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### Introduction

In Mongolia, the deposition of coal bearing strata commenced in Pennsylvanian, and continued in Upper Permian, in Lower-Middle Jurassic and finally in Lower Cretaceous time. Pennsylvanian coal seams were deposited in Western Mongolia, where peat formation was initially developed in the southernmost part and later gradually shifted to northward. By the Late Permian, the locus of coal formation had changed and main peat accumulation took place in southern Mongolia. Lower-Middle Jurassic coal was accumulated in western, northern and eastern Mongolia. During this time, peat forming condition was comparatively stable in entire Mongolia. In the Early Cretaceous, thick and extensive coal was formed in the Eastern Mongolia. Due to this general trend of peat accumulation, coal rank decreases from west (bituminous) to east (lignite).

### Mongolian coal-bearing basins

Mongolian coal deposits are classified into two coal-bearing provinces (Western and Eastern Mongolian), twelve basins, and three areas (Fig. 1). A total of 400 coal occurrences and deposits are known, of which 100 have been explored (Bat-Erdene., 2012).

#### Western Mongolian province

The Province includes two basins and two areas (Fig. 1). The Pennsylvanian sequence is the most prolific coal-bearing unit (Erdenetsogt et al., 2009).

#### Eastern Mongolian province

The Province is the largest coal and oil shale-bearing province (Erdenetsogt et al., 2009) and comprises six coal and oil shale-bearing basins. The coal presence mainly associated with Lower Cretaceous sequences.

#### Other basins and area

Main coal resource in *South Gobi basin* is hosted in Upper Permian sedimentary rocks. The basin contains predominant portion of coking coal reserves of Mongolia. Coal seams of *Southern Khangai, Ikh Bogd, and Ongi river basins* are hosted in Upper Permian, Lower-Middle Jurassic, and Lower Cretaceous sedimentary sequences.

*Orkhon-Selenge area* is composed of 20 scattered small graben are filled with coal-bearing Jurassic and Lower Cretaceous sedimentary rocks.

