 0.88	Band 5 - Near Infrared (NIR)
30	1.57 – 1.65	Band 6 - SWIR 1
30	2.11 – 2.29	Band 7 - SWIR 2
15	0.50 – 0.68	Band 8 – Panchromatic
30	1.36 – 1.38	Band 9 – Cirrus
100	10.60 – 11.19	Band 10 - Thermal Infrared (TIRS) 1
100	11.50 – 12.51	Band 11 - Thermal Infrared (TIRS) 2

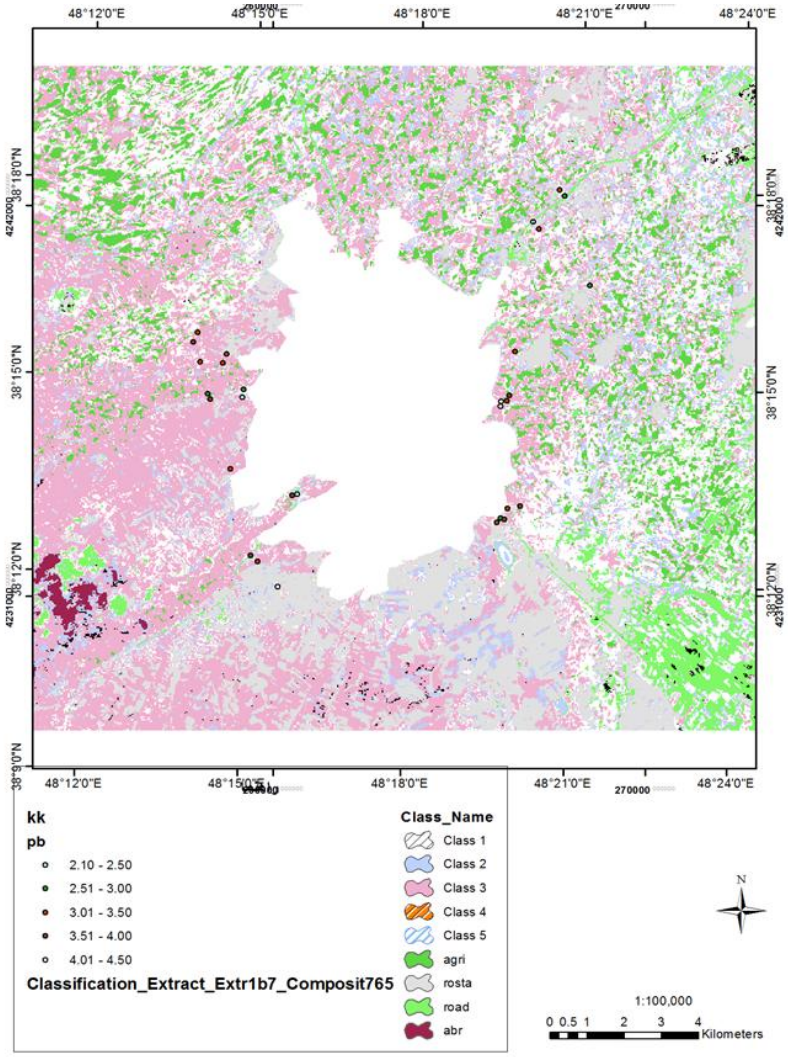


Picture 2: The consolidated output of the bands 2, 5, 7

Table 2: The space of the classes which have made from the band (2, 5, 7)

Number	The number of the class	Space
1	Class 1 of lead	46.76
2	Class 2 of lead	905.8
3	Class 3 of lead	20682.56
4	Class 4 of lead	853.49
5	Class 5 of lead	0.42
6	agriculture	2922.68
7	village	6804.62
8	road	317.72
9	Cloud cover	262.67

The output of the band 2,5,7, show the classification of lead level in the soil which is near the Ardabil and also the classification of the soil of the region, to find the level of the lead, agriculture, village, road and cloud cover. So that the most quantity of lead with 4.5 ppm is related to the places which are near to Ardabil. And the least quantity is related to the points which are far from Ardabil. And also the most space which is classified is related to class3 which is pink and it has been shown at the picture.



