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Tertiary Coal of North Eastern Part of India and Environment – An Overview

Manabendra Nath[1]* and Sarbasri Nath[2]

[1]Department of Geology, Gurucharan University, Silchar-788004, Assam
[2]Department of Chemistry, Gurucharan University, Silchar-788004, Assam
*Correspondence for materials should be addressed to MN (email: dr.manabendra.nath@gmail.com)

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Abstract

The mining of coal in Assam was initiated in 18th century and continued till date in different ways. Presently, both underground and opencast mining are in operation. In an opencast mining, waster rocks and mine tailings are dumped as overburden (OB) in the back fills or strips. The site becomes an eyesore desert. The North East coal also bears high sulphur of 2% to 11% and is highly acidic (pH 2.0- 3.0). Acid mine drainage (AMD) formation also causes environmental damage. For primary succession in such an adverse environment, a minimum period of 25 to 30 years is essential, which changes the topography and ecology. Many works at the regional, national and global levels are taken up to restore the environment and mining.

Keywords: Mining; Acid mine drainage; Overburden; Environment; Tertiary Coal

Introduction

The development coalfields of Assam, initiated by Dr. John Berry White, a Civil Surgeon and Mr. George Turner a Mining Engineer, can be traced back to 1870 (Akala, 1995) and is presently operated in the name of North Eastern Coal Fields, Coal India Limited (NECF, CIL), Margherita. Detailed exploration under the NECF, CIL is being done in Makum, Namchik-Namphuk, Dilli-Jeypore, Borjan, West Darrangiri, Langrin and Bapung Coal fields (Akala, 1995). Approximately 0.982 billion tones of reserves were estimated in these coal bearing regions, which is 0.5% of the country's total reserve of about 200 billion tones. The generation of mine tailings in an opencast mine as waste rocks to coal is approximately 1:14. The environmental degradation as a result of the dumping of mine tailings materials known as overburden (OB) is enormous (Chaoji, 2002). These materials were dumped in an identified manner in the form of stripping. Ecological succession in such OB dump site spans 25 to 30 years (Deka Boruah, 2002, Cherfas, 1992). According to the recent record of North Eastern Coal Fields, Margherita around 1000 hectares area of overburden (OB) dumping site is being created due to dumping of mine tailings.

It may expand further due to the continuous mining. Medlicott in 1869 and 1874 initiated the coal mining in northeast India (Sarma 2005a,b). For the last few decades the Cenozoic coals in the northeast states of India with their unusual physico-chemical characteristics have been playing an important role in the Indian economy(Baruah 2009, Saikia et.al. 2014a).Coals in northeast India draw special attention due to its unique properties and consequent environmental issues. The coals of northeast India have been studied by number of workers / researcher till now (Singh et.al. 2013, 2018, Mayuri et.al. 2016, Nath et.el. 2021, 2022, 2023, 2024). Their study revealed the north eastern coal contains a high amount of sulfur above 3% and reaching upto 11% to 12 % which is a serious threat to the environment both air, water, land and soil. This paper reviews mainly the environmental impact of coal mining of north eastern region of India.

Environmental awareness

Global awareness regarding the status and issues of the earth's environment was first demonstrated when a general consensus was made between the heads of the developing and developed nations. The United Nations conference on Human Environment 1972 was the landmark initiation on environmental issues where an objective was chosen to make the environmental

awareness. Environmental problems in India were realized in the early eighties of 19th century. Accordingly, Berlin declaration (1991) adopted Berlin Guidelines for mining and Environment. The same has been carry forwarded by the subsequent 1991 Bangkok deliberation on Environment Management for Mining and Mineral Resources Development where it has recommended some strategy. Later the 12th World Mining Congress, held at Delhi in 1991 continued the process of environmental concerns in Mining (Chaoji, 2002).

Prominent Coalfields of North-Eastern Parts of India

Assam

1. Makum coalfield
2. Dilli-Jeypore coalfield

Arunachal Pradesh

1. Namchik-Namphuk coalfield.

Nagaland

1. Borjan coalfield
2. Tiru Valley coalfield.

Meghalaya

1. Bapung coalfield.
2. West Darrangiri Coalfield
3. Langrin coalfield
4. Lakadong coalfields
5. Khasi Hills coalfields.
6. Lumshnong coalfields.
7. Roongrenggiri coalfields.
8. Gondwana coalfields
9. Cherrapungee-Mawkma-Laitrynhew coalfields.

Global Scenario

The myriad human activity on the verse of human explosion caused grave damage to the earth's climate. It is predicted that the temperature of earth surface will also increase by 10C to 3.50C within next century (Chaoji, 2002). Warming of this magnitude will change environment to different level. On the other hand to coup up the energy needs forced to exploration and encroachment of new mine sites continued. Therefore, the shrinkage of productive land is inevitable. These will further detoriate health and also the submergence of cultivable land will be very costly.

By Kyoto Protocol in 1997 on climate, a treaty has been signed and it has been decided that industrialised countries to cut their aggregate emissions by over 5% below 1990 levels by 2008-12.

