

**GEOLOGICAL SURVEY OF  
KENTUCKY. CHEMICAL REPORT OF  
THE COALS. SOILS. CLAYS,  
PETROLEUM, MINERAL WATERS ETC.,  
ECT., OF KENTUCKY; VOL. A, PART III**

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**ROBERT PETER & JNO. R. PROCTER**

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*J. C. Branner*

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GEOLOGICAL SURVEY OF KENTUCKY.

JNO. R. PROCTER, DIRECTOR.

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CHEMICAL REPORT

OF THE

COALS. SOILS. CLAYS, PETROLEUM,  
MINERAL WATERS ETC., ETC.,  
OF KENTUCKY.

BY ROBERT PETER, M. D., ETC., ETC.,

CHEMIST TO THE SURVEY,

ASSISTED BY ALFRED M. PETER, S. M.

THE SEVENTH CHEMICAL REPORT IN THE NEW SERIES, AND THE ELEVENTH SINCE  
THE BEGINNING OF THE SURVEY.

VOL. A PART III.

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INTRODUCTORY LETTER.

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CHEMICAL LABORATORY,  
KENTUCKY GEOLOGICAL SURVEY,  
LEXINGTON, KY., April 17, 1888. }

JNO. R. PROCTER, Esq.,

*Director of Geological Survey of Kentucky:*

DEAR SIR: I have the pleasure herewith to send you for publication, my report of the chemical work done in this Laboratory for the Geological Survey since the publication of my last report.

Very respectfully,

ROBERT PETER, M. D., Etc.,  
*Chemist to Kentucky Geological Survey.*



## CHEMICAL REPORT.

Of the more than 273 analyses reported in the following pages, 137 are of coals from 14 counties in the eastern coal field of Kentucky; the greater number of them being from Bell, Breathitt, Clay, Harlan, Leslie, Perry and Whitley counties; a comparatively few samples are from Johnson, Knott, Knox, Letcher, Laurel and Martin counties. In the Appendix, West Virginia is represented in the analyses of seven samples, for comparison with Kentucky coals, together with the analyses of many other coals received since this report was made.

Most of these coals would come under the head of semi-bituminous, splint, or block coal; some few are, no doubt, entitled to the name "bituminous coal," and some of them are cannel coals. With them are reported some with such high ash percentage as to cause them to be classed with the bituminous shales. These, however, are comparatively few in number, and most of them could be used for fuel in their immediate vicinity. Generally speaking, these coals are of very good quality, and many of them would answer admirably for the manufacture of coke, while some of the splint or block coals could, probably, be used without coking for smelting iron ores. In short, the coals of this, one of the two immense coal fields of Kentucky, will generally compare favorably with those of any other region in the world.

Comparing the ash percentages of the coals of the seven counties which furnished the greatest number of samples, we find the following results, viz.

COUNTIES.	No. of samples analyzed.	Highest ash percentage.	Lowest ash percentage.	Average ash of the whole.	Average exclusive of highest ash percentage.
Whitley . .	18	7.90	1.64	3.56	none excluded.
Bell . . .	11	8.40	1.80	4.28	none excluded.
Harlan . .	44	47.48	2.20	7.76	5.12 excluding 4 highest.
Leslie . .	11	16.00	4.00	8.19	7.40 excluding 1 highest.
Breathitt .	10	24.20	5.28	9.32	8.08 excluding 1 highest.
Clay . . .	9	32.00	5.80	9.79	7.00 excluding 1 highest.
Perry . . .	13	16.80	2.56	9.88	8.48 excluding 1 highest.



Of course such a comparison as this, of a limited number of samples, might not apply to the products of the whole of the several counties in question, as other samples from coal beds not here represented might alter these averages materially, and it is proper to state that those coals or bituminous shales which give very large ash, should be excluded from such calculations. Moreover, it is generally found that cannel coals—which variety abounds in Breathitt county particularly—very generally give more ash than the softer coals.

The West Virginia coals gave the following results, viz.: The 7 samples gave—highest ash, 12.76 per cent.; the lowest, 2.40 per cent.; the general average of their ash, 4.94 per cent.

In all these coals the sulphur ranges from 6.042 per cent. in what is really bituminous shale, of Clay county; 5.436 in this kind of shale from Harlan county, and 5.078 in cannel coal of Bell county, down to 0.420 in Harlan county coal, and 0.418 per cent. in coal of West Virginia. Generally the percentage of sulphur is comparatively moderate or small in these coals.

The thirty-nine *Cokes* analyzed were principally from Bell, Harlan and Knox counties, there being but one sample each from Laurel, Letcher and Whitley counties. West Virginia furnished 8 samples.

