VIRGINIA DIVISION OF MINERAL RESOURCES
PUBLICATION 114

COAL, OIL AND GAS, AND INDUSTRIAL AND METALLIC MINERALS INDUSTRIES IN VIRGINIA, 1988-1989

Palmer C. Sweet

COMMONWEALTH OF VIRGINIA

DEPARTMENT OF MINES, MINERALS AND ENERGY
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Robert C. Milici, State Geologist

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RICHMOND, VIRGINIA
O. Gene Dishner, Director

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INTRODUCTION

The total value of mineral production in Virginia in 1988 was 2.12- billion dollars (Table 1). About 1.58-billion dollars resulted from coal sales and about 42-million dollars were from the sale of petroleum and natural gas. The remaining 498-million dollars were from production of industrial rocks and minerals (Table 2). This represents an increase of more than 111-million dollars (about 5.5%) for 1988, when compared with 1987 statistics. Crushed stone production was up more than 9 percent and coal production was up almost 2 percent. On the decline were natural gas, 4.5 percent, and clays, which were down more than 10 percent from the previous year.

The number of producers, amount of production, and number of processing plants remained stable during the year for cement, feldspar, gem stones, gypsum, industrial sand, iron-oxide pigments, kyanite, ornamental aggregate, sand and gravel, and vermiculite.

The total value of Virginia's mineral production in 1989 was 2.18- billion dollars (Table 3): 1.62-billion dollars from coal and almost 40- million dollars from petroleum and natural gas. The remaining 520.1- million dollars of nonfuel production were from a variety of industrial rocks and minerals (Table 4). The leading increase in nonfuel mineral production (25-million dollars; 5.1 %) was in lime production (14 % over 1988) and crushed stone (6 % over 1988).

Virginia led the nation in the production of kyanite, was the only producer of feldspar, marketed as "Virginia aplite," and was one of three states mining vermiculite. Several mineral commodities - lithium carbonate, magnetite, manganese, mica, perlite, and phosphate rock were imported for processing.

1988

COAL[1]

A record 46,364,647 short tons (Table 1) of coal were produced from the southwest Virginia coalfields in Buchanan, Dickenson, Lee, Russell, Scott, Tazewell, and Wise Counties from approximately 543 surface and underground mines. Tables 5 through 7 provide production data by county and coal bed, and employment statistics. Table 8 provides coal mine fatal- accident data. The majority of the bituminous coal from the southwest fields was produced from the Pocahontas No. 3 coal bed. Included in this production total are 5553 short tons of semi-anthracite coal produced from two additional surface mines in the Valley Coal field, Montgomery County.

Coal from Virginia is used for metallurgical purposes, electrical power generation (steam coal), industrial purposes, and residential heating. A large percentage of Virginia coal is contracted for export to overseas markets. The coal is exported through the ports in the Hampton Roads area in Virginia and at Wilmington in North Carolina.

Table 1. Mineral production in Virginia, 1988[1]

Mineral Commodity	Quantity	Value (thousands)
Clays—thousand short tons—	1,113	$ 6,614
Coal (bituminous)[2] ($34/ton)—do—	46,365	1,576,398
Gem stones	NA	20
Lime—thousand short tons—	741	33,875
Natural Gas[2] ($2.23/1000 cu. ft.) —million cubic feet—	18,683	41,663
Petroleum (crude)[2] ($13.95/Bbl.) —42-gallon barrels—	24,952	348
Sand and gravel —thousand short tons—	12,551	48,100
Stone:		
Crushed—do—	66,000	326,700
Dimension—do—	10	2,900
Combined value of cement, clay (fuller's earth), feldspar, gypsum, industrial sand and gravel, iron-oxide pigments((crude), kyanite, sulfur, vermiculite	XX	81,830
Total	XX	$2,118,448

NA Not available. XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers) - from U.S. Bureau of Mines.

[2] Virginia Department of Mines, Minerals and Energy

OIL AND GAS[2]

Crude oil production totaled 24,952 barrels in 1988, a 46 percent increase over the 1987 production of 17,141 barrels. Production was by 12 companies from 54 wells in three fields (Ben Hur, Rose Hill, and Roaring Fork) (Table 9). The average price paid by refineries for Virginia oil in 1988 was 13.95 dollars per barrel.

