

Relentless Mining in Meghalaya, India

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“Environmental sustainability of rural areas in Meghalaya has been marred by indiscriminate exploitations of natural resources, mainly mineral deposits”.

Local people of Meghalaya and migrants from neighboring states and even from Bangladesh have started mining to survive, putting increased pressure on land and water supplies. The mining activities have brought in the desired effect of economic growth but on the other hand, affected the environment in a variety of ways, which contributed to its degradation. The pertinent question that everybody needs to ask: who pays the cost of degradation? Local indigenous people who are not knowledgeable about future disaster are not able to bear the cost. Scientists must speak loudly about the impending disaster of natural resources exploitation to make this knowledge available to others in a form that can impact decision making.



Photograph by K Sarma and SK Barik

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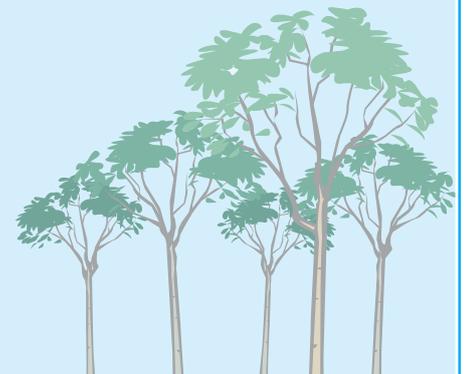
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Meghalaya is rich in large deposits of coal, limestone, gypsum and clay (**Figure 1**), including kaolin, glass, sand, quartz and feldspar. The recent discovery of more than 16,000 tonnes of uranium in the Mahadek basin of Khasi hills puts Meghalaya forefront in the valuable mineral deposits. Coal deposits distributed throughout the state, mainly along the southern fringe of the Shillong plateau (400 km), is believed to have 562.8 million tonnes in 20 deposits. Coal deposits occur as thin seams which range in thickness from 30 cm to 1.5 m in sedimentary rocks, sandstone and shale of the Eocene age (Guha Roy 1991). The total estimated reserve of limestone in the state is about 2462.5 million tonnes which are found in Cherrapunjee and Shella-Bholagang area in Khasi hills (38%), Nongkhlieh and Lumshong in Jaintia hills (55%) and Darrangiri-Era and Anig-Siju in Garo hills (7%) (Tripathi et al. 1996).

Some of the areas where extensive coal, limestone, clay and gypsum mining is going on in Meghalaya are depicted in **Figure1**.

Looking at satellite snapshots showing replacement of forested areas with bare earth, everyone can easily infer that mining industries are driving force of deforestation (**Figure 2**) (Sarma et al. 2010).

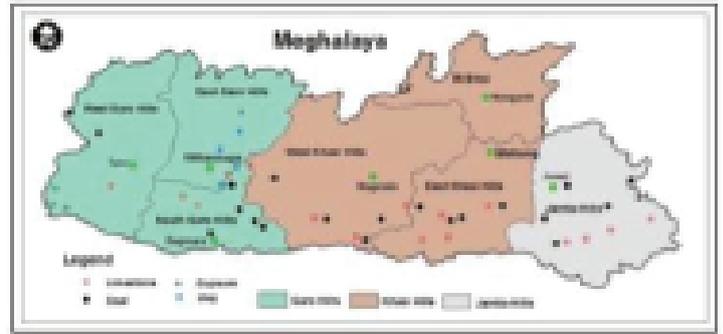


Figure 1: Distribution of minerals in the state of Meghalaya. (source: www.meghalaya.gov.in)

But there is a little space to avert excessive mining since the mining concessions are on control of land owners, who have exclusive rights on land resources as guaranteed under the 6th Schedule of Indian constitution. Permits for mining concessions throughout much of the state are controlled by the customary rights of local indigenous people that are not covered by any mining acts, rules or environmental acts. People are mining with rudimentary technologies to survive that have been causing a large scale damage to the natural systems like land, water, air and vegetation (Sarma 2005).