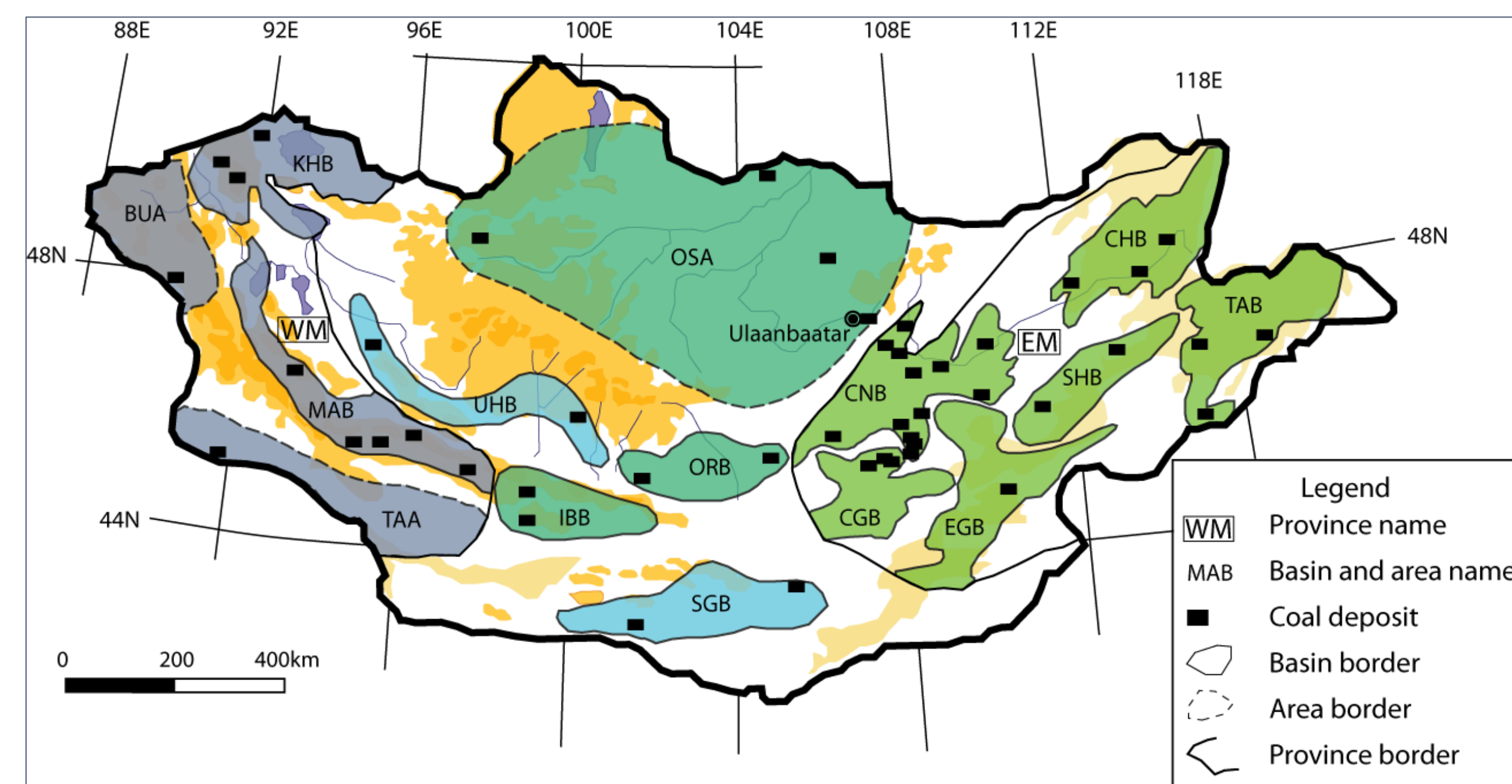


Fig. 1. A location map of Mongolian coal-bearing provinces, basins and deposits (Modified after Bat-Erdene, 1992)

Province: WM - Western Mongolian; EM - Eastern Mongolian;  
Basins: KHB - Kharkhiraa; MAB - Mongol-Altai; SGB - South Gobi; UHB - South Khangai; IBB - Ikh Bogd; ORB - Ongi river; CNB - Choir-Nyalga; CHB - Choibalsan; TAB - Tamsag;  
SHB - Sukhbaatar; EGB - East Gobi; CGB - Central Gobi; Areas: BUA - Bayan-Ulgii; TAA - Trans-Altai; OSA - Orkhon-Selenge;

### Petrographic composition of Mongolian Paleozoic coals

The significant portion of Pennsylvanian and Upper Permian coal reserves, existed in western and southern Mongolia, are coking coal. Thus, petrographical studies of the coals are notable important. However, previous petrographical studies of Paleozoic coals have been sparse, and only few deposits have been conducted.

#### Western Mongolian Pennsylvanian coals

The maceral compositions of Western Mongolian Pennsylvanian coals such as Khushuut, Maanit, Khurengol, Zeegt, Tsagaangol, Nuurstkhotgor, Khartarvagatai and Olonbulag were studied. The results show that the coals are dominated by vitrinite (45 vol.% to 71 vol.%) and inertinite (28 vol.% to 53 vol.%) macerals. Liptinite contents are low, less than 4 vol.%. In addition, vitrinite reflectance values of Khushuut (1.85%), Maanit (0.92%), Khurengol (1.4%), Zeegt (0.86%), Tsagaangol (3.6%), Nuurstkhotgor (0.9%), Khartarvagatai (1.1%) and Olonbulag (1.7%) were determined (Table 1, Fig 2, Photo1).

Table 2. Petrographic composition of Upper Permian coals (Selected deposits)

Deposit (age)	Coal characteristics, %					Petrographical composition, %			
	IM	Ash	VM	CV, MJ/kg	St	R <sub>0</sub>	Vt.	In.	Lp.
Khushuut (C)	1.06	6.98	15.39	36.25	1.03	1.8	82.2	13.6	1.0
	0.75	10.0	14.88	36.62	0.91	1.86	73.3	32.0	0.5
	0.81	24.8	14.36	35.45	0.67	1.82	55.3	39.0	2.4
	0.86	30.2	14.11	34.40	-	1.88	40.0	59.2	2.0
Nuurstkhotgor (C)	0.93	16.2	30.1	34.40	0.70	0.92	33.8	27.8	3.0
	0.91	33.9	30.2	31.8	0.3	0.9	48.1	45.6	1.3
Khartarvagatai (C)	1.93	30.5	39.7	30.5	0.67	0.71	37.5	59.0	5.0
	1.68	25.7	40.9	31.06	0.52	0.72	59.8	31.1	3.5
	2.04	12.3	37.7	34.3	0.76	0.82	73.4	19.6	2.0