1. Information supplied by Division of Mines, 219 Wood Avenue, Big Stone Gap, Virginia 24219.
2. Information supplied by Division of Gas and Oil, P. O. Box 1416, Abingdon, Virginia 24210.

Table 2. Summary of metal/nonmetal mining and quarrying, 1988.

	Annual Tonnage	Office Workers	Office Hours	Office Wages	Plant Workers	Quarry Workers	Production Hours	Production Wages
Aplite	368,832.00	10	15,792	$ 218,400	33	26	93,221	$ 938,633
Clay	634,905.00	35	60,060	977,898	495	32	758,107	5,081,179
Coal Refuse	50,000.00	0	0	0	0	2	6,720	25,880
Diabase	4,161.00	2	593	13,000	0	10	16,400	137,467
Diorite	336,856.00	6	13,010	356,389	10	9	53,928	352,813
Dirt/Fill Material	3,578,542.56	82	4,339	57,884	95	286	169,919	1,722,758
Dolomite	2,688,685.00	19	42,201	946,788	62	47	249,531	2,409,309
Fuller's Earth	100,00.00	6	12,480	145,600	48	2	95,680	541,137
Gemstones	1.00	1	0	0	0	0	0	0
Gneiss	544,852.00	6	12,692	131,638	14	7	42,144	325,599
Gold	0.00	0	0	0	2	0	250	2,500
Granite	34,014,592.00	158	367,131	4,451,014	478	397	2,000,535	20,274,508
Gravel	196,718.00	4	815	16.487	1	11	5,180	45,109
Gypsum	535,814.00	3	6,193	99,269	0	41	105,186	978,778
Iron Oxide	209.00	0	0	0	0	0	0	0
Kyanite	537,175.00	15	33,883	519,828	105	27	292,380	2,912,690
Limestone	19,231,175.00	254	525,290	5,913,218	702	513	2,593,057	23,433,107
Limonite	812.00	11	20,453	261,883	25	11	47,053	314,188
Marble	284,300.00	2	5,070	54,194	8	5	37,008	303,288
Marl	10,737.00	0	0	0	0	2	200	1,200
Other	8,000.00	1	10	0	0	2	150	0
Quartz	3,000.00	1	20	200	0	3	1,200	25,200
Quartzite	1,019,275.00	10	21,441	334,494	44	8	120,008	898,489
Sand	7,048,469.82	71	67,457	711,716	70	207	252,693	2,186,408
Sand and Gravel	11,851,783.00	79	113,268	1,631,694	244	184	197,551	6,506,375
Sandstone	954,949.00	4	4,140	34,899	8	27	66,394	595,070
Schist	59.00	0	0	0	0	1	5	35
Shale	732,003.00	57	123,311	1,837,301	348	41	23,024	6,742,513
Slate	501,733.00	27	43,072	717,685	222	55	333,565	2,149,390
Soapstone	2,851.00	7	10,532	118,942	21	4	50,235	331,564
Trap Rock	8,198,931.00	30	65,296	1,097,740	75	108	466,549	5,449,577
Vermiculite	46,000.00	3	7,800	98,700	15	5	46,800	407,800
	93,784,811.38	915	1,576,549	$20,848,820	3,126	2,073	9,575,183	$85,094,570

Table 3. Mineral production in Virginia, 1989[1] (preliminary).

Mineral Commodity	Quantity	Value (thousands)
Clays——thousand short tons———	1,038	$ 6,031
Coal (bituminous)[2] ($37/ton)—do—	43,855	1,622,644
Gem stones———————	NA	20
Lime———thousand short tons——	807	38,740
Natural Gas[2] ($2.19/1000 cu. ft.) — million cubic feet ——	17,935	39,278
Petroleum (crude)[2] ($18.17/Bbl.) — 42-gallon barrels ——	21,271	386
Sand and gravel —thousand short tons——	12,500	48,100
Stone:		
Crushed————do—————	66,300	344,800
Dimension———short tons———	8,548	2,898
Combined value of cement, clay (fuller's earth), feldspar, gypsum, industrial sand and gravel, iron-oxide pigments (crude), kyanite, sulfur, vermiculite———————	XX	79,494
Total———————————	XX	$2,182,391

NA Not available. XX Not applicable.
[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers) - from U.S. Bureau of Mines.
[2] Virginia Department of Mines, Minerals and Energy

Natural gas production in 1988 was 18,682,530 Mcf (one Mcf equals 1000 cubic feet) from 728 wells in Buchanan, Dickenson, Russell, Scott, Tazewell, Washington, and Wise Counties (Table 10). This reflects a decline of 4 percent from the 1987 record production of 19,520,312 Mcf. The average price paid to Virginia's 18 natural gas producers in 1988 was 2.23 dollars per Mcf.