Indian Scenario

The recent events of weather, devastating Tsunami, incessant rainfall at Maharashtra, Tamilnadu a window to what the earth may be like with global warming. According to the Chaoji (2002; TERI energy data Directory and Year Book) the fragility of environment can be considered from its eight factor.

(i) India is the world's sixth largest and fastest growing producer of green house gases.
(ii) Delhi, Mumbai and Chennai are the 3 of the World's 10 most populated cities.
(iii) Estimated pollution due to motorized transport in 1997 was 68 times than that in 1947 and particulate matter in air in 60 of 62 cities exceeded world trade organisation guidelines.
(iv) Survey of 22 industralised zones conducted by CPCB revealed that the ground water quality in all these zones was contaminated with heavy metals, chemicals and coliform bacteria and therefore unfit for drinking. River water too in most parts of the country is highly polluted in terms of biochemical oxygen demand and coliform bacteria.
(v) The industrial sector generates about 100 million tones of non-hazardous solid waste and 2 millions tones of hazardous waste annually.
(vi) Carbon dioxide emission from India are over 3% of global equivalent emissions of which about 55% are from the energy sector (road transport, burning of biomass fuels, coal mining and fugitive emission from oil and gas).
(vii) Nearly 23% of Indian animal species have become extinct.
(viii) Over 24000 has of Indian Forest cover is lost every year and 25% of the country's area is under threat of desertification.

From the above consideration it is quite clear that the Indian environmental issues are quite fragile and reach its threshold limit.

Coal mining of North Eastern region and its Environmental implications

The mining of cola in North East India is continued since 1870 and confined to Makum coalfields in Tinsukia District of Assam. Since then, the mining is being continued either in underground and in of opencast by NECF, CIL Margherita. The mining operated under opencast were Tikak and Tirap, while underground were Bargoloi, Ledo and Tipang. Apart from this many coalmines were operated in the neighboring states either in opencast and in underground. The major environmental threat arises due to mining is alteration of vegetation, water pollution, noise pollution, vibrations due to blasting etc. Considering the impact of environment due to coalmining, Central Pollution Control Board (CPCB) has categorized coal mining as red category meaning, it is in top bracket in environmental degradation. A serious threat to environment occurs due to unscientific mining resulting in reduction of forest cover and loss of biodiversity, soil erosion and pollution of air, water and land. In Meghalaya the primitive and unscientific 'rat-hole' method of mining adopted by private operators and related activities have caused large-scale environmental degradation and severe ecosystem destruction. (Swer and Singh 2003, 2004). Some of the conspicuous environmental implications of coal mining in North eastern coal mines of Meghalaya are large scale denudation of forest cover, scarcity of water, air and water pollution, degradation of soil and agricultural lands, land subsidence, haphazard dumping of coal and overburden. (Swer and Singh, 2004). The effect on environment due to coal mining are shown below:

$$2SO_2 + O_2 \rightarrow 2SO_3$$

sulphur dioxide oxygen sulphur trioxide

$$SO_3 + H_2O \rightarrow H_2SO_4$$

sulphur trioxide water sulphuric acid

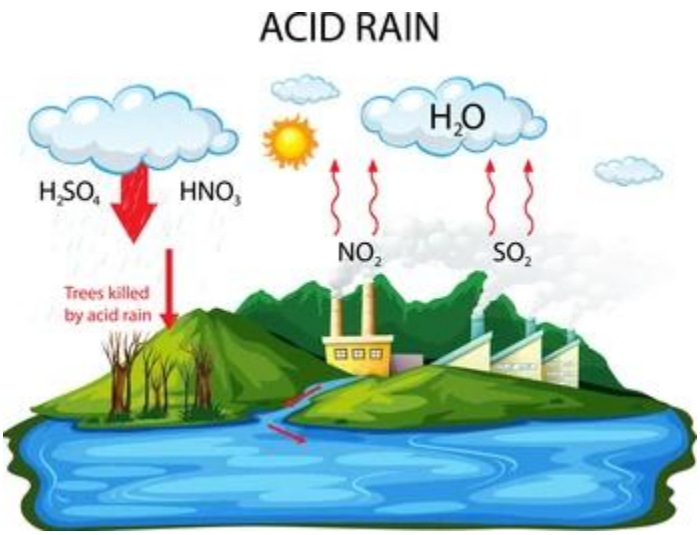

Fig. 1. Impact of coal mining on acid rain formation

Land degradation and vegetation

Coal bearing area in India is spread over about 3.50 million hectare and all the coalfields are located in major river basins. Total land requirement during 10th plan period was assessed at about 539 sq.km. The major collierires of North East India are lying in thick Forest areas. Therefore, to mine in the respective site cleaning of vegetation and forest is inevitable. However, land and ecosystem degradation due to open cast mining is enormous. The alteration of top soils and dumping of mine tailings (generated at a ratio of 1:14) changes the vegetation and topography. Dumping of mine tailings in a specified terrace many eye sore desert has been created in the neighbouring opencast collieries. To re-vegetate such areas a minimum of 25 to 30 years is a minimum gestation period.

