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Comparative Study of Coal Qualities from Three Large Coal basins in Xinjiang, Northwest China

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INTRODUCTION.

Up to 2.19 trillion tones of coal reserves, around 40 percent of the whole Chinese coal reserves, have been predicted in Xinjiang Province, northwest China, and the reserves will reach 15 trillion tonnes in 2020. There are four large coal basins in Xinjiang: Junggar coal basin, Kuqa-Baicheng coal basin (Ku-Bai for short), Yili coal basin, and Tulufan-Hami coal basin (Tu-Ha for short) (Fig.1), with predicted coal reserves of 0.7, 0.7, 0.6, and 0.1 trillion tonnes, respectively.

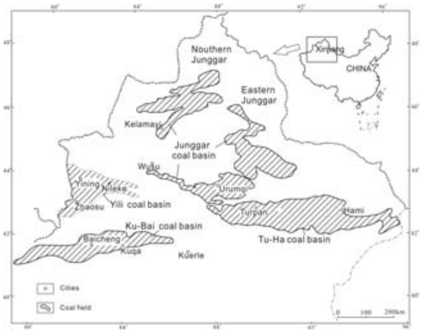

***fig 1.** Locations of four large coal basins in Xinjiang, northwest China.*

Due to the low exploration degree, the coal quality and coal accumulation mechanism of Xinjiang coals have seldom been studied until resent years. This study mainly analyzes and compares the coal quality from Junggar, Ku-Bai, and Yili large coal basins.

METHODOLOGY.

One hundred and sixty borehole and open-pit coal samples were collected from eleven coalmines in Junggar, Ku-Bai, and Yili coal basins, respectively.

The proximate analysis was performed following the ISO-589, 1171, and 562 recommendations. The mineralogical characteristics and particle morphology were investigated by Powder X-Ray Diffraction (XRD) and Scanning Electron Microscope with Energy Dispersive X-ray analyzer (SEM-EDX), respectively. The major and selected trace element contents were analysed by Inductively-Coupled Plasma Atomic-Emission Spectrometry (ICP-AES), and most other trace element contents were analysed by Inductively-Coupled Plasma Mass Spectrometry (ICP-MS).

RESULTS AND DISCUSSION.

Coal Characteristics.

On the basis of the exploration borehole core from these coalmine samples, the macroscopic lithotype of Junggar coal is mainly composed of dull, semi-dull coals, with minor thin banded semi-bright coals, while Ku-Bai coal and Yili coals are mainly of bright and semi-bright coals.

The Junggar coal, and the Yili coal are characterized by low ash yields (8.2%, and 8.5%, respectively, dry basis) and low to very low sulfur content (mostly <0.2%, and <0.4%, respectively, dry basis), while the Ku-Bai coal has low-medium ash (10.5% dry basis) and low sulfur contents (<0.5%, dry basis). According to the moisture and volatile matter contents, the coal rank of Junggar coal falls within subbituminous, while Ku-Bai and Yili coals belong to bituminous.

%	Junggar	Yili	Ku-Bai
M (ad)	11.6	12.1	8.5
A (db)	8.2	8.5	10.5
V (daf)	30.9	34.1	36.1
S (db)	<0.2	<0.4	<0.5

***Table 1.** Moisture, ash, volatile matter and sulfer contents (%) of Junggar, Yili, and Kuqa-Baicheng coals.*
ad- air dry basis, db- dry basis, daf- dry, ash-free basis.

Mineralogy.

The minerals present in very low contents in all coals were mainly quartz, kaolinite, with traces of siderite, pyrite, calcite, dolomite and illite (Table 2). Moreover, the average mineral contents in Ku-Bai coals were slightly higher than in Junggar and Yili coals. But the mineral contents in some Junggar coalmines were higher than those in some Ku-Bai coamines.

%	Junggar	Ku-Bai
Kaoklinite	3.3	3.2
Quartz	2.8	4.9
Calcite	0.7	0.4
Dolomite	0.5	0.1
Siderite	0.4	<0.1
Illite	0.1	0.1
Pyrite	0.3	0.2
Gypsum	0.1	0.1
Others	0.6	1.4
Sum	8.8	10.5

***Table 2.** Mineral contents (%) of Junggar, and Kuqa-Baicheng coals.*

Ankerite, albite, gypsum, microcline, clinochlore and anorthite were only present in some coalmines in trace amount. Saponite, palygorskite, and aragonite were only detected in one Junggar coal mine, and rhodochrosite was detected in another Junggar coalmine. The jarosite present in the thin coal seams in one Ku-Bai coalmine, probably indicated the weathering by underground waters of these coal seams, which were overlapped with sandstones or gravels.

palabras clave: Mineralogía, Geoquímca, Grandes cuencas de carbón, Xinjiang	***key words:*** Mineralogy, Geochemistry, Large coal basins, Xinjiang.

