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Coal potential of Patala Formation, Dandli area, Kotli district, Kashmir, Pakistan

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ABSTRACT

Detailed geological mapping was carried out in Dandli of the Kotli district where Middle Cambrian to Late Miocene rocks are exposed. The coal bearing Patala Formation of the Upper Paleocene epoch is well exposed on both limbs of the doubly plunging Tattapani-Karela anticline and also on the eastern plunge of the doubly plunging Devigarh-Palana anticline. These anticlines are considered as the continuation of the Riasi anticline in Jammu, India. Structurally, the Kotli area lies to the south east of the Hazara-Kashmir Syntaxis.

The 73.2 m thick Patala Formation contains two coal seams. The exposed thickness of individual seam ranges from 1 m to 1.2 m and in the underground, it reaches upto 4 m at some places. The coal from the Dandli area has medium volatiles and low moisture with generally low ash content and good fixed carbon. Sulphur content varies from 0.51 to 3.17% and occurs in the form of pyrite nodules. The chemical analyses reveal that the coal is bituminous to semi-anthracite variety.

Keywords: Patala Formation, Dandli, Hazara-Kashmir Syntaxis, Cambrian, Paleocene.

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INTRODUCTION

Pakistan is suffering from energy crises and present level of energy generation is not enough for its present demands and industrial growth. Coal is one of the primary source of energy, it can be used in electricity generation, cement factories and brick kilns. Pakistan has huge reserves of unexplored coal, but 2.5 million metric tons of coal per year was imported for its industry. The present study area in the Kotli district is one of the potential coal fields of Pakistan situated between longitudes 73° 57'54" E to 73°58'00" E and latitudes 33° 32' 00" N to 33° 32' 25" N (Fig. 1) where ancient style of coal mining is carried out since 1970.

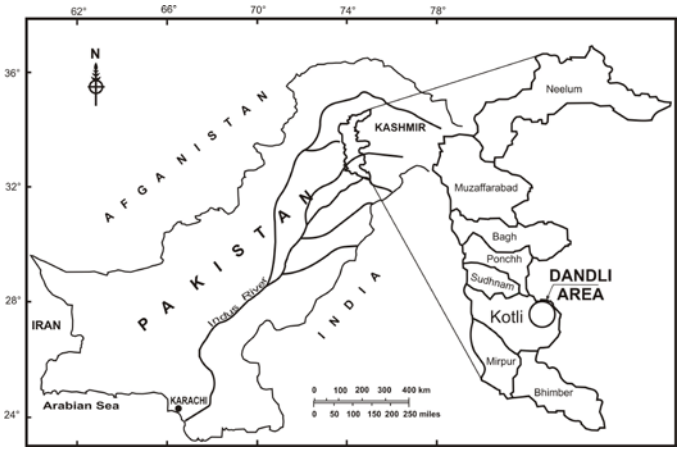

Fig. 1: Location map of study area.

Verchere (1867) is the pioneer of geological work in the Dandli area. He had worked on the fundamental geology of the Kashmir Himalaya and Afghan mountain area. Meddlicott (1876) had described the geology of Sub-Himalayan Series in Jammu Hills. Ledekker (1876) had done the basic work on the geology of the Pir Panjal and its surroundings. Wadia (1928) had described the geology of Poonch area and some parts of Punjab. Chaudhary and Ashraf (1980) had worked on the volcanic rocks of Poonch district. Ashraf et al. (1983) have established the stratigraphy of Kotli district and correlated with the geology of other areas of Pakistan. Ashraf et al. (1986) were the first one who worked on the coal of the Kotli area. Wells and Gingerich (1987) has established the paleoenvironment of Paleogene strata of this area. Present study is the first comprehensive research work of this area, in which a detailed geological mapping of the area was carried out, a stratigraphic section was measured in detail as well as samples were analysed to estimate the quality and quantity of the coal present in this area.

MATERIAL AND METHOD

Geological mapping was carried out in semi-detail scale of 1:10,000 and cross-sections were also prepared. The stratigraphic section was measured at Dandli and a detailed stratigraphic column was prepared. Coal samples were collected from different outcrops of the formation and from the mines and analysed them in the laboratory to assess its quality. The available data were also used to estimate the total quantity of the coal in this area.