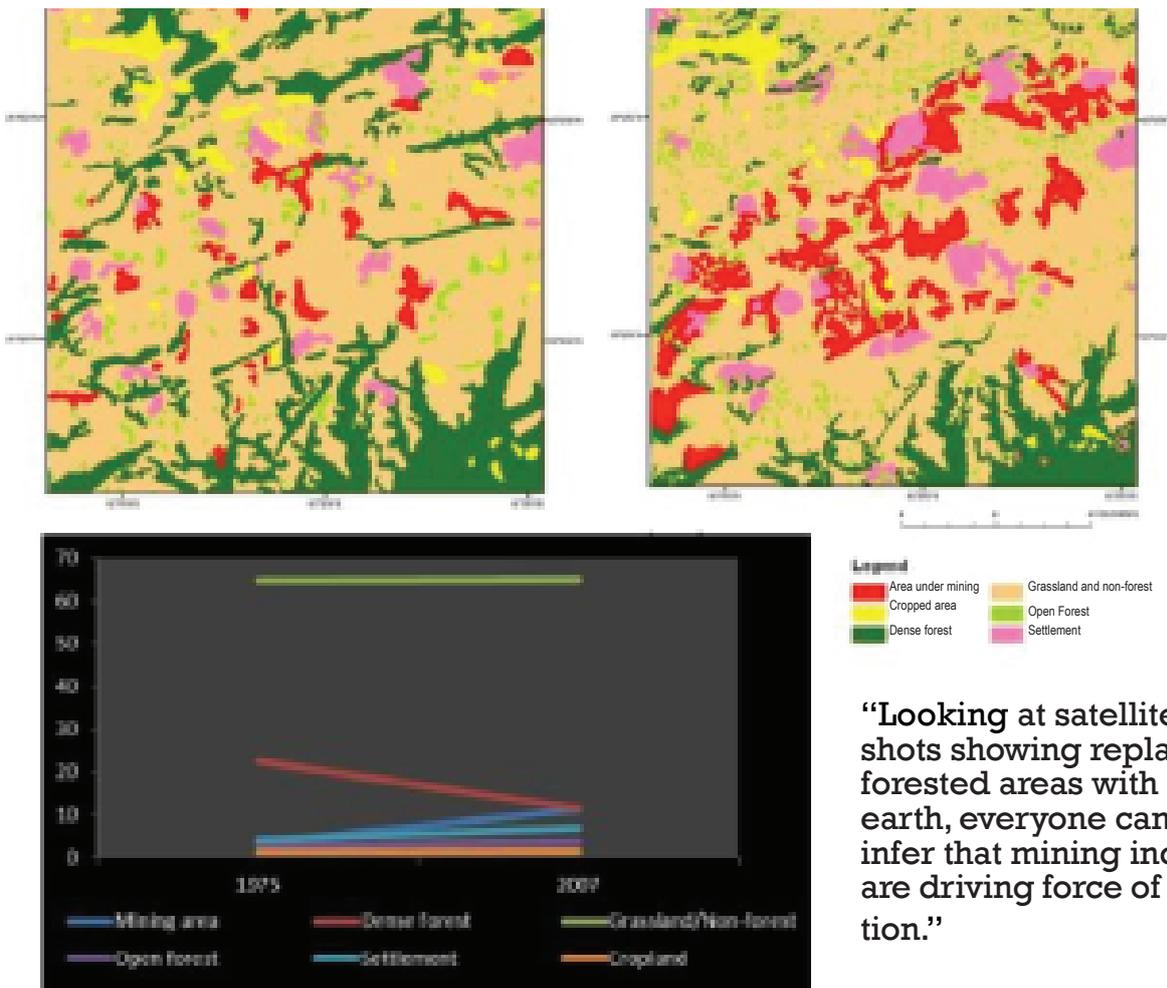


Figure 2: Degradation of forest area (in percentage) during 1977 and 2007 in Jaintia Hills of Meghalaya due to indiscriminate mining activities (Sarma 2010b)

“Looking at satellite snapshots showing replacement of forested areas with bare earth, everyone can easily infer that mining industries are driving force of deforestation.”