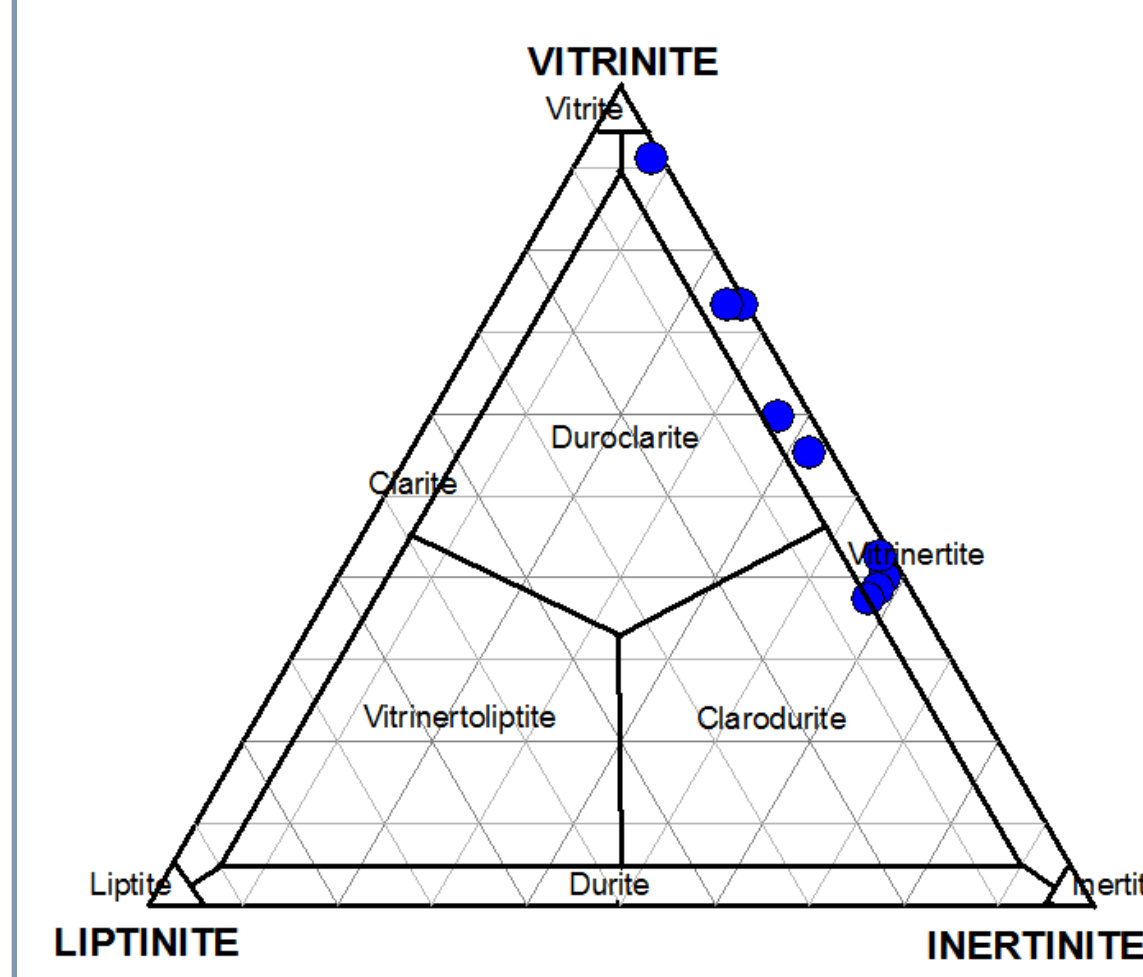


Fig. 2. Lithotypes of Western Mongolian coals (Nuurstkhotgor, Khartarvagatai and Olonbulag) (Jargal et al., 2002)

