

GEOLOGIYA

ENVIRONMENTAL EFFECTS OF MINING COAL IN
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This study focuses on the environmental effects of mining coal from Galandrud region in the Central Alborz of northern Iran. Especial environmental situation in the zone of central Alborz, hard topography and steep slope in the heights and the most important type of sediments that cover the layers of coal causes that mineral efforts for mining of coal have observable or unobservable physical effects in this area that we can considered subsidence, landslide, creating holes and cracks in constructions and building around the mines and destroying effects of metan gas that penetrated from holes.

Introduction

Existence of human on earth basically depends on hidden sources in earth such as water, soil, solid substance such as metals, minerals and even energy that obtained from sources. Human must cancel physical and chemical structures of earth and its natural system to profit by these sources that these effects are called “Environmental Effects”. Sometimes these effects have positive characteristics so that by human efforts, the earth becomes a desirable environment to live and possibility for better use is occurred but sometimes human’s wrong efforts cause confusion in natural systems and by creating changes on surface or underground, they cause irreparable damages for environment and consequently for the inhabitants of this environment [4].

One of this underground’s sources that their mining and usage by human is very old and always is used as a source for fuel, is coal. Coal is one of the primary energy source for many developed and developing countries, although its mining, processing, combustion and postcombustion waste products expedite thermal pollution, particulate release (smog), sulfur emissions, acid rain, greenhouse effect and trace elements emission; it may also cause environmental and human health problems [10, 1 and 7]. Recently scientists have become more interested in the causes of these problems to use of coal more efficiently [9, 12, 2, 11, 3, and 5].

The mining of coal either in the way of underground or open has different environmental effects and influences the environment, air pollution, entrance of mine

goings into environment, repletion of waste substances etc. [13]. These effects are sometimes so destroying that are even able to destroy environment irreparably in a short period of time, and endanger the health of inhabitants around these mines and especially the human.

Generally, environmental effects of mining and use of coal mine in central Alborz can be surveyed in three groups: physical effects, hydrological effects and medical geological effects.

2. Study area

This study focuses on Central Alborz zone (northern Iran). Although the coal deposits of the Central Alborz have been scattered in various points of this zone, the most extended coal beds were seen in Galandrud coalfield. The coal-bearing stratum of Galandrud are located on northern slopes of Alborz mountain range and are as far as 20km south of Rooyan (Alamdeh) town (between $36^{\circ}34'/36^{\circ}40'N$ and $51^{\circ}19'/51^{\circ}56'E$, Fig. 1) in Mazandaran province [15]. Galandrud coalfields with longitudinal extension of about 100 km have deposited at an altitude of more than 1240 m. As a result of the humid climate (average annual rainfall of more than 850 mm) and consequent expansion of forest vegetation in Galandrud region, the coal beds are totally masked by the dense forest.

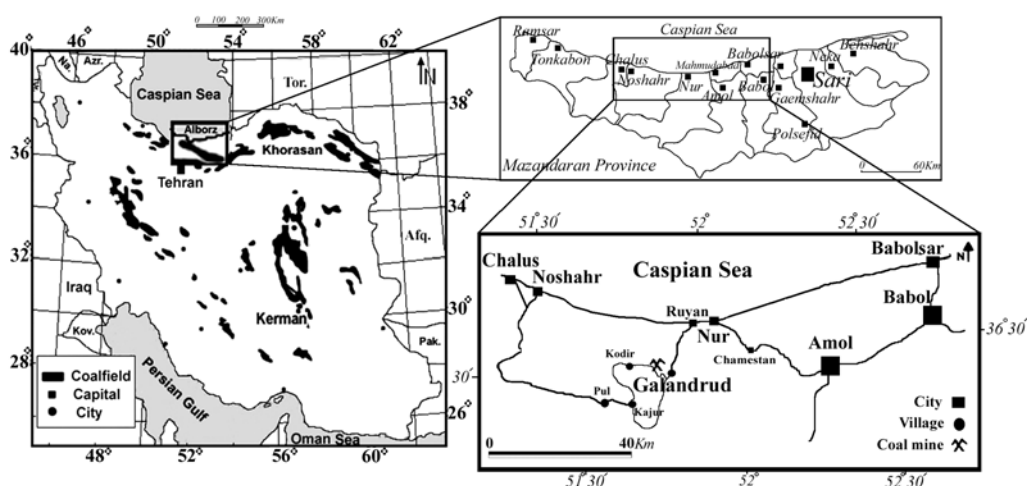


Fig. 1. Location map showing location of Galandrud coals in the Central Alborz, Iran.

3. Results and discussion

Wide extension of Shemshak formation in the central Alborz zone as the sediments in coal beds in Jurassic causes several coal mines in this area. These mines are underground mines and mining of coal from them are often in a traditional way and in some mines such as Galandrud, the mining is done by developed techniques. Especial environmental situation in the zone of central Alborz, hard topography and steep slope in the heights and the most important type of sediments that cover the layers of coal causes that mineral efforts for mining of coal have observable or unobservable environmental effects in this area that we can consider subsidence,

landslide, creating holes and cracks in constructions and building around the mines and destroying effects of metan gas that penetrated from holes.