DRILLING ACTIVITY

In 1988, a total of 45 wells were drilled in Virginia; this represents a 12 percent decrease from the 51 wells drilled in 1987. The total footage drilled in 1987 was 213,527 (Table 11). The average depth for the 14 exploratory wells was 4322 feet and the average depth for the 31 developmental wells was 4963 feet. Eight of the exploratory wells were completed as producers, and 30 of the developmental wells were successful. Thirty-seven wells were completed as gas wells, and one was completed as an oil well (LE-162). Tables 12 through 14 provide data on company delivery of gas to pipelines, reserves of gas, and 1988 well-completion data.

BUCHANAN COUNTY

Ashland Exploration drilled three developmental wells in the Glick field. Total footage drilled for the three successful wells was 14,007.

DICKENSON COUNTY

EREX, Inc. drilled 17 successful developmental wells in the Nora field. Total footage drilled was 83,333. One exploratory well was abandoned after the drill string was lost in the hole at a depth of 2691 feet.

There were two exploratory wells drilled to the Lower Pennsylvanian-age coal seams in the Nora field. The wells were completed in the deep unminable coal seams that underlie this area. Total footage drilled for both wells was 4884. After the wells were stimulated, pumps were installed to de-water the coal seam. Based on the data from these three wells, coal-bed methane development appears to have potential in the coal bearing regions of Virginia. This resource may make a significant contribution to Virginia's energy development.

LEE COUNTY

Penn Virginia Resources expanded its exploration in the Rose Hill district of Lee County. A five-well program resulted in one oil well, two gas wells, and two dry holes. Total footage drilled was 19,347.

PULASKI COUNTY

Valley Basin Gas Association continued to explore the coal-bed methane potential of the "Valley Coal beds" near Radford, Virginia. The two wells drilled totaled 9500 feet and were abandoned after evaluation.

SCOTT COUNTY

Penn Virginia Resources drilled four developmental wells and one exploratory well in the Scott County portion of the Early Grove field. Of the four developmental wells, three were successfully completed and one was a dry hole. Total footage drilled for the developmental wells, including the dry hole, was 17,025. The exploratory well reached a depth of 6300 feet and was plugged after evaluation.

WASHINGTON COUNTY

One successful developmental well was drilled in the Washington County section of the Early Grove field by Penn Virginia Resources. Total depth of this well was 4519 feet.

Table 4. Summary of metal/nonmetal mining and quarrying, 1989.