Picture 3: The consolidated output of the bands 5, 6, 7

Table 3: The space of the classes which have made from the band combination of 5, 6, 7

Number	The number of the class	Space
1	Class 1 of lead	112.57
2	Class 2 of lead	2907.57
3	Class 3 of lead	11628.11
4	Class 4 of lead	5833.39
5	Class 5 of lead	1775.48
6	agriculture	2995.62
7	village	5343.76
8	road	1989.49
9	Cloud cover	204.01

The output of band 5, 6, 7 show the classification of the lead level in the soil which are near the Ardabil, and also the classification of the soil of the region to find the level of lead, agriculture, road and cloud cover. So the most quantity of lead is 4.5 PPM which is related to the places that are near the Ardabil. And the least quantity is related to the points which are far from Ardabil. And also the most space which is classified is related to class3 which is violet and it has been shown at the picture.

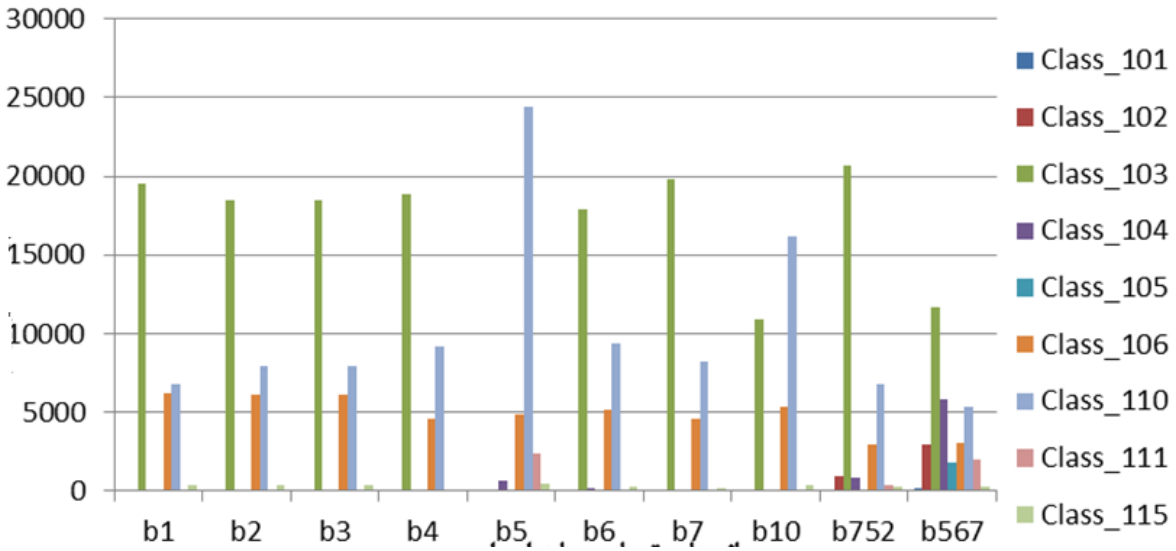


Diagram 1: The comparison of the spaces for the different lead floors in each satellite image band