3.1. Subsidence

Subsidence is the sudden and sometimes gradual subsidence of a part of earth that causes the upper surface of ground, locally and vertically, under the influence of power of gravity, move downward because of the weaken or to be empty the lower layers of earth. The mechanism of this phenomenon depends on the natural and physical processes that this situation is often created by human and human efforts. In areas that coal mining is underground way, when the use of it is not in a right way, the possibility of the phenomenon of subsidence on the surface of earth after the lower beds of earth being empty and without setting of support, are so much [4].

In the central Alborz zone, a type of sedimentary layers that cove the coal beds cause that roof-strata of coal beds often consists of shell, siltstone or sandstone, in fact , more than 50% of the volume of covering stone of this coal beds consist of shel. It causes at the time of usage of coal from the tunnels of mines that there are an extended empty space under the weak argillite layers, these layers that are not so powerful for tolerating the upper layers, especially in deep earth, since there is no column or support for transferring of upper forces, break downward under the influence of the upper layers' forces and by creating wide and extended holes and cracks on the upper layers, as seen on figure 2, extended subsidences are created [8].



Fig.2. The created holes in Glalndrud coalfield.

In the extension and depth of such a subsidence, depth of mining of coal beds, their slope and thickness, nature and thickness of roof-strata of coal beds are the main controlling factors but inspite of these factors, environmental factors such as climates situation of area, type of plants, topography, direct and range of slope of area and the flow of surface and underground water are influencing in extension and aggravation of subsidence in the central Alborz [4], so that in some coal mines exploitation of sedimentary layers that happens so near the surface of earth and slope of sedimentary layers are so much too, subsidence happens suddenly and after a short period of time

after exploitation by creating a hole that has destroyed parts of farm lands and parts of forests.

In the Galandrud mine in the central Alborz zone, exploitation of deep layers of coal is accomplished that sedimentary layers of roof-strata are often argillite. Empty space created by mining of coal in digged tunnels are often released without any kinds of protective factor such as column, but existence of mine in higher heights and espacial topography of area, existence of forest and lack of existence of installations and inhabital areas on upper layers and surface of earth has caused that has not yet occurred sensible subsidence in the lands around the tunnels. Certainly, holes and cracks in upper layers of fine created that existence of plants and forests makes disable to identify it. Subsidence created by mine working efforts may occur at the same time of exploitation but sometimes this phenomenon may start after finishing of these efforts that natural and environmental factors influence on start and extention and aggravation [4].

3.2. Landslide

One of the environmental factors due to mining of coal from underground mines in the central Alborz that is observable in environment around the mines is landslide. Landslide is called to the movement of giant volume of unstable surface substances on slopes toward the foot of slope under influence of gravity force and is considered one of the morphological factors of mountainous areas that can cause damages for people and financial economical loss [4].

Existence of shell beds in Shemshak formation in the central Alborz on one hand and the damp and rainy climates of area on the other hand, can cause reducing of resistance in the surface of sedimentary layers that composed this formation and make available the landslide, but hard rugosity in sediments of Shemshak under influence of techtonical effects of area and creation of a large synclinal caue change in slopes of sedimentary beds inward. Since in one sequence of sedimentary stones that have slope, if the layers have inward slopes, the foot is more stable and the risk of slide and movement of sedimentary piles reduces [4] so in the coal beds of Shemshak also, the possibility of slide must be low naturally, but existence of coal mines in area and mines efforts and construction of installations for exploitation of mines by creating factors causes landslide on the slope foot of the central Alborz. These factors that with each other cause increasing of forces that cause the layers to move and reducing the resistance cuttings in layers surfaces in Shemshak formation are:

1- Increasing in degree of slope angle of foot because of construction of road for access to mine and transportation of exploited coal: the most common factor in increasing motor forces and reducing resistance forces slopes is road constructions that at the time of road construction, foot of slope is cut and extent of slope increases, so the influence of motor forces on it increases that causes unstable substances of surface move downward [4]. In spite of this, withdrawal of the substances that provide resistance forces against slide cause these forces are destroyed through the slide surface. This factor increases because of existence of lots of water in the region weather as rain and snow or as surface and underground waters and creates slide that in some areas causes the destruction of roads and creation of holes and cracks in buildings (fig. 3).



Fig. 3. The cracks have been created in Galandrud road.

2- Increasing of water pressure intermolecules in substance that are on slope especially through probably slide surface: this is the most important factor for landslide under influence of exploitation from coal mines in the central Alborz and shows near relation between landslide with low deep with the flow of destroying substances of Shemshak formation in the fluid from and hard raining of height of the central Alborz.