	Annual Tonnage	Office Workers	Office Hours	Office Wages	Plant Workers	Quarry Workers	Production Hours	Production Wages
Aplite	493,796.00	6	11,895	$ 210,813	31	9	98,228	$ 1,003,678
Clay	216,966.00	7	5,413	95,871	0	30	13,961	82,271
Coal Refuse	93,515.00	0	0	0	0	2	6,720	26,880
Diabase	781.00	2	90	1,800	0	10	2,567	23,300
Diorite	290,411.00	6	13,117	187,522	11	8	48,004	326,047
Dirt/Fill Material	2,902,587.00	55	12,822	132,560	39	246	74,284	813,615
Dolomite	2,498,235.00	18	39,168	905,725	51	50	189,678	2,465,151
Fuller's Earth	46,700.00	4	2,080	88,234	43	2	56,107	612,821
Granite	28,718,801.00	148	291,970	3,830,798	480	363	1,724,265	18,398,437
Gravel	184,062.00	5	493	5,625	0	11	5,027	46,333
Gypsum	498,168.00	3	6,001	91,433	0	48	110,996	1,046,859
Iron Oxide	150.00	0	0	0	0	0	0	0
Kyanite	674,875.00	15	30,247	590,859	104	28	309,248	3,103,051
Limestone	18,778,637.00	264	521,556	7,246,246	732	514	2,570,880	24,173,885
Limonite	375.00	9	17,407	448,547	19	1	34,716	273,008
Marble	184,408.00	1	2,562	19,474	5	3	26,327	239,531
Marl	20,263.00	5	11,973	106,809	2	12	26,314	224,185
Quartzite	1,008,627.00	5	7,815	93,997	45	8	115,984	1,363,535
Red Dog	500.00	0	0	0	0	0	0	0
Sand	6,168,092.00	98	102,563	1,006,188	63	249	321,016	2,895,133
Sand and Gravel	10,646,637.00	97	133,947	1,763,938	322	228	816,825	7,584,704
Sandstone	642,757.00	6	5,217	43,281	18	16	60,031	541,081
Schist	0.00	0	0	0	0	0	5	35
Shale	1,233,694.00	79	140,963	2,050,592	426	46	975,346	6,721,032
Slate	396,856.00	19	32,671	644,842	125	28	213,477	1,613,728
Soapstone	3,147.00	8	2,999	170,166	28	4	35,354	315,852
Trap Rock	13,708,461.00	52	120,857	2,001,392	151	151	742,523	9,025,229
Vermiculite	40,000.00	3	7,500	150,000	19	3	55,000	550,000
	89,451,501.00	915	1,521,416	$21,886,712	2,714	2,070	8,632,878	$83,469,346

Table 5. Summary of coal mine production in Virginia, 1988.

	Buchanan	Dickenson	Lee	Montgomery	Russell	Scott	Tazewell	Wise	Total
Number of Mines									
Auger	14	7	3	0	1	0	0	29	54
Strip	24	22	3	2	5	0	0	62	118
Surface Total	38	29	6	2	6	0	0	91	172
Tipple	15	6	1	0	0	0	3	7	32
Truck	166	54	24	0	8	1	31	57	341
Underground Total	181	60	25	0	8	1	34	64	373
Total	219	89	31	2	14	1	34	155	545
Tonnages									
Auger	40,656	104,182	78,529	0	245	0	0	173,334	396,946
Strip	1,304,298	1,069,862	93,072	5,553	80,088	0	0	4,992,820	7,545,693
Surface Total	1,344,955	1,174,044	171,601	5,553	80,333	0	0	5,166,154	7,942,639
Tipple	9,249,973	2,449,970	1,190,929	0	0	0	539,812	1,921,691	15,352,375
Truck	9,174,309	4,376,472	1,203,840	0	280,315	121,902	2,614,018	5,298,777	23,069,633
Underground Total	18,424,282	6,826,442	2,394,769	0	280,315	121,902	3,153,830	7,220,468	38,422,008
Total	19,769,236	8,000,486	2,566,370	5,553	360,648	121,902	3,153,830	12,386,622	46,364,647
Mining Methods									
Underground									
Longwall									
Tipple	6,382,678	1,219,226	1,126,776	0	0	0	0	942,894	9,671,574
Truck	0	449,729	0	0	0	0	0	0	449,729
Total	6,382,678	1,668,955	1,126,776	0	0	0	0	942,894	10,121,303
Continuous Miner									
Tipple	2,867,295	1,230,744	64,153	0	0	0	539,812	978,797	5,680,801
Truck	8,143,468	3,434,371	1,186,891	0	274,997	121,902	2,199,973	5,291,715	20,653,317
Total	11,010,763	4,665,115	1,251,044	0	274,997	121,902	2,739,785	6,270,512	26,334,118
Other									
Tipple	0	0	0	0	0	0	0	0	0
Truck	1,030,841	492,372	16,949	0	5,317	0	414,044	7,062	1,966,586
Total	1,030,841	492,372	16,949	0	5,317	0	414,044	7,062	1,966,586
Underground Total	18,424,282	6,826,442	2,394,769	0	280,315	121,902	3,153,830	7,220,468	38,422,008
Surface									
Auger	40,656	104,182	78,529	0	245	0	0	173,334	396,946
Strip	1,304,298	1,069,862	93,072	5,553	80,088	0	0	4,992,820	7,545,693
Surface Total	1,344,954	1,174,044	171,601	5,553	80,333	0	0	5,166,154	7,942,639

Table 6. Summary of coal mining in Virginia, by coal bed, 1988 (*short tons*)*.

