Use of Modern Technology for Adapting the Tourist Areas Affected by the Mining Exploitations

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Summary

Monitoring of subsidence phenomenon is an activity that only topographer makes in order to follow the surface movement which cover the surface of the underground mining. The Jiul Valley is a region in which on approximately 53 km were 17 mining perimeters. By preserving some of them and continued exploitation in others, we have to pursuit this phenomenon permanently, because deformation continue even if the mines were closed. A solution for this problem can be the implementation of tourism development and construction that would not be affected by the subsidence phenomenon. The exploitation of underground deposits of useful minerals, create goals, solid state voltage change, causing a change in the balance of tensions surrounding rock. Rebalancing stress causes a series of movements that are felt to the surface area. The study of these influences is necessary to highlight and take appropriate measures for the protection of buildings and underground water that may flood. Findings can be also used in space weather influence surface mined underground in mining basins similar to those already studied. Application of modern technology to research the phenomenon of displacement and deformation of the terrain under the influence of groundwater exploitation leads to good results and a better understanding of the phenomenon. Monitoring of subsidence is a very important activity that takes place both during the mining of the deposit and in case of closure or groundwater conservation. Development of a region involves large investments and can be correlated and integrated tourism by components of the local economy , as long as it takes into account the following aspects, namely that these investments do not affect the future and does not endanger the resource pool it holds.

Keywords: monitoring, subsidence phenomenon, deformation

Introduction

The most important factors of surface deformation are opening dimensions resulting from the operation, operating depth, layer thickness and inclination of useful minerals, mining method and technology applied pressure control mode, geomechanical characteristics of rocks, structure and tectonic ore, etc lifespan.

Depending on these factors, in some cases, massive rock movement occurs only on a certain height without damaging the surface of the ground, however, in most cases this movement is transmitted to the surface affecting it, also causing degradation of civilian objects and industrial.

The main parameters defining dipping bed are:
- Dip angles (βs downstream and upstream γs, δs direction)
- Breaking angles (βr, γr, δr);
- Sinking or vertical displacement (W or S) mm;
- Horizontal displacement (U) mm;
- Specifies the horizontal deformation (ε) mm / m;
- Tilting (T) mm / m;
- Curve (K) m -1.

Need to study the phenomenon of displacement and deformation of the land, has emerged with the development of mining, especially with the passage of the operation predominant surface to underground mining. Moving rock strata covering is a complex process that depends on the properties of rocks and that manifests itself in various forms like: collapse of roof rock live rock strata fall under its own weight the arrow bending, compaction rock mass as a result of the compression of the layers as a result of the pressure pad, the movement of the rock layers for stratification planes.

Movement starts bending rock layers above the stope and collapse of the roof. Moving layers undermined separation occurs in the form of successive layers of the upper and lower their normal bending.

As the advancing stope front, put in motion new doors of package layers undermined. If the operated area is large, the displacement of the mass of rock to the surface. Depending on the degree of disturbance of the rocks above the mined area, we distinguish the following areas in Fig. 2 and Fig. 3.

As a result of groundwater exploitation. On the surface may occur following the degradation of land and buildings:
- detachment base pavements buildings;
- horizontal and vertical to the ground construction;
- cracks in the ground;
- fissures and cracks in plaster;
- non-stick plaster on exterior walls;
- fissures and cracks in the bearing walls and non load-bearing.

The application of modern technology in the phenomenon of subsidence

GPS, Global Positioning System, is a global positioning system based on artificial and satelitte radio. The application of GPS technology to monitor subsidence phenomenon consists in the periodic measurements on parts