RESULT AND DISCUSSION

The rocks exposed in the Dandli area are from Cambrian to Early Miocene in age. The oldest one is Abbottabad Formation of Cambrian age and the youngest one is the Murree Formation of Early Miocene age. The straitigraphic sequence is given in Table 1.

Table 1: Stratigraphy of the Dandli area.

Formation	Lithology	Geological Age
Alluvium		Recent
Murree Formation	siltstone, fossiliferrous monotonous sequence of clay	Early Miocene
----Unconformity----		
Margala Hill Limestone	Marl, limestone	Early Eocene
Patala Formation	shale, marl and limestone	Late Paleocene
----Unconformity----		
Datt Formation	siltstone and mudstone, glass sand, fire clay	Jurassic
---Unconformity---		
Abbottabad Formation	Dolomite, quartzite and phyllite	Cambrain

In the Dandli area, the Patala Formation is directly overlying Sirban Dolomite of the Abbottabad Formation of Cambran age. The contact is unconformable and marked by bauxite/ laterite (Fig. 2). At the base, 4 m thick thin bedded ferruginous, grey to dark shale is exposed, followed by 1 m thick band of lenticular coal seam which is black with bright luster, brittle and pyritized. The sample No. 1 was collected from this point. Then 6 m thick ferruginous shale with little sand is exposed which is capped by 2.1 m thick fossiliferous limestone of greyish to brownish colour, followed by 17.9 m thick earthy grey shale. At the top of this shale, 1.2 m thick second seam of coal is exposed.

The sample No. 2 is collected from this upper coal seam. At the top of this upper coal seam 13 m thick greyish, fossiliferous calcareous shale is exposed with interbedded limestone followed by 3 m thick light grey to greyish thin bedded limestone. Then 8 m thick Patala Formation is covered by scree. At the top of this formation, 17 m thick earthy grey shale is exposed with interbedding limestone. The upper contact of the Patala Formation in this area is conformable and sharp with the Eocene Margala Hill Limestone. The coal samples No. 3 and 4 are collected from the mines of this area. All these samples were analysed in the laboratory (quantitative analysis) and results are presented in Table 2.

Table 2: Semi Quantitative Analysis coal samples from Dandi area.

Sample No.	Moisture	Volatile Matter	Carbon Contents	Ash Contents	Sulphur
01	9.75	18.40	57.51	14.33	0.51
02	11.07	22.67	53.02	12.83	0.29
03	1.79	11.56	56.21	33.39	3.17
04	7.04	29.38	42.18	21.39	0.34
05	10.8	18.7	56.37	12.5	1.63
06	9.60	17.29	63.53	8.40	1.18
07	6.18	9.44	60.18	22.22	1.98
08	7.72	10.25	65.01	15.12	1.9
09	5.27	10.78	59.21	23.45	1.29
10	13.95	9.64	61.83	12.80	1.78
11	11.76	25.51	48.60	12.78	1.35
12	16.55	23.36	44.83	13.96	1.3
13	19.52	24.26	41.89	12.35	1.98
14	7.18	10.44	58.18	23.22	0.98
15	10.76	22.51	51.60	13.73	1.40
16	11.80	17.7	54.37	14.54	1.59
17	11.04	20.38	50.18	18.39	0.34
18	10.79	11.56	56.21	25.39	1.17
19	14.55	15.36	54.83	14.93	1.23
20	10.27	14.78	55.21	18.54	1.20

The study area is lying in the south east of Hazara-Kashmir Syntexis and structurally folded and faulted (Fig. 3). The coal bearing Patala Formation of the Upper Paleocene epoch is well exposed on both limbs of the doubly plunging Tattapani-Karela anticline and also on the eastern plunge of the doubly plunging Devigarh-Palana anticline. These anticlines are considered as the continuation of the Riasi anticline in Jammu, India. The occurrence of coal is shown in the cross sections along line L-M and X-Y in Fig. 3.

