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Mining Activity Impact on Air Quality in Jiu Valley, Romania

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Abstract. In Romania, in Meridional Carphatian Mountain, in the upper basin of river Jiu there is the most important coal field that produce coke coal named Jiu Valley.

The oblong form of this field, surrounding by mountains, has a great importance for climatic feature, because air circulation is made more easy along the Jiu Cerna corridor, following the longitudinal splitting of Meridional Charpatian Mountain and less from north to south through transversal broken of mountain, Banita-Merisor and Surduc Lainici. The mountain are weir against air circulation, hampering its moving. The mountain protection hamper the air refresh in the depression.

Air is polluted by a power station and by mining and coal processing activity with dust. Another pollutants are between legal limits.

Air quality is monitoring in some point that are placed in the most sensitive area. The main issue is to identify the pollutant sources correctly.

Mining activity have a strongly negative air impact because due to dust emissions.

Mining activity air impacts cannot be assess due to another polluting source that superpose their impact over mining impacts.

1. INTRODUCTION

In Romania, in Meridional Carphatian Mountain, in the upper basin of river Jiu there is the most important coal field that produce coke coal named Jiu Valley.

Coal field is placed in a intramountain depression surrounding by four mountain massifs, two of them with high over 2,500 m and one of them was declared Biosphere Reservation. This geographical placement made that in this field air circulation to be disturbed by the relief forms. For this reason the air pollution in area is a very sensitive issue.

2. CLIMATIC CONDITION IN JIU VALLEY

In same characterisation Jiu Valley is considered to be an southern extension of Hateg depression. If in a way this think is true, taking into account the relief feature, the another features makes it very particularly. The Jiu Valley is characterised to be the most specific discontinuity geographic area from Meridional Charpatian mountain.

The oblong form of this field, surrounding by mountains, has a great importance for climatic feature, because air circulation is made more easy along the Jiu Cerna corridor, following the

longitudinal splitting of Meridional Charpatian Mountain and less from north to south through transversal broken of mountain, Banita-Merisor and Surduc Lainici. The mountain are weir against air circulation, hampering its moving. The mountain protection hamper the air refresh in the depression.

In the huge trough between mountain there is one more interesting phenomena: the stagnation and cooling of air slide from hills to the depression ground, named thermal inversion, well-known in all Charpatian depression. Under thermal inversion influence, the lowest temperature are under minus 30°C while at Parang meteorological station the lowest temperature is not exceed minus 24°C. Consequently, the most severe cold but no longer was in the bottom part of depression and no on the hills, that are under the weather air circulation influence. Even if the severe cold there is not on the hills, the number of cold days, with temperature under minus 10°C are greater then bottom of depression. The frosty weather from Petrosani is due to air cooling by radiation (air that is stationed between mountain). By this reason days with white frost or hard frost are even in the may.

Even if by geographical position and altitude the climate should be a submountain one, taking into account the average temperature oh the most hot month (July with an average by 16.7°C) and the year average temperature (6.8°C) the climate may be considered a low altitude mountain one. The submountain climate, characteristic for Sub-Charpatian area, have the July month average temperature greater with 3 ÷ 4°C and the year average greater with 2 ÷ 3°C.

The number of hot days with an average temperature over 10°C is more reduced at Petrosani then in other places that are considered colder, and the summer days , with the temperature over 25°C is about 50 in the central part of Jiu Valley. Through western part, simultaneously with the altitude the number of summer days decreased. The climate character results obviously from thermal amplitudes that is greater than 64°C. The tropical days are in number of 4 ÷ 5 on year, while at north (Deva) and south (Targu Jiu) they are almost 35.

Generally, the climatic data show that it is an excessive feature climate due to great thermal oscillation that in the winter months are over 20°C. This fact proves the same influence of thermal inversion climate due to relief features.

The monthly average temperature evolution in Jiu Valley in comparison with surrounded areas in shown in Figure 1.