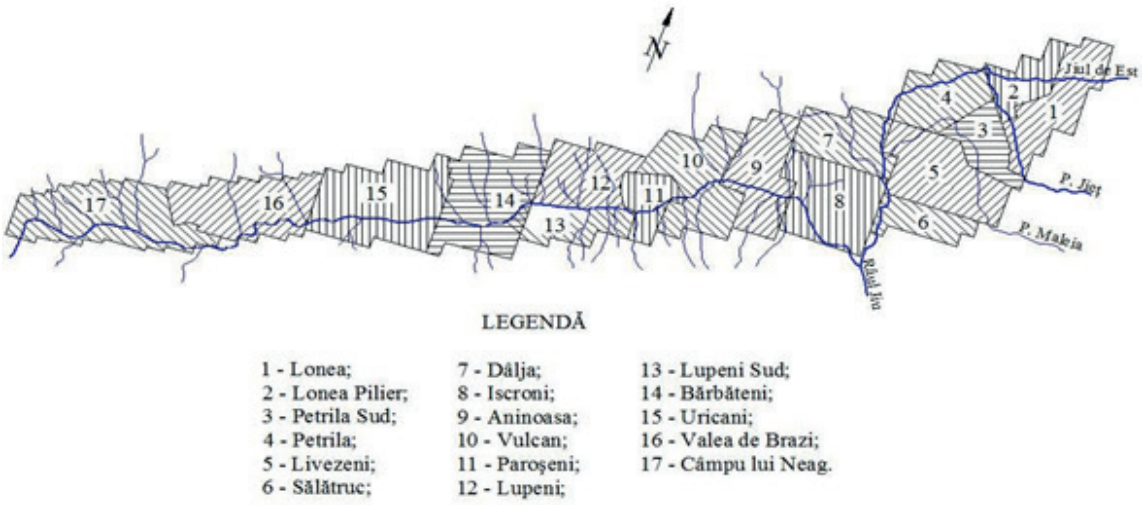

Fig. 1 Jiu Valley coal basin

Rys. 1 Zagłębie węglowe Doliny Jiu

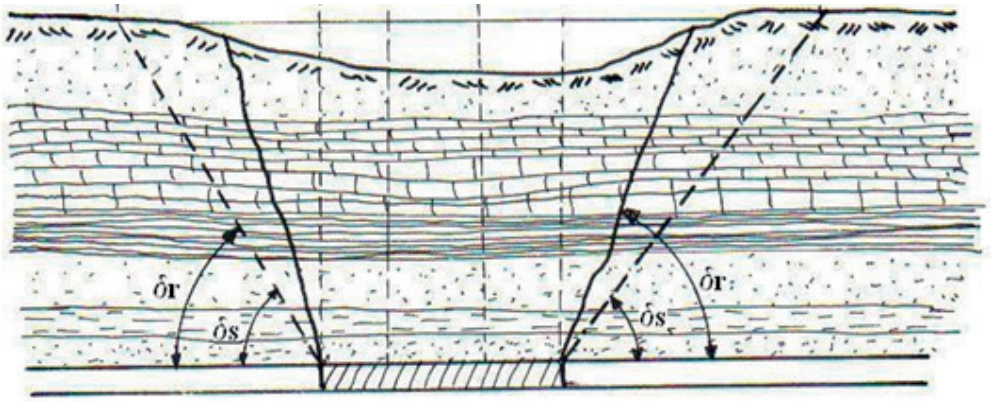

Fig. 2 Massive displacement and deformation of rock under the influence of groundwater exploitation

Rys. 2 Masowe przesuwanie i deformacja skał pod wpływem eksploatacji wód podziemnych

materialized land surface affected by underground mining. There are several measurement techniques, using GPS technology to determine the horizontal and vertical position of the parts, namely: Static Survey Real Time Kinematic (RTK) and Post Processed Kinematic (PPK). The choice of measurement method depends on various factors such as the desired accuracy, the size of the area monitored, the number of marks, density of marks, the number of available receptors, etc.

a. Static survey - or static measurement is characterized in that the GPS receiver, leveled and centered over the item sought, require a long time stationary (1-8 hours) and therefore a large number of observations (Fig. 4). For the method to be effective need more GPS receivers positioned above the track marks, and at least one base point (point stable and known coordinates).

b. Real Time Kinematic (RTK) - or real-time measurement, characterized in that the GPS receiver is mounted on a pole (Fig. 5) to be positioned over each track reference part. The method requires a short residence time on the work piece (a few seconds) and then proceed to the next landmark (stop & go method) .

c. Post Processed Kinematic (PPK) - this method is similar except that the RTK method is no longer used correction signal emitted by radio. Therefore, the method requires further processing of the measurement and correction with correction based receiver.