In the coal sediments of Shemshak formation especially roof-strata and floor-strata of coal, the most volume of holes intermolecules occupied by gas such as metan and some space occupied by fluid. In such situation, if there is a force on the slope, because of more compression characteristic of gas than fluid, layers can tolerate the pressure and there will be no slide. But by exploitation of coal in mine, amount of this gas is released and water takes its place. In this situation sedimentary beds especially argillite layers of roof-strata of coal beds transfer the force to the water of intramolecules, then this force will increase, friction will reduced and landslide will happen both in the tunnels and in the lands around the mine tunnels.

3- Destroying of plants and cutting the forest's trees because of mine working efforts and making installations: considering the area of the central Alborz is mountainous, existence of rather more slope is one of the efficient cause in landslide in the region. Destroying the plant covering in this area especially cutting the trees, increases the sleep of the landslide because the roots of plants especially trees act such as dust protective and by destroying it, erosion increase and layers of dust will be weak and possibility of slide increases.

4- Situational shocks, shakes and stroke that have forces on earth by construction machines or shaking waves by exploitation and mining of coal [4] companied by other mentioned factors, is considered as a aggrated factor in the landslide phenomenon in the central Alborz.

5- Exiting of gas metan from holes and cracks created on upper surface of earth: one of the environmental effects of coal mining from underground mines and in fact

one of the dangers of subsidence phenomenon by exploitation of coal that is considered rarely, is exiting of gas metan from holes and cracks and breaknesses created by subsidence in surface layers of earth. The coal mines are an important anthropogenic source for creating gas metan. If the volume of produced metan inside the mine tunnels is high, the reason is that high force in closed space of tunnels, metan has away by cracks and holes in upper layers of tunnels toward the surface of earth and sometimes cause hard explosion on the surface of earth, like the explosion that happened in coalfield Dontez in Russia [8].

In the area of the central Alborz, however because of low resistance of stone coverings of coal beds in upper layers of lots of coal mines, crack and holes has created, but exiting of gas was not so high that cause an explosion.

The influence that exiting of gas metan from crack and holes has an upper part of tunnels of coal mines in the central Alborz environment is increasing the temperature of the region. Considering the hotness created by existence of metan in atmosphere is 23 times more than carbon dioxide and however the time of survival of metan in atmosphere considering carbon dioxide that is 50-200 years, is shorter and is almost 12 years. It is proven that increasing the percent of metan influences on the composition of atmosphere the global changes of climate and on the increasing of global hotness [6].

Increasing of environment hotness in the central Alborz under influence of increasing of metan in atmosphere and other natural factors cause fast melting of snow in heights of the area and the range of moisture increase so considering statistics of recent 25 years in aerology by the climatology base of Chamestan of the central Alborz shows the increasing in rain, evaporation, temperature and also percent of moisture and reducing of the numbers of freezing-weather days during recent three decades [6]. Reducing of freezing-weather days during recent 25 years causes that in cold months of year, the extent of erosion of stones covering the mine working area increases.

The landslide that occurred in the sediments of Shemshak formation in the central Alborz is more rotational. In this type of landslide, the surface of slide is curative and often his spoon shape that happen often because of water of interamolecules and under influence of hard raining (fig.4). Topography is the controller factor in extension and intensity of earth slide in central Alborz especially in Galandrud area because the deepest part of mine is in the place higher than surrounded lands.



Fig. 4. Landslide in Galandrud coals mine.

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MƏRKƏZİ ALBORZUN KÖMÜR MƏDƏNLƏRİNİN İSTİSMARI ZAMANI YARANAN EKOLOJİ PROBLEMLƏR (ŞİMALİ İRAN)

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XÜLASƏ

Məqalədə İranın şimalındakı Mərkəzi Alborz zonasının Gələndrud rayonunun kömür mədənlərinin istismarı zamanı yaranan ekoloji problemlər tədqiq edilib. Mərkəzi Alborz zonasında xüsusi ekoloji vəziyyət, sərt topoqrafiya, meyillilik və çöküntülərin boş vəziyyətdə çökməsinə, kömür mədənlərinin mühitində önəmli fiziki problemlərə, o cümlədən torpağın sürüşməsinə, yağanların və çatların yaranmasına səbəb olmuşdur.

ЭКОЛОГИЧЕСКИЕ ПОСЛЕДСТВИЯ ПРИ РАЗРАБОТКЕ УГОЛЬНЫХ МЕСТОРОЖДЕНИЙ ЦЕНТРАЛЬНОГО ЭЛЬБОРСА (СЕВЕРНЫЙ ИРАН)

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РЕЗЮМЕ

Рассматриваются экологические последствия добычи угля на угольных месторождениях Центрального Эльборса. Особая экологическая ситуация в зоне Центрального Эльборса, резкий рельеф и крутые склоны на высотах, привели к погружению осадков, что, в свою очередь, явилось следствием важных геолого-технических проблем, таких как оползни, возникновение балок и т.д..