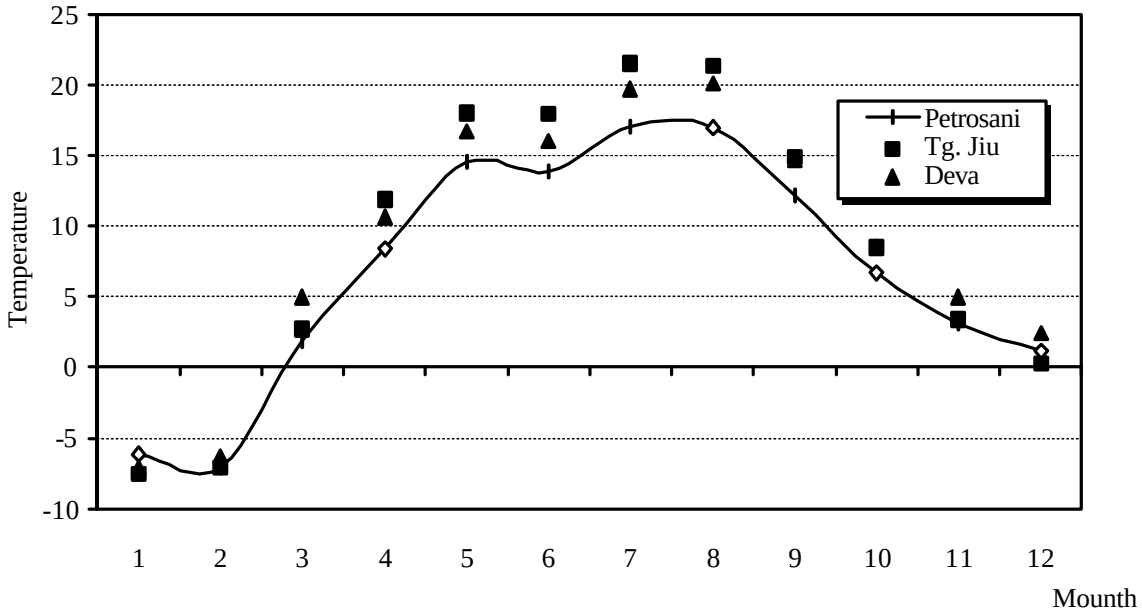

Figure 1 Average temperature evolution in Jiu Valley

Figures 2 and 3 show the evolution of minimal and maximal temperature in Jiu Valley in comparison with the surrounded areas, Deva at north and Targu Jiu at south.

Orographycal conditions influence feel the effects of air current circulation.