Band 1: totally in band 1, 4 classes have classified, which include: 1. Class 3 which is related to the lead. 2. Class 6 which is related to agriculture. 3. Class 7 which is related to village. 4. Class 9 which is related to the cloud water. Between these classes, class 3 which is related to the quantity of lead, shows the most space with green color, and the least space is related to the class 9 which is related to the cloud cover, shows the least space with light green.
Band 2: totally in band 2, 4 classes have classified, which include: 1. Class 3 which is related to the lead. 2. Class 6 which is related to agriculture. 3. Class 7 which is related to village. 4. Class 9 which is related to the cloud water. Between these classes, class 3 which is related to the quantity of lead, shows the most space with green color, and the least space is related to the class 9 which is related to the cloud cover, shows the least space with light green.
Band 3: totally in band 3, 4 classes have classified, which include: 1. Class 3 which is related to the lead. 2. Class 6 which is related to agriculture. 3. Class 7 which is related to village. 4. Class 9 which is related to the cloud water. Between these classes, class 3 which is related to the quantity of lead, shows the most space with green color, and the least space is related to the class 9 which is related to the cloud cover, shows the least space with light green.
Band 4: totally in band 4, , 3 classes have classified, which include:1. Class 3 which is related to the lead. 2. Class 6 which is related to agriculture. 3. Class 7 which is related to village. Between these classes, class 3 which is related to the quantity of lead, shows the most space with green color, and the least space is related to the class 6 which is related to the agriculture, shows the least space with brown.
Band 5: totally in band 5, 5 classes have classified, which include: 1. Class 4 which is related to the lead. 2. Class 6 which is related to agriculture. 3. Class 7 which is related to village.4. Class 8 which is related to the road. 5. Class 9 which is related to cloud cover. Between these classes, class 7 which is related to the village, shows the most space with blue color, and the least space is related to the class 9 which is related to the cloud cover, shows the least space with light green.
Band 6: totally in band 6, 5 classes have classified, which include:1. Class 3 which is related to the lead. 2. Class 4 which is related to the lead.3. Class 6 which is related to agriculture.4.Class 7 which is related

to village. 5. Class 9 which is related to cloud cover. Between these classes, class 3 which is related to the lead, shows the most space with green color, and the least space is related to the class 4 which is related to the lead, shows the least space with navy.

Band 7: totally in band 7, 4 classes have classified, which include: 1. Class 3 which is related to the lead. 2. Class 6 which is related to agriculture. 3. Class 7 which is related to village. 4. Class 9 which is related to the cloud water. Between these classes, class 3 which is related to the quantity of lead, shows the most space with green color, and the least space is related to the class 9 which is related to the cloud cover, shows the least space with light green.

Band 10: totally in band10, 4 classes have classified, which include:1. Class 3 which is related to the lead. 2. Class 6 which is related to agriculture. 3. Class 7 which is related to village. 4. Class 9 which is related to the cloud water. Between these classes, class 3 which is related to the quantity of lead, shows the most space with green color, and the least space is related to the class 9 which is related to the cloud cover, shows the least space with light green.

The Consolidated Band of 2, 5, 7

Totally in the consolidated band of 2, 5, 7 classes have classified which include: 1. Class 2 which is related to the lead. 2. Class 3 which is related to the lead. 3. Class 4 which is related to the lead. 4. Class 6 which is related to agriculture. 5. Class 7 which is related to the village. 6. Class 8 which is related to the road. 7. Class 9 which is related to cloud cover. Between the classes, class 3 which is related to the lead shows the most space with green color, and class 9 which is related to the cloud cover, shows the least space with light green.

The Consolidated Band of 5, 6, 7

Totally in the consolidated band of 2, 5, 7, 8 classes have classified which include: 1. Class 1 which is related to the lead. 2. Class 2 which is related to the lead. 2. Class 3 which is related to the lead. 3. Class 4 which is related to the lead. 4. Class 6 which is related to agriculture. 5. Class 7 which is related to the village. 6. Class 8 which is related to the road. 7. Class 9 which is related to cloud cover. Between the classes, class 3 which is related to the lead, shows the most space with green color, and class 1 which is related to the lead, shows the least space with blue.

Conclusion

The slightly part was chosen by the satellite land set 8, that was stretched and then the consolidated bands of 2, 5, 7 and 5, 6, 7 were produced. The reason for incorporating these bands is that they can be useful at the zoning of lead density. After that, its floors were extracted from the images by ML method. In all bands, the most space of lead density is related to class 3, with the space of 1734.60, and lest lead density is related to the class 1 with the space of 79.67. And also for the total series of the lead floors, for each band, most of them is related to band 7 with the space of 19844.76 and the least is related to the band 5 with the space of 653.29. Consequently, band 7 has had the best usage for the lead and it was as the first band at all considerate bands.

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