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Geochemistry.

The concentrations of most major and trace elements were all very low in Junggar, Yili, and Ku-Bai coals when compared with their concentration ranges in worldwide and Chinese coals (Table 3).

%	J	K	W	C
Al	3.3	3.2	nd	3.2
Ca	2.8	4.9	nd	0.9
K	0.7	0.4	nd	0.2
Na	0.5	0.1	nd	0.1
Fe	0.4	<0.1	nd	3.4
S	0.1	0.1	nd	nd
Mg	0.3	0.2	nd	0.1
mg/kg				
Li	4	3	12	32
Be	<0.1	2	2	2
B	41	10	52	53
P	207	95	231	402
Sc	1	1	4	4
Ti	395	460	798	1980
V	14	8	25	35
Cr	7	8	16	15
Mn	117	43	85	116
Co	5	17	5	7
Ni	8	15	13	14
Cu	10	22	16	18
Zn	20	43	23	41
Ga	2	2	6	7
Ge	0.4	0.6	2	3
As	1	0.9	8	4
Se	0.2	<0.1	1	2
Rb	3	3.1	14	9
Sr	238	72.7	110	140
Ba	211	86	150	159
Ta	0.2	nd	0.3	1
W	0.1	0.5	1.1	1
Pb	3	4	8	15
U	0.3	0.1	2	2

Table 3. Major and some trace element *contents of Junggar, and Ku-Bai coals* compared with worldwide and Chinese coals
J- Junggar; K- Ku-Bai; W- worldwide; C- Chinese; nd- no data

Be, Co, Ni, Cu, and Zn concentrations in one Ku-Bai coalmine, and B, P, Mn, Sr, and Ta concentrations in some Junggar coalmines, were still in the typical worldwide range, but slightly higher than their worldwide average values and concentration ranges in Chinese coals. Sr, and Ba contents in some Junggar coalmines even exceeded their maximum values of worldwide concentration ranges.

CONCLUSION.

The properties above indicate that Junggar, Ku-Bai, and Yili large coal basins in Xinjiang all have high coal qualities. The low ash yields, low S, Fe, as well as trace element (including some toxic element) contents in Xinjiang coal basins may be attributed to the sedimentological setting, with rapid peat bog aggradation in a very shallow lake environment with a low detrital supply. Thus Xinjiang coals and their combustion wastes from pulverized coal combustion power plants both will probably have promising utilization with low threat to environment.

REFERENCES.

BP. (2010): Statistical Review of World Energy. www.bp.com.

*Dai, S., Li, D., Chou, C., Zhao L.., Zhang, Y., Ren, D., Ma, Y., Sun, Y. (2008): Mineralogy and geochemistry of boehmite-rich coals: new insights from the Haerwusu Surface Mine, Jungar Coalfield, Inner Mongolia, China. Int J Coal Geol, **74**, 185–202.*

Dai S., Ren D., Chou C., Finkelman R. B., Seredin V. V., Zhou Y. (2011): Geochemistry of trace elements in Chinese coals: A review of abundances, genetic types, impacts on human health, and industrial utilization. Int J Coal Geol, Article in Press.

ISO 589. (2003): Hard coal - Determination of total moisture. International Standardization Organization.

ISO 1171. (1997): Solid mineral fuels - Determination of ash. International Standardization Organization.

ISO 562. (1998): Hard coal and coke – Determination of volatile matter. International Standardization Organization.

*Ketris M.P. & Yudovich Y.E. (2009): Estimations of Clarkes for carbonaceous biolithes: world average for trace element contents in black shales and coals. Int J Coal Geol, **78**, 135–148.*

Swaine D.J. (1990): Trace Elements in Coal. Butterworths, London.

*Zhou J., Zhuang X., Alastuey A., Querol X., Li J. (2010): Geochemistry and mineralogy of coal in the recently explored Zhundong large coal field in the Junggar basin, Xinjiang province, China, Int J Coal Geol, **82**, 51–67.*