Acidic mine Drainage (AMD) Problem : The North East coal bears high sulphur (2% to 11%). Sulphur remain either in the form of elemental sulphur or as pyritic sulphur. During oxidation of sulphur due to the effect of biotic and abiotic factor, the mine effluent became highly acidic (pH 2.0 to 3.0). Therefore, the mine effluent known as acid mine drainage (AMD) when leached out to neighboring low lying areas it degrade the environment. The effects cause havoc when the concentration of mine effluent exceeds its threshold limit.

Air Quality

Air pollution associated mainly with opencast coalmining and in transportation of coal and in handling of mine tailings (OB). These are mainly generation of suspended particulate matters and respirable particulate matters, namely soil particles and occasionally fine grained coal particles. However, no drastic deterioration on air quality was reported in and around coalmine areas (Chaoji, 2002).

Socioeconomic issues: Besides environment, the major hind-range faced due to mining operation is the socioeconomic impact. This is due to acquisition of large areas by coal sector to achieve targeted growth of coal. As we know that most of the collieries are located in the dense vegetation or in occupation by tribal people. Because of establishment of coalmine either the native people were displaced or lose their livelihood or remain scars.

Remedial measures

From the discussion it appears that in general coal deposits were restricted to hills with thick growth of vegetation. For opencast mine, clearing of vegetation and sub soil exposure is inevitable. Moreover dumping of mine tailings in the specified areas also creates new wasteland. The formation of AMD from mine OB and mines is also major environmental concerns. To revive and to remediate AMD both by chemical and biological means were adopted. However, recent investigation shows that bioremediation/ phytoremediation strategy to rejuvenate such mine environmental deterioration is economic and eco-friendly. Bioremediation/phytoremediation is a confluence of biotic and abiotic factors. Considering the grave of environmental pollution, the Government machinery also has given priority on environmental pollution control. In the same line the NECF, CIL Margherita, has made its effort to restore the detoriated environment by carrying out tree plantations, prevention of soil erosion, land reclamation and restoration, effluent treatment and other development activities. However, the measures are not adequate to recloth and restore the denuded environment in the present scenario of mining.

In this context it will be worthwhile to mention that Regional Research Laboratory (RRL), Jorhat (the only National Laboratory of Council of Scientific Industrial Research in entire North Eastern states) taken up many bioremediation and phytoremediation investigation to rejuvenate such mine and industrial pollutants affected land. In an in situ remediation investigation carried out with local support of NECF, CIL Margherita, the Institute has been successful in achieving secondary succession within a span of one and half years.

The Coalfields of North Eastern Region of India are shown in Fig. 2

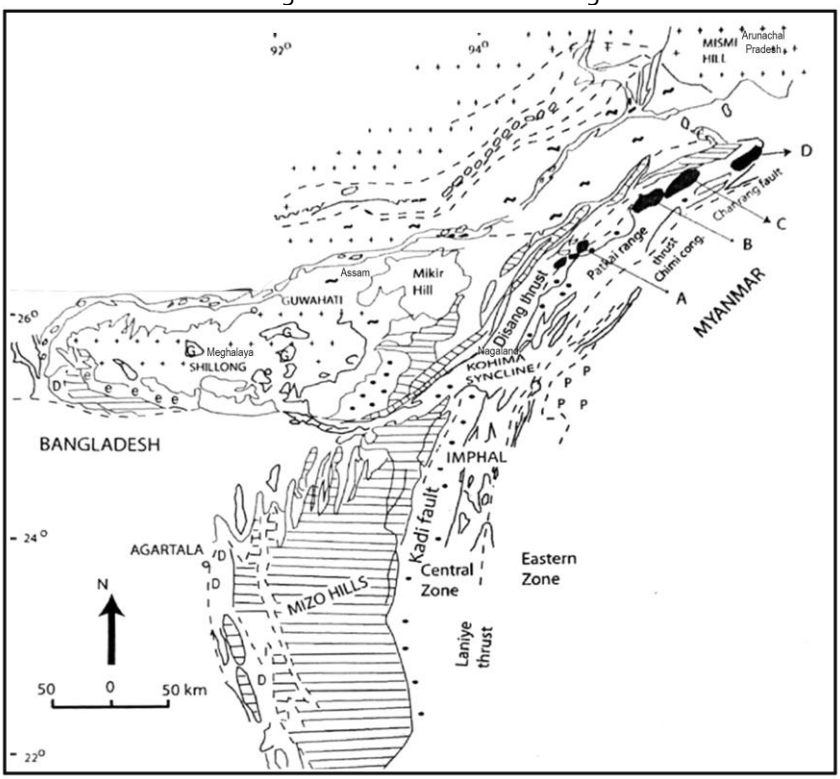

Fig. 2. Coalfields of North Eastern Region of India
(Modified after Nath, 2024)

Conclusion

It is predicted that North Eastern Coal will contribute approximately 5% of the country's total needs. So, it plays a vital role in mitigating the country's energy demands near future. It is also forecasted that the increasing demand of energy sector will be substantiated by coal. As such, the shrinkage of coalmine activity is in doubt. Simultaneously abatement of environmental deterioration also rises in the same patch. Therefore marching together of R&D organizations and the mining industry will be indispensable to restore the environment.

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