The 20 samples of coke from Bell county gave an average ash percentage of 7.83, but without the highest four, which would be excluded from this manufacture, the ash was only 6.97 per cent, the highest being 12.2 and lowest only 4.00; which compares favorably with the best cokes in the market. The percentage of carbon in the coke varied from 95.80 in F. Barner's to 85.30 in Jas. Meyers'.

The average ash of the 4 Harlan county cokes was 9.10 per cent. But excluding the highest, 17.3, the ash average is only 6.20 per cent. The 4 Knox county cokes gave an average of 5.20 per cent. of ash, including the highest, 8.40. The lowest being only 3.20. The 8 West Virginia cokes gave a general average of 6.47 per cent. of ash, including one at 9.10 per cent.

The sulphur is moderate or small in all these cokes which do not contain too much ash, ranging from 1.975 to 0.217 per cent.

Of the 51 soils, the analyses of which are herewith reported, 12 are from Ballard county; 15 from Calloway; 2 from Graves; 11 from Marshall, and 10 from McCracken; in all, 50 from the so-called Jackson Purchase; one only is from Jefferson county. Five other soils, from Clinton county, are reported in the Appendix.

The Jackson Purchase soils and subsoils, with the exception of those from the bottom lands of the Ohio, Obion and Tennessee rivers and Shannon creek, and the Oak and Hickory Flats, all contain but a small or moderate proportion of organic matters or humus. This is, probably, due to the circumstance that they, with the exceptions above noted, generally contain quite a large quantity of sand and insoluble silicates in proportion to their alumina. The exceptional soil, No. 2622, from the first bottom of Tennessee river, Calloway county, gave but 77.719 per cent. of siliceous residue; while the red sandy soil of Sandy Ridge, No. 2565, gave 93.385 per cent., the general range being from about 81. to 91. per cent.

This rather large proportion of sand, although it is very fine sand generally, and moderate proportion of alumina, cause these soils to be light and porous, easily worked or drained under favorable conditions.

Lime and phosphoric acid are small, or only moderate in quantity, in several of them, which may render necessary the use of calcareous and phosphatic fertilizers, but the potash is usually in good proportions; a few exceptions only being noticeable. This fact, as well as their light porous condition, allowing free penetration of the atmospheric agencies, with the absence of gravel or coarse sand, aids in making these soils favorable to tobacco culture.

All of the 26 clays, etc., reported, are from the Jackson Purchase. Six from Ballard county; 8 from Calloway; 5 from Graves; 1 from Hickman; 6 from Marshall, and 5 from McCracken county; mostly from the Tertiary and Quaternary formations. A few of the most siliceous or sandy of them are derived from decomposing chert or hornstone of the Lower Carboniferous siliceous group.

Many of them are highly refractory, and would make good fire-brick or furnace linings, or, possibly, glass pots. Some

are white enough for fine pottery-ware. Some, composed mainly of very fine sandy material, would answer to mix with tough clays, or probably for glazing material or glass, or for the manufacture of water cement. Several of these siliceous clays have such a fine texture that they may be used as scouring or polishing material.

Some of them, containing much iron peroxide, may find their applications as cheap paints, for terra-cotta work or cheap pottery-ware.

The 3 iron ores from Bath county belong to the Clinton group, and present the general characteristics of the so-called Clinton Iron Ore.

## BALLARD COUNTY.

## MINERAL WATERS.

No. 2554—MINERAL WATER, *from the Kilgore Spring at Blandville: temperature (in August) 58° F. Slightly chalybeate.* Collected by R. H. Loughridge, August 19th, 1885. Sample in stone-ware gallon jug. Cork sealed.

Evaporated to dryness, it left 0.0674 per 1000 of *saline matters*, which lost 0.0030 of *organic matter* on ignition.

The saline matters consisted of chlorides, carbonates and sulphates of calcium, magnesium, potassium, sodium and iron, silica and a trace of Lithium. They are slightly alkaline in reaction.

The water is a good saline chalybeate.

No. 2555—MINERAL WATER, *from the McGee Spring, Blandville. Strongly chalybeate. Temperature 60° F. (in August).* Collected by R. H. Loughridge, August, 1885.

## COMPOSITION IN 1,000 PARTS.

Carbonate of iron . . . . .	0.0244
Carbonate of lime . . . . .	.0108
Carbonate of magnesia . . . . .	.0019
Chloride of magnesium . . . . .	.0099
Chloride of sodium . . . . .	.0053
Carbonate of soda . . . . .	.0316
Sulphate of potash . . . . .	.0072
Silica . . . . .	.0156
Total solid matters . . . . .	0.1067