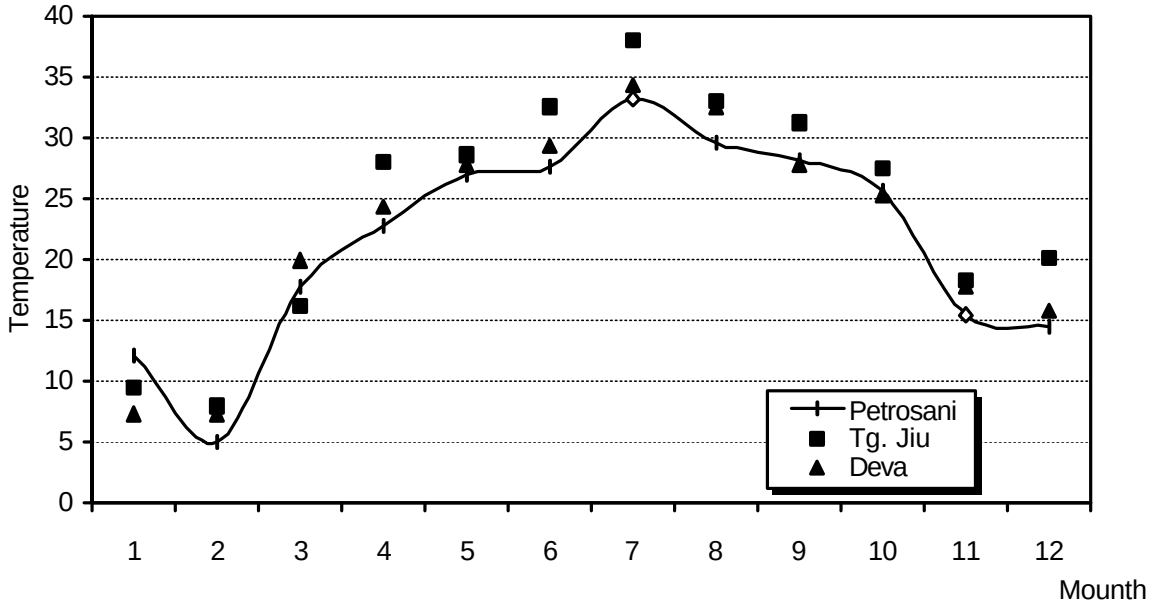

Figure 2. Evolution of maximal temperature in Jiu Valley

The western part of Romania in under western and north-western air circulation influence. However, in Jiu Valley there is a north-south air circulation due to obstacle effect of Retezat and Godeanu Mountain that are hampered the air circulation. Even if the western direction of wind is not common, this winds are the most strongly. The mountain cover make that cold air to be

deposited on the bottom of depression and then there are long period of calmness, especially in January and February (when are 82 ÷ 83% calmly days).

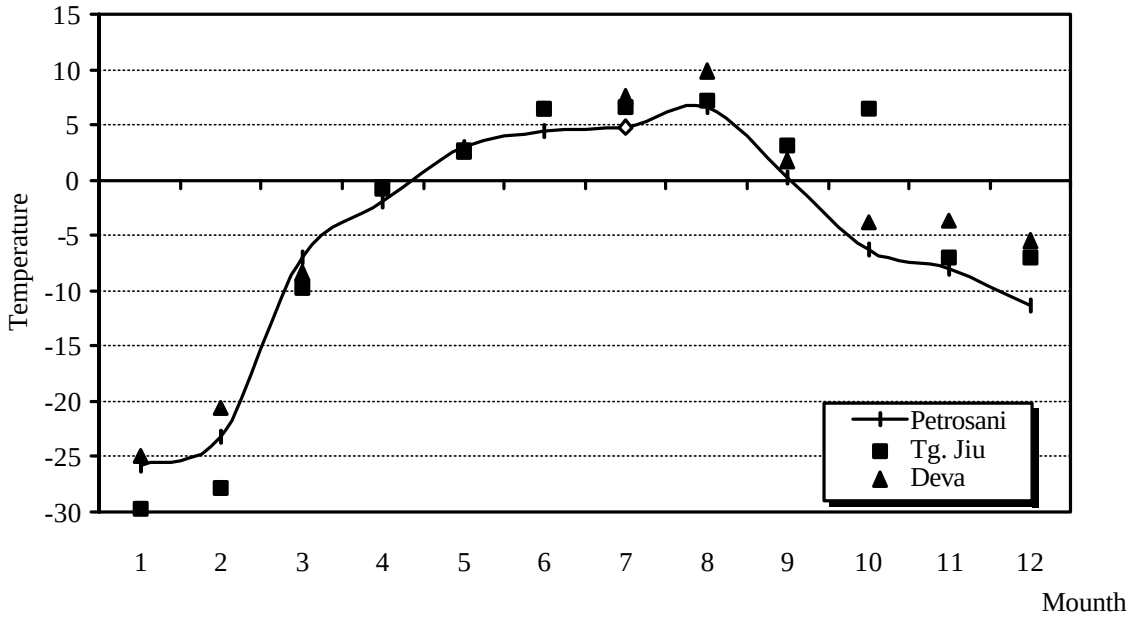

Figure 3. Minimal temperature evolution in Jiu Valley

A local feature is the wind that blew from Jiu canyon, that is a strong and cold wind especially in spring and autumn time. In the summer are north-western winds that bring humidity. Southern wind are not wished because they produced cool in spring and winter and drought in summer.