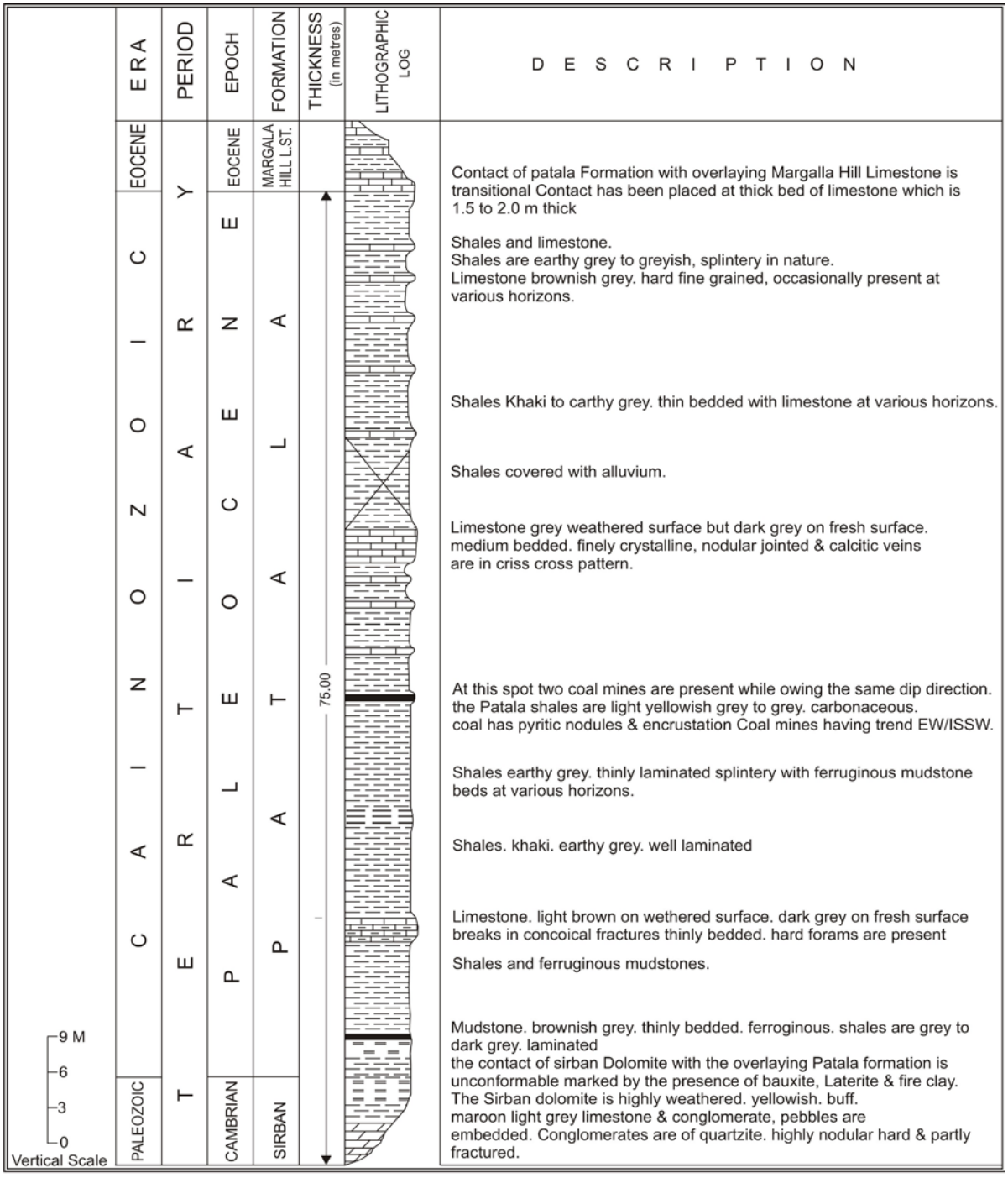

Fig. 2: Stratigraphic Section of Patala Formation, Dandli area, Kotli district.