	Buchanan	Dickenson	Lee	Montgomery	Russell	Scott	Tazewell	Wise	Total
Aily	0	0	0	0	0	0	0	73,826	73,826
Big Fork	0	0	0	0	45,247	0	0	0	45,247
Blair	1,289,359	0	0	0	0	0	0	565,614	1,794,973
Campbell Creek	99,784	0	0	0	0	0	0	934,914	1,034,699
Cedar Grove	155,259	0	0	0	0	0	0	112,798	268,047
Clintwood	48,164	515,294	16,919	0	0	0	0	1,947,744	2,523,151
Cove Creek	0	0	0	0	0	121,902	0	0	121,902
Dorchester	433,804	730,495	34,850	0	0	0	0	3,427,426	4,656,375
Eagle	829,875	54,192	0	0	0	0	0	0	884,059
Greasy Creek	0	0	0	0	0	0	639,671	0	639,671
Hagy	511,848	0	0	0	0	0	0	0	511,848
High Splint	0	0	0	0	0	0	0	223,245	223,245
Jawbone	2,501,919	925,449	0	0	110,065	0	0	185,544	3,723,977
Kelly	0	94,499	0	0	0	0	0	753,503	848,202
Kennedy	1,313,650	0	0	0	47,237	0	0	0	1,360,887
Lower Banner	66,061	1,782,096	0	0	0	0	0	799	1,848,956
Lower Horsepen	0	0	0	0	0	0	89,672	0	89,672
Low Splint	0	0	110,764	0	0	0	0	638,676	749,440
Lower Seaboard	0	0	0	0	0	0	539,812	0	539,812
Lower St. Charles	0	0	146,574	0	0	0	0	0	146,574
Lyons	0	8,978	0	0	0	0	0	445,827	454,895
Merrimac	0	0	0	5,553	0	0	0	0	5,553
Morris	0	0	0	0	0	0	0	120,535	120,535
Middle Seaboard	0	0	0	0	0	0	20,615	0	20,615
Pardee	0	0	214,101	0	0	0	0	680,346	894,447
Phillips	0	0	235,487	0	0	0	0	222,185	457,673
Pinhook	0	0	0	0	0	0	0	16,423	16,423
Pocahontas #3	9,111,650	0	0	0	0	0	248,330	0	9,359,980
Pocahontas #5	0	0	0	0	0	0	150,823	0	150,823
Raven	855,264	742,922	0	0	152,402	0	413,350	121,185	2,295,124
Splashdam	2,326,011	959,545	0	0	0	0	0	107,851	3,393,407
Taggart	0	0	1,199,637	0	0	0	0	608,153	1,807,791
Taggart Marker	0	0	0	0	0	0	0	129,805	129,805
Tiller	216,796	249,944	0	0	0	0	147,772	0	614,512
Upper Banner	0	1,907,072	5,583	0	5,696	0	0	408,774	2,325,126
Upper Horsepen	0	0	0	0	0	0	903,785	0	903,785
Upper Standiford	0	0	322,887	0	0	0	0	722,448	1,045,335
Wax	0	0	279,538	0	0	0	0	0	279,538
	19,769,236	8,000,466	2,566,370	5,553	350,646	121,902	3,153,830	12,386,622	46,364,647

* Coal bed and county totals may differ slightly because of rounding.

Table 7. Summary of coal employment in Virginia, 1988.