Flowing the air current along the main valley is a frequent phenomenon, but local. Along of all valleys may be felt the cool mountain breeze. The wind distribution on the main direction is shown in Figure 4

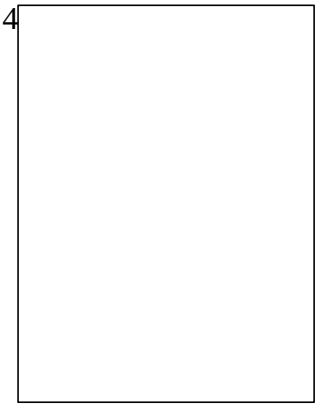

Figure 4. Wind direction distribution

The sheltering and the isolation of area are reflected in the rain year average quantities. In the depression the rainfall are among 700 ÷ 800 mm in comparison with the mountain area where are 1000 ÷ 1500 mm. The monthly average of rainfall is shown in Figure 5.

The number of cloudily days is over 200 per year. In the central part of depression, where the industrial activity is more developed and atmosphere is more polluted, the rain are more frequently due to dust and smog particles which are condensation centres. By this reason, in autumn the smog and drizzling rains are more frequently.

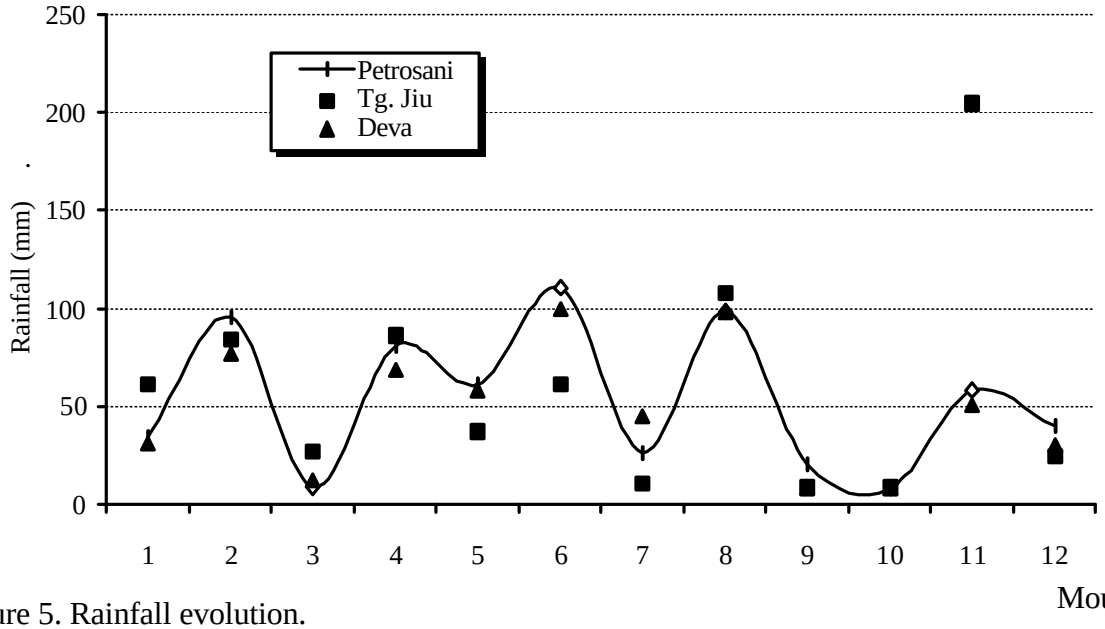

Figure 5. Rainfall evolution.

Many days, even weeks in every morning fog cover all this area . Even if the wind blows the fog, a translucent fog remains almost all year. Only in climatic changes period this fog disappears (march - April) when the air turbulence is maximal.

In conclusion can say that Petrosani area has long winters, but not very cold, short and cool summers with fog and rainfalls, with cool and long autumns.

3. AIR POLLUTION ASSESSMENT

Air is polluted by a power station and by mining and coal processing activity with dust. Another pollutants are between legal limits can see in table no. 1.