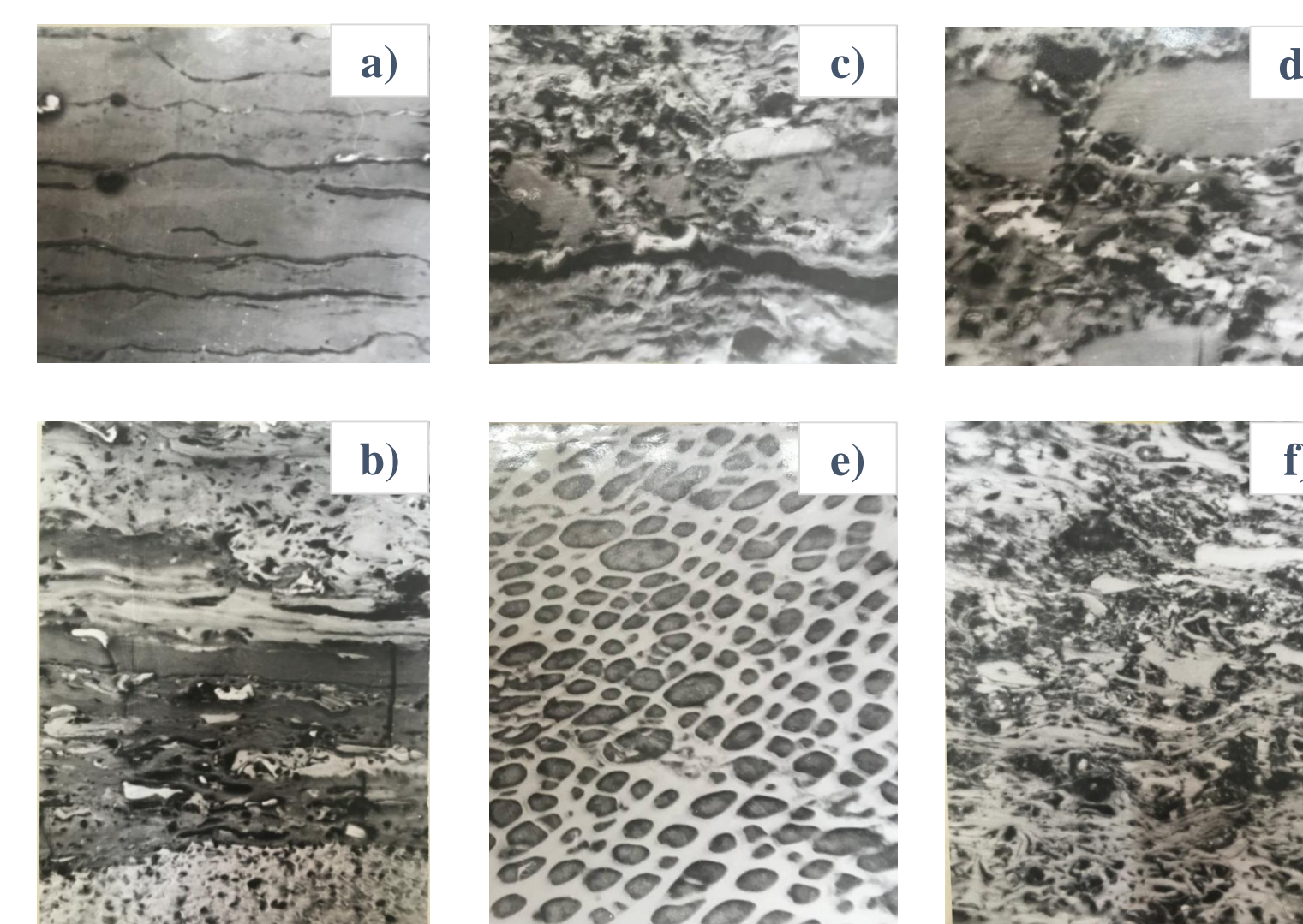


Photo 1. Microphotographs of Western Mongolian coals (Jargal et al., 2002). Magnification 212x. a-Liptinite (Nuurstkhotgor); b-Inertinite (Nuurstkhotgor); c,d-Inertinite (Khartarvagatai); e,f-Inertinite (Olonbulag)

### Southern Mongolian Upper Permian coals

Upper Permian coals in southern Mongolia (Tavantolgoi, Nariinsukhait, Jargalant, Tsagaantolgoi, Buduuniikhyar) are dominated by vitrinite (55 vol.% to 78 vol.%) and inertinite macerals (19 vol.% to 44 vol.%). Liptinite contents range from 1 vol.% to 7 vol.%. The vitrinite reflectance values of Tavantolgoi and Nariinsukhait coals vary from 0.7% to 1.2% and from 0.7% to 0.8%, respectively (Table 2, Fig 3, Photo 2).