Figure 3: A map of Meghalaya (25°47' -26°10'N, 89°45'-92°47'E) (Source: www. meghalaya.gov.in)

This land locked plateau of Meghalaya has a highly dissected and undulating topography, especially in the western and the northern sides (**Figure 3 and 4**). The southern side is characterized by continuous escarpments with steep slopes. The state has a 496 km long international boundary with Bangladesh in the south and west while northern and eastern sides are bordered by the state of Assam. Meghalaya was carved out of Assam as an autonomous state on April 2, 1970 and was declared a full-fledged state of the Indian Union on January 21, 1972. The state of Meghalaya comprises of the Khasi, Garo and Jaintia hills (Sarma 2010a).

To carry out this study data have been collected from an extensive literature review (e.g., research papers, books, journals, reports and theses) aided by site visits of ten different locations representing Garo, Khasi and Jaintia hills



Figure 5: Limestone mine in Cherrapunjee of Khasi hills. (Photograph by PK Yadav)

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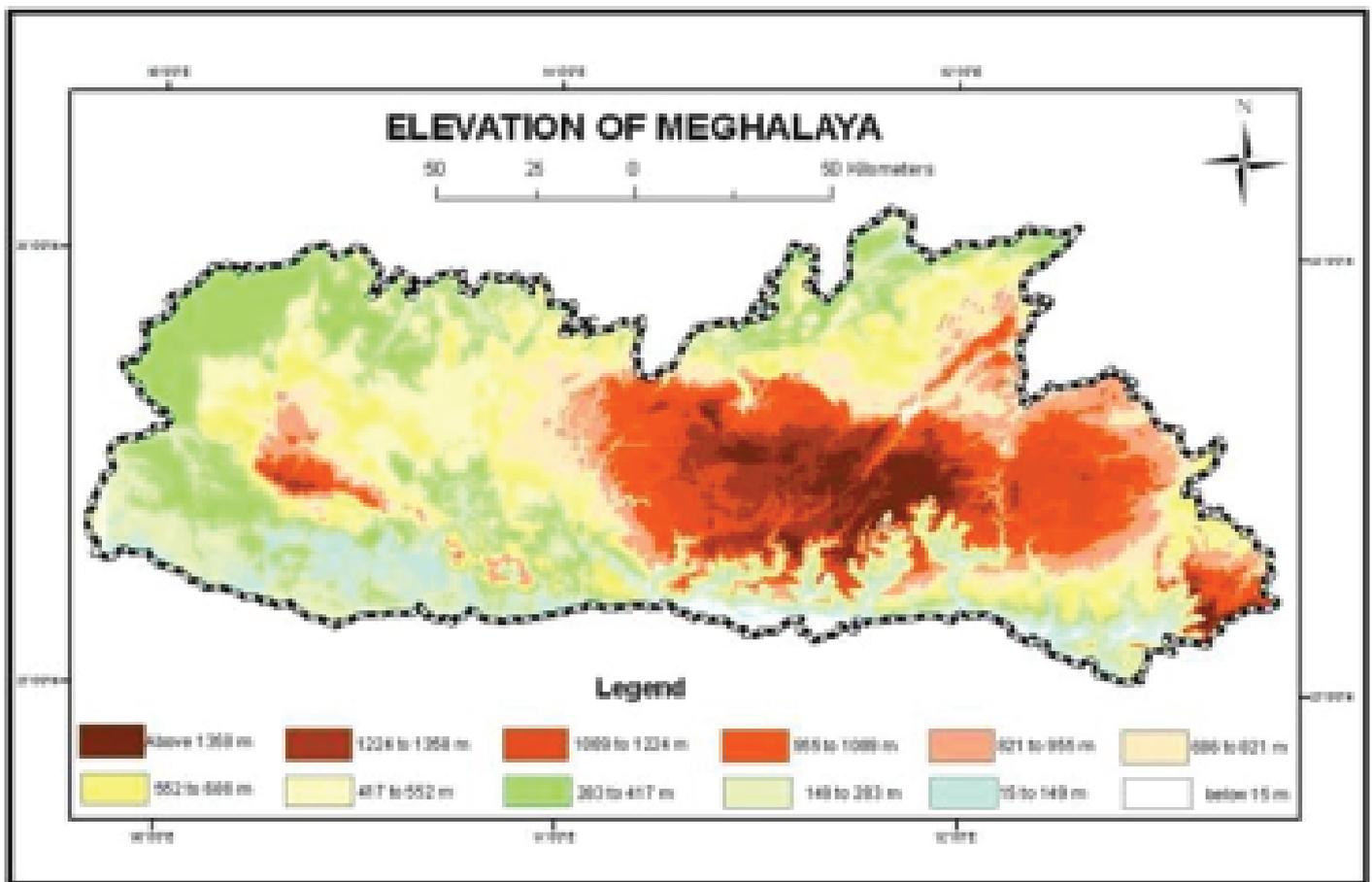