Table 1. Air pollutants

No.	Pollutant	U.M.	Legal	Value
1	HCl	mg/m3	0.100	0.000
2	NO2	mg/m3	0.100	0.023
3	SO2	mg/m3	0.250	0.018
4	Suspension particles	mg/m3	0.150	0.101

Air quality is monitoring in some point that are placed in the most sensitive area. The main issue is to identify the pollutant sources correctly. In this chapter are presented the issues that appear in air pollutants sources identification process.

Sedimentable particles in are presented in Figure 6 from an area placed at Paroseni power station and in the surrounding area. Figure 6 shows that air pollution depend on power station dust

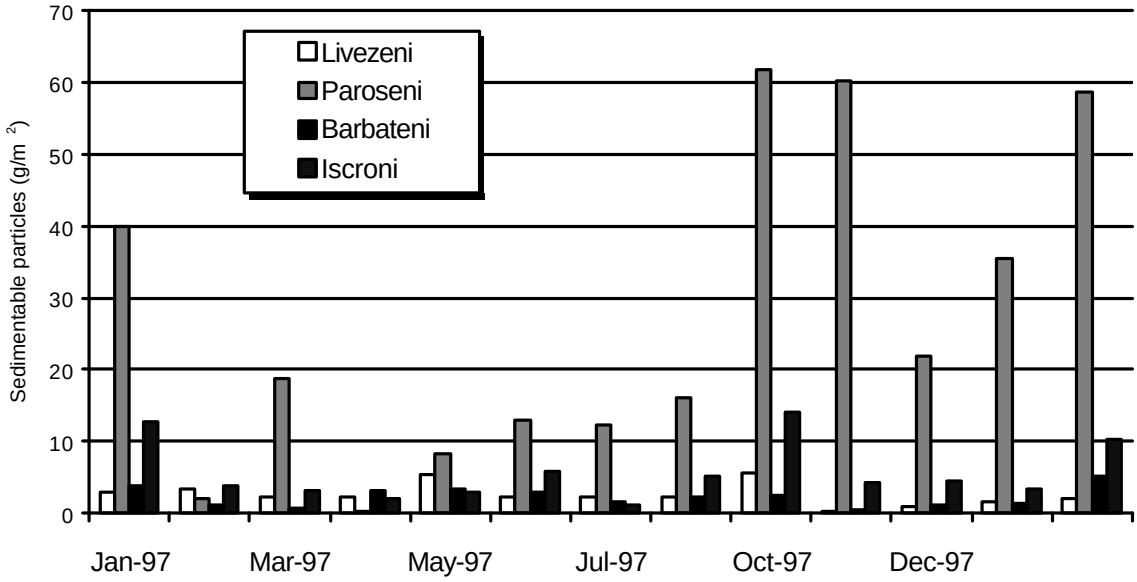

Figure 6. Sedimentable particles in air near Paroseni power station and in surrounding areas.

emission.

To assess what are the pollution sources with dust is interesting to show the daily evolution of suspension particles in air (Fig. 7.).