	Buchanan	Dickenson	Lee	Montgomery	Russell	Scott	Tazewell	Wise	Total
Production Employees									
Auger	38	22	35	0	2	0	0	83	180
Strip	434	227	31	5	37	0	0	881	1,615
Surface Total	472	249	66	5	39	0	0	964	1,795
Tipple	1,662	740	124	0	0	0	150	567	3,263
Truck	2,645	1,083	345	0	114	30	537	1,294	6,048
Underground Total	4,307	1,823	469	0	114	30	687	1,881	9,311
Total	4,779	2,072	535	5	153	30	687	2,845	11,106
Man Days									
Auger	1,620	2,135	7,556	0	10	0	0	8,523	19,844
Strip	92,606	45,738	7,274	591	6,180	0	0	190,677	343,066
Surface Total	94,226	47,873	14,830	591	6,190	0	0	199,200	362,910
Tipple	398,835	167,066	31,000	0	0	0	37,800	140,510	775,211
Truck	469,752	231,719	62,269	0	15,493	6,900	112,240	270,690	1,169,063
Underground Total	858,587	398,785	93,269	0	15,493	6,900	150,040	411,200	1,944,274
Total	962,813	446,658	108,099	591	21,683	6,900	150,040	610,400	2,307,184
Man Hours									
Auger	15,506	16,246	63,490	0	80	0	0	72,413	167,735
Strip	551,457	347,866	61,112	7,800	56,275	0	0	1,616,807	2,641,317
Surface Total	566,963	364,112	124,602	7,800	56,355	0	0	1,689,220	2,809,052
Tipple	3,663,152	1,408,388	237,456	0	0	0	313,112	1,005,327	6,627,435
Truck	4,124,114	1,744,988	1,167,627	0	143,047	54,451	867,072	2,054,930	10,176,229
Underground Total	7,787,266	3,153,376	1,425,083	0	143,047	54,451	1,180,184	3,060,257	16,803,664
Total	8,354,229	3,517,486	1,549,685	7,800	199,402	54,451	1,180,184	4,749,477	19,612,716
Production Wages									
Auger	327,902	173,712	1,283,159	0	977	0	0	437,542	2,223,292
Strip	6,088,107	4,407,796	1,262,968	15,782	380,888	0	0	21,399,192	33,554,733
Surface Total	6,416,009	4,581,508	2,546,127	15,782	381,865	0	0	21,836,734	35,778,025
Tipple	48,747,018	19,269,736	4,806,710	0	0	0	5,125,231	20,031,308	97,980,003
Truck	56,174,151	21,931,020	7,663,780	0	1,929,265	647,864	11,278,603	29,772,246	129,395,931
Underground Total	104,921,169	41,200,756	12,470,490	0	1,929,265	647,864	16,403,834	49,803,556	227,376,934
Total	111,337,178	45,782,264	15,016,617	15,782	2,311,130	647,864	16,403,834	71,640,290	263,154,959
Office Employees									
Auger	3	0	0	0	0	0	0	0	3
Strip	5	12	0	2	6	0	0	71	96
Surface Total	8	12	0	2	6	0	0	71	99
Tipple	21	10	6	0	0	0	0	18	55
Truck	115	40	12	0	7	0	15	65	254
Underground Total	136	50	18	0	7	0	15	83	309
Total	144	62	18	2	13	0	15	154	408
Office Wages									
Auger	1,080	0	0	0	0	0	0	0	1,080
Strip	40,484	69,954	0	18,400	91,928	0	0	1,931,841	2,152,607
Surface Total	41,564	69,954	0	18,400	91,928	0	0	1,931,841	2,153,687
Tipple	588,630	201,003	188,194	0	0	0	0	590,771	1,568,598
Truck	2,184,018	970,558	119,363	0	270,162	0	336,439	1,297,068	5,177,608
Underground Total	2,772,648	1,171,561	307,557	0	270,162	0	336,439	1,887,839	6,746,206
Total	2,814,212	1,241,515	307,557	18,400	362,090	0	336,439	3,819,680	8,899,893

Table 8. Fatal accidents in coal mines, 1988.

TOTAL	5
Age:	
20 to 30	3
31 to 40	0
41 to 60	2
Total Years Mining Experience:	
0 to one year	1
One to ten years	2
Ten years and over	2
Cause:	
Rock Fall (Outside)	0
Roof Fall	3
Haulage	0
Gasoline Ignition	0
Electrical	0
Explosion	0
Machinery	2
Occupation:	
Beltman	0
Continuous Miner Operator	0
Continuous Miner Operator - Helper	1
Cutting Machine	0
Erection Worker	0
General Laborer	0
Heavy Equipment Operator	1
Longwall Jack Machine Operator	0
Longwall Jack Setter	1
Mine/Section Foreman	0
Roof Bolter	1
Roof Bolter - Helper	1

Table 9. Oil production by field and company, 1988.