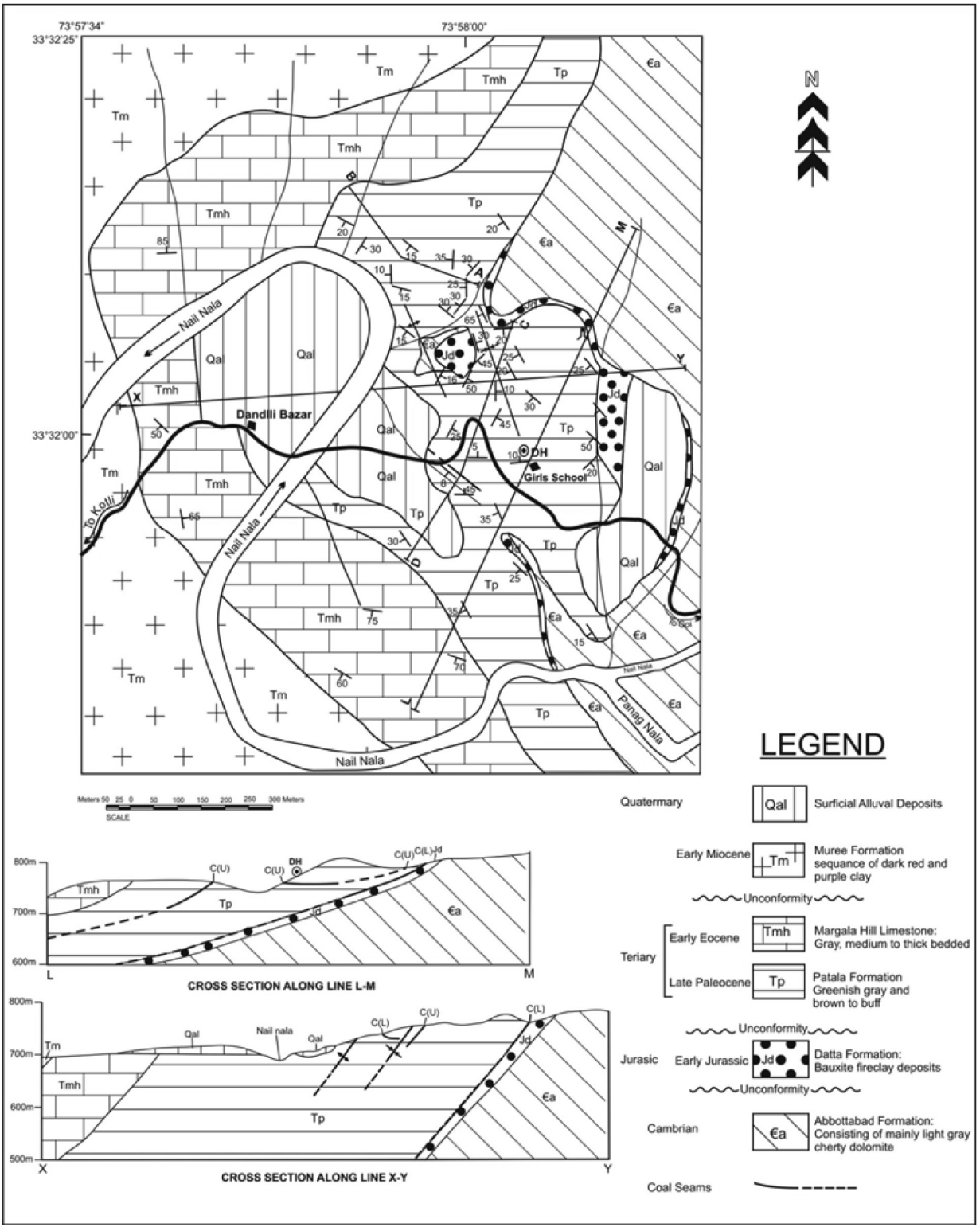

Fig. 3: Geological map of Dandli area.

CONCLUSIONS

The coal of the Dandli area has medium volatiles (sulphur, short chain/aromatic hydrocarbons etc), low moisture content, and generally low ash content with good fixed carbon (56% in average). Sulphur content varies from 0.51 to 03 % and occurs in the form of pyrite nodules. The chemical analyses reveal that coal of the Kotli district is bituminous to semi-anthracite type of coal.

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