Figure 4: Topographical variations of Meghalaya (Sarma 2010a)



Figure 6: Coal mine in Jaintia hills. (Photograph by PK Yadav)



Figure 7: Stone mine in Garo hills of Meghalaya
(Photograph by PK Yadav)

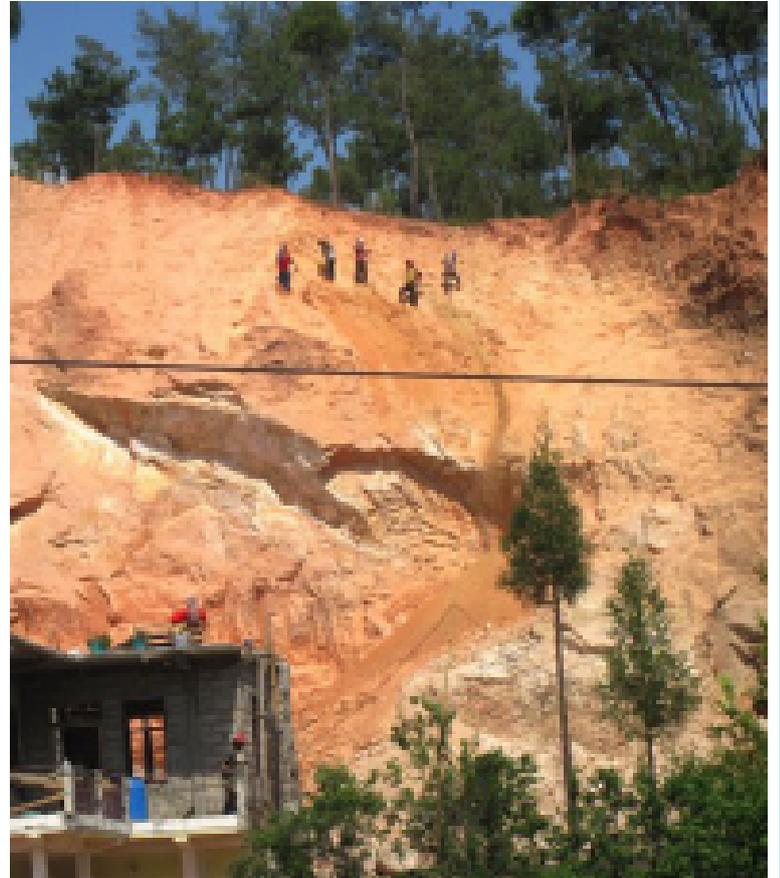


Figure 8: Sand mine in Khasi hills of Meghalaya.
(Photograph by PK Yadav)



Figure 9: Abandoned rat-hole coal mines in Jaintia hills. (Photograph by PK Yadav)

Coal mining is carried out manually by the 'rat-hole' method, which is crude, uneconomical, vulnerable and unscientific (**Figure 9**). This method involves felling tree, digging a pit of 5 to 100 m² till coal seam is reached, making a side way tunnel, and finally extraction of coal from the pit by wheel-barrow. In Garo hills, instead of digging a pit straight, parallel galleries along seam at a short distance from each other are made. The unconsolidated and consolidated materials, which comprise mainly sand and gravels, are brought out manually from the tunnels along with coal. After sorting out, coal is dumped in the adjacent unmined land (Sarma 2010b). Surface mining activities are common for limestone, graphite, stone and sand as well (**Figure 6, 7 and 8**).