There are advantages to using GPS technology to track movement and deformation of the surface:

- GPS technology provides the ability to measure both X, Y coordinates of points and share their Z and therefore, while providing information on the vertical and horizontal displacements of points;
- By means of GPS technology are determined coordinates in a reference system desired and well defined, which enables monitoring of displacements and deformations on large tracts of land;
- GPS technology leads to determine the coordinates of the points with an accuracy of a few mm;
- GPS technology can be used continuously, day and night, independent of weather conditions;

There are also disadvantaged to use GPS technology to study the phenomenon of subsidence (sinking), namely:

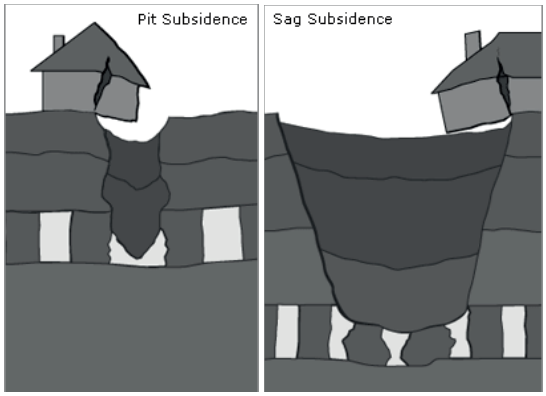

Fig. 3 Examples of degradation

Rys. 3 Przykłady degradacji

Fig. 4 Examples of subsidence

Rys. 4 Przykłady osiadania

Fig. 5 GPS (static and RTK method)

Rys. 5 GPR (statyczne i metodą RTK)

Fig. 6 Highlights constituting alignment tracking

Rys. 6 Najważniejsze punkty obserwacji wyrównania

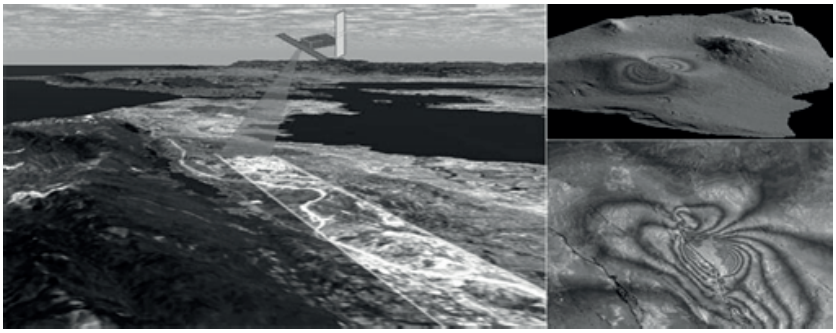

Fig. 7 Radar remote sensing (Stanford)

Rys. 7 Radar teledetekcji (Stanford)