Table 2. Petrographic composition of Upper Permian coals (Selected deposits)

Deposit (age), coal seam #	IM, %	VM, %	Ash, %	CV, %	St, %	Petrographic composition, %			
						Vt.	In.	Lp.	R <sub>0</sub> (%)
Tavantolgoi (P), Seam--XIII	2.1	34.2	27.0	32.6	0.7	72	21.0	7.0	0.74
Tavantolgoi (P), Seam-- IX	0.5	30.1	24.6	33.7	0.7	78	19.0	3.0	0.95
Tavantolgoi (P), Seam--VIII	0.6	29.8	24.0	33.7	0.7	75.5	22.5	2.0	0.96
Tavantolgoi (P), Seam--IV	0.5	26.3	21.5	33.7	0.7	73.5	25.0	1.5	1.05
Tavantolgoi (P), Seam--III	0.6	25.9	19.9	34.4	0.7	63.0	36.0	1.0	1.09
Tavantolgoi (P), Seam-0+1	0.5	23.1	25.1	33.5	0.7	55.4	43.6	1.0	1.28
Nariin Sukhait, (P), Seam--V	1.0	33.2	12.5	32.4	0.5	64.8	33.2	2.0	-
Gurvantes (P), Seam-I	2.3	34.3	20.7	32.5	0.9	-	-	-	-

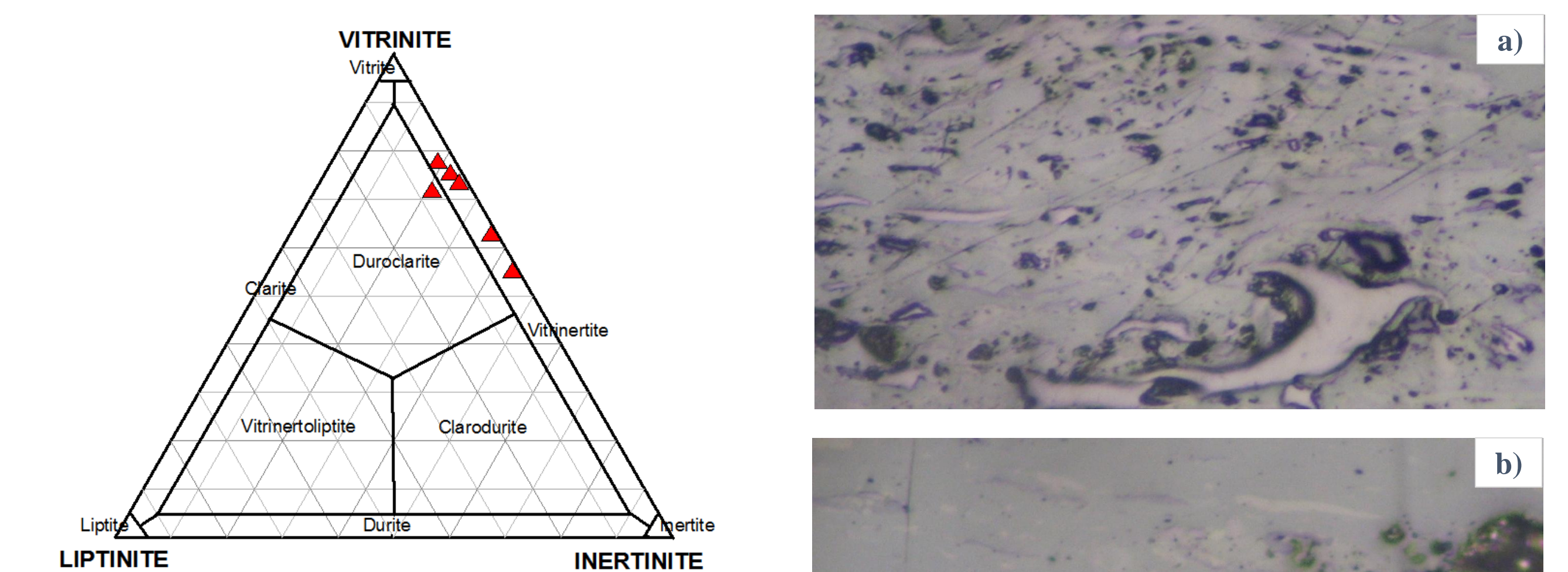


Fig. 3. Lithotypes of Tavantolgoi coals (Jargal et al., 2002)

Photo 2. Microphotographs of South Mongolian coal (Jargal et al., 2002). Magnification 212x. a-Inertinite (Tavantolgoi); b-Vitrinite (Tavantolgoi)

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