During the rainy season, soluble materials from the coal mine get dissolved in the rain water and enter into the nearby streams and the adjoining paddy fields. Soil and water of mining sites usually have high acidity, which affects most of soil chemistry and reduces soil productivity (**Figure 10**). Acidity is measured in pH value and lower the pH value the higher acidity. Pandey et al. (1993) observed as low as 4.0 soil pH (pure water has a pH very close to 7 at 25 °C) in the coal mined areas of Jaintia Hills. Again in another result they explained that the concentration of sulphur in soils of mined areas is as high as 1.5 mg/g which could be considered highly contaminated, while in unmined areas of the district it is recorded 0.02 mg/g. The acid run off from mines dissolves heavy metals such as copper, lead, mercury into the ground or surface water. Thus, in mine sites, water pollution strips soil off its nutrients and deteriorates aquatic environment (Nath 1992).

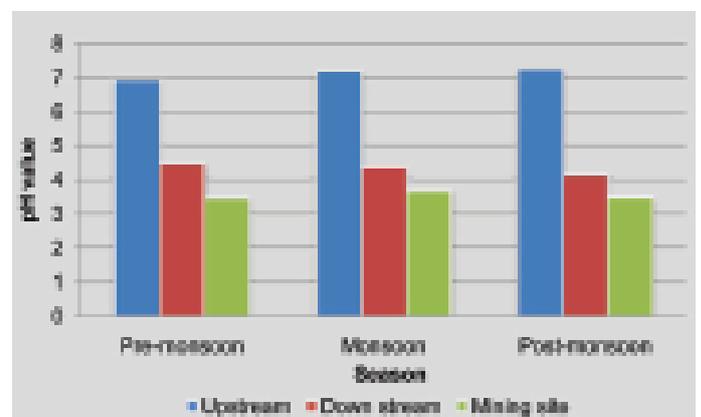


Figure 10: pH of water in different seasons in three different coal mining sites in Garo hills of Meghalaya (After Sharma et al. 2005)

The biggest threats from the small-scale mining don't revolve around felled trees, but land erosion that causes dumping the slurry into waterways, and other damages to land, air and Vegetation

Table 1: Impact of coal mining in the plant species richness in Garo hills of Meghalaya (After Sarma and Barik 2011)

Number of Species	Site-I		Site-II		Site-III	
	Unmined	Mined	Unmined	Mined	Unmined	Mined
Tree	38	25	31	26	44	25
Shrub	5	6	16	13	18	17
Herb	28	33	26	17	18	18

Trees and shrubs are the first to be removed directly during mining (Lyngdoh 1995). Eroding land is unable to support vegetation. A recent study on plant species composition in Garo hills of Meghalaya showed an adverse impact of coal mining in plant species composition (Table 1). Mining activities bring water and air pollution, which results in the loss of top fertile soil (Lyngdoh et al. 1992). Loss of soil productivity and ground vegetation serve as a signal for an imminent transition to a desert state. Furthermore, water soluble heavy metals such as boron, copper, iron, nickel, lead and zinc adversely affects survival, growth and species diversity of soil micro-organisms like: *Aspergillus niger*, *Alternaria alternata*, *Aspergillus flavus*, *Cladosporium herbanum*, *Curvularia lunata*, *Fusarium oxysporum*, *Helminthosporium sp.*, *Mucor hiemalis*, *Penicillium waksman*, *Pythium intermedium*, *Steril mycelia*, *Trichoderma viride*, *Trichoderma harzianum* and *Verticillium alboratum*.

or near the site of work. The area in and around the coal mines invariably remain damp due to mining activity and extremely high rainfall. Because of the work pressure and lack of adequate sanitation facilities, the miners do not keep proper personal hygiene. A study reveals that 77.88% of the workers suffer from one or the other type of sickness. Out of these about 71% have more than one health problems (Figure 11). Similarly, more than fifty percent are found to be suffering from low back pain (Pandey et al. 1993).

“Loss of soil productivity and ground vegetation serve as a signal for an imminent transition to a desert state.”