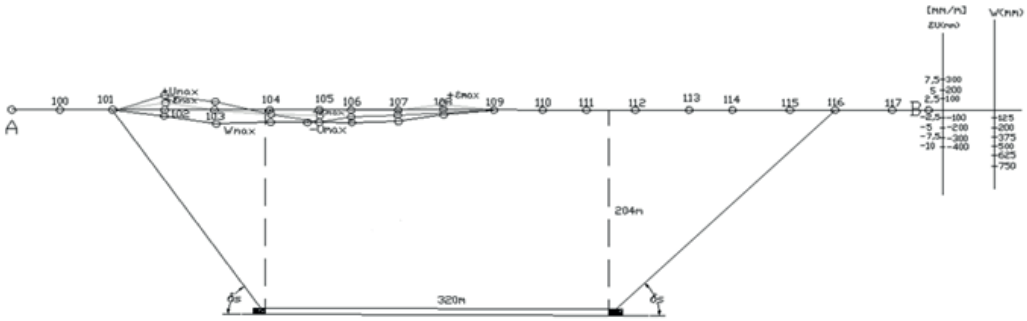

Fig. 8 Representation of diving in the field

Rys. 8 Prezentacja obszaru nurkowania

Fig. 9 Salt pan in Turda

Rys. 9 Turda – złoże soli

Fig. 10 Parâng Slope

Rys. 10 Stok Parâng

- Among the biggest drawbacks of GPS technology as the high cost of purchasing GPS receivers ;
- Another problem would be that, the points to be made observations tracking the movement and deformation field using GPS technology cannot always be set to the desired location. These points cannot be placed near high buildings, trees, etc. under high voltage wires. Because signal from the satellite can be diverted to these obstacles.
- Must be taken into account that, for the detection of ground motion with an accuracy of a few mm is required dual-frequency GPS receivers, personnel, etc. Available only at the scientific level;
- Another problem of the method is that the GPS measurements are restricted to the points , not a continuous space .

To cover this limitation can be applied technology InSAR (Interferometric Synthetic Aperture Radar) which provides a complete spatial coverage, but it is a relative technique that requires a connection to GPS technology.

Estate development opportunities

If we consider the subsidence areas of plains and depressions cart their tourism planning areas involve a number of factors that determine the importance of the area and thus presents as important in terms of tourism planning.
The main element of attraction of these areas is further natural tourist resource with its valences aesthetic, scientific and cultural - educational. This resource is large and varied in form, content and function features can practice area as a first step what we call travel weekend, the fact that it is imposed by the landscape and its components.

We know that subsidence areas, especially those operating are generally avoided the possible investment in tourist facilities, this first element, which is natural resource can be harnessed and promoted with the help of well structured projects with clearly defined objectives and especially since natural resources are always available to everyone and as long as they are well preserved and protected can be an unlimited potential.

Each area has a complex pool of resources and can be represented by its location on the tourist map as follows:
- By producing forests and their wildlife fund , which are popular in terms of tourism , due to their position near the lake surfaces making them also the importance of landscape aesthetics and recreation default function - leisure ;
- The network of waters play an important role in meeting the needs of tourism development and recreation and leisure;
- The existence , where appropriate, natural reserves is a scientific and tourist attraction;
- The potential presence of cultural - and economic history.

If the area has potential and tourist value then can be identified by its components tourist areas can be proposed for development and promotion thereafter. The concept of planning is quite complex and can indicate that this may be taken into account construction of structures for the reception and accommodation vary by specific area because you have to keep a continuous line in terms of authenticity and belonging to the tradition and originality of the area and market requirements, also the construction of structures for food and recreation. All these are made well worth if there is a link between them, so that monitoring of existing infrastructure, development of roads and provision of efficient transport are very important and necessary if you want to arrange a structured complex.

Areas that have received intense underground mining, some of which have completed the activity, such as for example the Jiu Valley, can be integrated in an efficient and productive conservation program for the community to have the program basic idea of sustainable development. It is very important that we all realize today to have a positive effect in the near future and the future generations do not affect in a negative way. As an overview as this subject, I prefer to outline the following ideas as referring to some aspects to be taken into account in setting intensively exploited areas.

Solutions that can be implemented for the area to develop could include greening works intensively exploited areas that affected the environment. Greening and transformation of mines safe public open spaces for visitors.

The role of tourist facilities is significant because it can favour the inclusion of these areas in a tourist circuit, allowing access to tourists in landscaped areas, promote specific forms of tourism and also can be implemented through their educational programs and information on the conservation and environmental protection in the context of the implementation of future projects that will have a major impact on the decision and economic growth of the area, not least in promoting it as a viable tourist area.