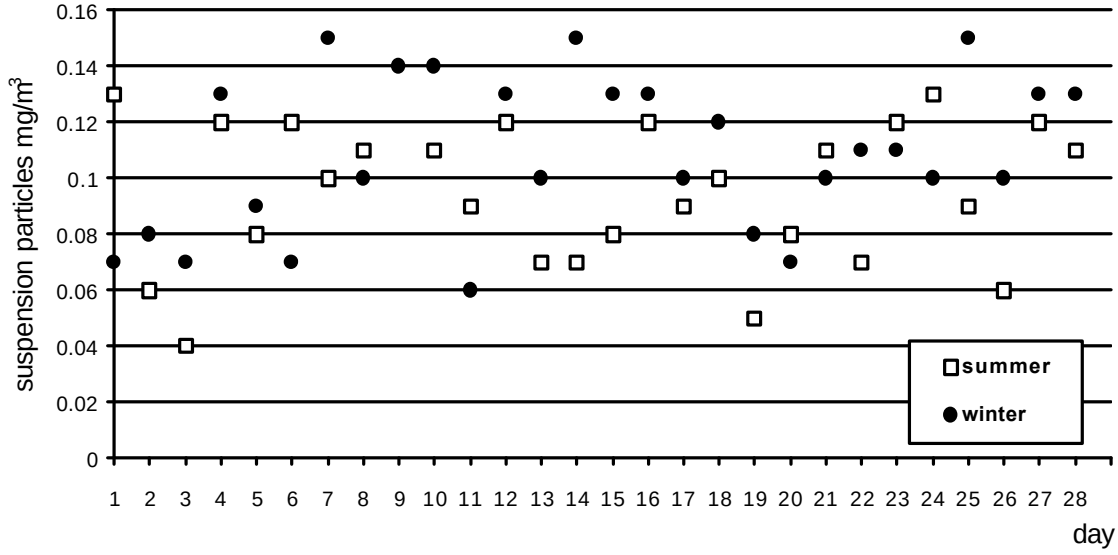

Figure 7. Daily evolution of suspension particles content.

In mining companies Saturday and Sunday are free days so that it was expected that suspension particles in air to be reduced in these days. The fact that suspension particles have not a weekly variation show that air is polluted in a large measure by other companies like power station.

In Figure 8. is shown a comparison between air content in suspension particles in 1997 winter and 1998 winter This figure show that air quality decrease in the last year.

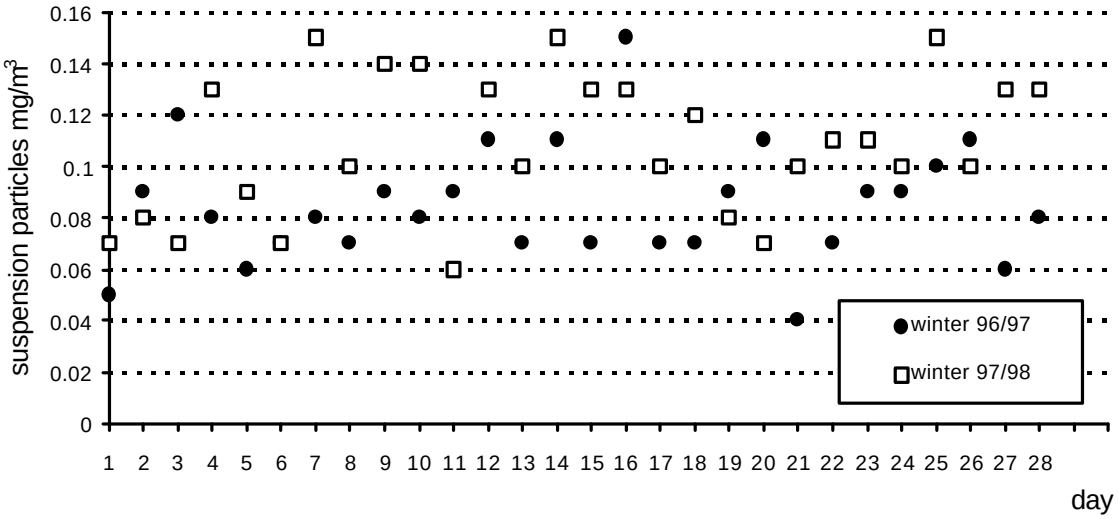

Figure 8. Comparision between air quality in winter 1997 and winter 1998

To assess what are exactly the polluting sources is necessarily to increase the number of places in which air quality is analysed. For example in Table 2 is shown the suspension particles content in air in an area surrounding one chimney. The results show that the chimney is a pollution source that cannot be assess using just established sample points.

Table 2. Suspension particles in air in area surrounding a chimney from a coal processing plant

No	Sample place	Suspension particles $\mu g/m^3$
1.	10 m to chimney	1.15
2.	50 m to chimney	3.10
3.	100 m to chimney	2.45

CONCLUSION

Mining activity have a strongly negative air impact because dust emissions.

The main pollutant sources in Paroseni power station.

Mining activity air impacts cannot be assess due to another polluting source that superpose their impact over mining impacts.

In order to assess every polluting sources impacts is necessarily to increase very much the samples drawing points.

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