Table 2: C/N ratio in soil of un-mined and mined areas in Garo hills (After Sarma and Barik 2012)

Depth	Pre-monsoon		Monsoon		Post-monsoon	
	Unmined	Mined	Unmined	Mined	Unmined	Mined
0-10	9.26	4.07	4.04	7.92	3.38	5.89
10-20	15.51	7.59	3.65	3.96	3.10	5.08
20-30	8.46	6.07	3.42	4.87	2.95	6.52

Soil erosion sucks in the figurative sense, it also literally sucks the storehouse of micro and macro nutrients that provide valuable ecological service to humankind. Uma Shankar et al. (1993) reported a change of physico-chemical properties of soil following mining. It inflicts an incalculable damage to the land surface irrespective of the mode of extraction employed. High acidity due to oxidation of iron pyrites (FeS_2) is an important limiting factor for plant growth in the coal mined areas (Chadwick 1973, Doubleday 1974, Caruccio 1975, Armiger et al. 1976, Bennet et al. 1976). The soil carbon to nitrogen (C/N) ratio is drastically reducing day by day due to mining activity undergoing in the state. The impact of mining activity in soil can be recognized upto 30 cm depth (Table 2).

Mining sites are inherently unhealthy places to work. In the mine workers inhale large amount of dust flumes and gases which cause many diseases, which include influenza, asthma, emphysema, stomach and lung cancer and hypertension. Pneumoconiosis and bronchitis together resulted in the death of a large number of people. All of the workers stay in worrying situations; in small makeshift huts at

“Mining sites are inherently unhealthy places to work.”

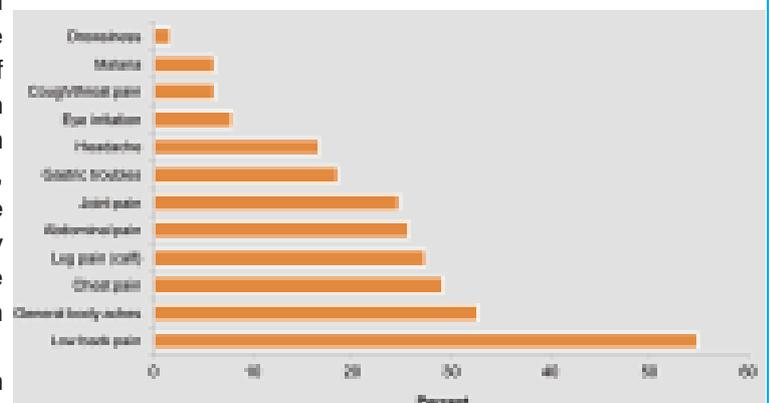
**Figure 11:** Mining workers reporting various types of diseases (After Pandey et al. 1993)



Figure 12: Degraded landscape in Khasi hills which is the result of mining activities. (Photograph by PK Yadav)

Surface mining, mainly the limestone, has resulted in the destruction of the vegetation and soil profile and therefore is a major cause of desertification of the spoil area (Rai 2002). A study of environmental pollution by subsurface coal miners found that emissions of particulate matter and gases including methane (CH_4), sulfur dioxide (SO_2), oxides of nitrogen (NO_x) and carbon monoxide (CO) made ambient environment particularly detrimental to workers as well as the nearby residents and wildlife (Rai 1996).

The social impact of mining is also serious. With the increase in income, the traditional joint families are slowly changing into nuclear families. Traditional agricultural practices that provide social and institutional infrastructure to harmonize mountain ecosystems are declining. With new avenues of money earning there appears to be a general overall decline in the authority of traditional leaders of the society (Bariket al. 2006). Accidental death of the rat-hole miners [recently in the month of July 2012 at least 15 laborers died due to the subsidence of land in Garo hills (Times of India 2012)] put a serious impact in family and society.

Conclusions

Conservation simply is not a “buzzword” of conservation biology. The tragedy of the commons is as a result of uncontrolled access to common resources and their relentless exploitation. The landscapes and forests of the fragile mountainous regions are the best common environmental resources that provide invaluable environmental services. By avoiding further haphazard mining in areas such as Meghalaya, the future of local people can be secured sustainably. Scientists sometime need to come forward as conservation activists with solid scientific evidences to convince government, local authority

and people that existing mining system needs a complete change to sustainably support future generations.



Figure 13: Mining areas in Lad Rymbai of Jaintia Hills (Photograph by Kiranmay Sarma)

“Scientists must speak loudly about the impending disaster of natural resources exploitation to make this knowledge available to others in a form that can impact decision making.”

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Biography

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