Lately this development in tourism sector had a chaotic rise and therefore we need to guarantee that what we achieve in the future for growth and dynamism area automatically involve a form of sustainable tourism as sustainable tourism is an important component in social and economic life of a country. Tourism resources are practically inexhaustible and that tourism is an economic sector perspectives and long-term development plans and whether their management and utilization are accompanied by promoting effective domestic and external then this area can become a source of income.

Conclusions

Diving phenomenon is studied today, and will be studied in the future, whereas it is a topical issue of the protection of the surface construction, engineering, groundwater, communication channels, networks, utilities, land etc.

Follow this phenomenon should be conducted tracking stations topographic measurements to determine the parameters defining the phenomenon of immersion so as to produce a forecast for the future evolution of the phenomenon in order to protect both land and existing buildings in the area .

Proposed future use of modern technologies takeover tracking station observations (GPS) and the use of specific programs for processing the measured variables.

Literatura - References

1. *Popa, Aron, Engineer Handbook, Vol II, Technical Publishing House, Bucharest, 1985*
2. *Herbei, Octavian, Herbei Mihai, Geographic Information Systems. Theoretical and applications. Universitas Publishing House, Petrosani, 2010*
3. *http://www.stanford.edu/group/radar/ -09 martie 2011*
4. *http://www.hoinareala.ro/noutati/salina_turda_din_cluj_se_deschide_pentru_turisti/ -10 march 2011*
5. *http://www.dep.state.pa.us/MSIHomeowners/WhatIsMS.html#9pics -3 March 2011*
6. *http://eco-ist.rs/proceedings%20eco%20ist%2010.pdf -2 March 2011*
7. *http://www.un.org/esa/agenda21/natlinfo/wssd/romania.pdf -2 March 2011*

Wykorzystanie nowoczesnych technologii w celu adaptacji terenów turystycznych dotkniętych eksploatacją wydobywczą

Obserwacja zjawiska osiadania jest aktywnością, którą topograf wykonuje w celu zaobserwowania ruchów powierzchni, która pokrywa powierzchnię kopalni podziemnych. Dolina Jiul jest regionem, w którym na w przybliżeniu 53 km znajdowało się 17 obwodów górniczych. Zabezpieczając niektóre z nich i kontynuując eksploatację w innych, musimy stale podążać za tym zjawiskiem, ponieważ deformacja jest kontynuowana nawet jeśli kopalnie zostały zamknięte. Rozwiązaniem tego problemu może być implementacja rozwoju turystyki i budownictwa, które nie byłoby zagrożone zjawiskiem osiadania. Wykorzystanie podziemnych złóż użytecznych materiałów, stawianie celów, zmiana napięcia ciał stałych, powoduje zmianę równowagi naprężenia otaczających skał. Naprężenia związane z przywróceniem równowagi powodują serię ruchów, które odczuwalne są na powierzchni. Badanie tych wpływów jest niezbędne aby naświetlić i wybrać odpowiednie środki ochrony budynków i wód podziemnych, które mogą wylać. Uzyskane dane mogą również zostać użyte w obszarze atmosfery górniczej, która wpływa na wydobycie podziemne w zagłębiach górniczych podobnych, do tych, które były do tej pory zbadane. Zastosowanie nowoczesnych technologii w badaniu zjawiska przemieszczenia i deformacji tereny pod wpływem eksploatacji wód gruntowych, prowadzi do uzyskania dobrych wyników i lepszego zrozumienia tego zjawiska. Monitorowanie osiadania jest bardzo ważną aktywnością, która ma miejsce zarówno podczas wydobycia depozytu jak również w przypadku zamknięcia lub konserwacji wód gruntowych. Rozwój regionu pociąga za sobą duże inwestycje i może być skorelowany i zintegrowany z rozwojem turystyki z częściami lokalnej gospodarki, tak długo jak brane są pod uwagę następujące aspekty, mianowicie, że te inwestycje nie mają wpływu na przyszłość i nie zagrażają puli zasobów, która je utrzymuje.

Słowa kluczowe: monitoring, zjawisko osiadania , deformacja