Field	Company	Producing Wells Number	Bbls.
BEN HUR			
	APACO Petroleum	5	1,787.68
	Ben Hur	5	1,830.00
	Eastern States	2	2,905.00
	Mountain Empire	1	25.00
	Penn Virginia Resources	2	1,143.85
	Raintree	3	299.00
	Southern Exploration	1	1,469.01
	Stonewall Gas	1	197.00
	Witt Oil & Gas	1	408.00
ROARING FORK			
	ANR Production	26	2,435.74
ROSE HILL			
	Eastern States	1	1 34.00
	Penn Virginia Resources	2	9,244.52
	Pride Oil	1	1,857.44
	Sovereign	1	306.83
	Stonewall Gas	2	909.00
	TOTALS	54	24,952.07

Table 10. Natural gas production by company in each county, 1988.

County	Company	Number of Wells	Volume Produced (Mcf)
BUCHANAN			
	Ashland Exploration	44	588,129
	Berea Oil & Gas	2	61,223
	Cabot Oil & Gas	1	12,286
	Cities Service (Oxy)	1	23,002
	Columbia Gas	98	1,882,439
	NRM	6	54,640
	P&S	6	29,868
	Panther Creek Ltd.	2	15,241
	Peake Operating	1	55,681
	Total	161	2,722,509
DICKENSON			
	ANR Production	2	8,752
	Columbia Gas	32	771,150
	W. E. Elliott	2	36,439
	EREX	295	8,659,954
	Pine Mountain	9	75,285
	Total	340	9,551,580
RUSSELL			
	Pine Mountain	1	20,255
SCOTT			
	Penn Virginia Res.	12	367,256
TAZEWELL			
	Columbia Gas	6	187,660
	Consol Ray	14	225,230
	R&B Petroleum	2	34,156
	Scott Oil & Gas	2	48,196
	CNGD	1	4,308
	Total	25	499,550
WASHINGTON			
	Penn Virginia Res.	6	40,277
WISE			
	ANR	165	4,969,846
	EREX	18	511,257
	Total	183	5,481,103
	TOTAL	728	18,682,530

Table 11. Gas wells and footage drilled, 1988.

County	Exploratory No.	Exploratory Footage	Development No.	Development Footage	Total Footage Drilled
Buchanan	0	0	3	14,007	14,007
Dickenson	3	7,575	17	83,333	90,908
Lee	5	19,347	0	0	19,347
Pulaski	2	9,500	0	0	9,500
Scott	1	6,300	4	17,025	23,325
Washington	0	0	1	4,519	4,519
Wise	3	17,783	6	34,138	51,921
Totals	14	60,505	31	153,022	213,527

Table 12. Natural gas delivery to pipelines, 1988 (gas in Mcf).

Company	QUARTERS First	Second	Third	Fourth	Total
Columbia Natural Resources	2,475,304	2,337,638	1,550,169	1,656,828	8,019,939
Consolidated Gas Supply	216,765	172,936	184,694	183,198	757,593
East Tenn. Natural Gas Co.	3,014,809	2,112,027	1,888,367	2,631,772	9,646,975
TOTAL	5,706,878	4,622,601	3,623,230	4,471,798	18,424,507

Table 13. Reported estimated reserves of natural gas.

County	PRODUCING WELLS Number	Remaining Reserves (Mcf)	SHUT-IN WELLS Number	Remaining Reserves (Mcf)	TOTAL Number	Remaining Reserves (Mcf)
Buchanan	161	34,685,211	15	1,560,000	176	36,245,211
Dickenson	340	72,114,554	11	3,113,789	351	75,228,343
Lee			14	1,443,558	14	1,443,558
Russell	1	64,325	1	100,000	2	164,325
Scott	12	2,481,197	5	414,000	17	2,895,197
Tazewell	25	2,043,597			25	2,043,597
Washington	6	296,943	2	310,119	8	607,062
Wise	183	67,041,008	20	3,356,000	203	70,397,008
TOTAL	728	178,726,835	68	10,297,466	796	189,024,301

WISE COUNTY

ANR Production Co. drilled one successful developmental well in the Coeburn field. Total depth was 5040 feet.

EREX, Inc. drilled two successful developmental wells in the Coeburn field. Total footage drilled was 10,952 feet.

Amvest Oil and Gas began an exploration program in a new field near Wise, Virginia. There were three successful wildcats and three successful off-set wells drilled in 1988. Total footage drilled was 17,783 for the exploratory wells and 18,146 for the developmental wells.

PIPELINE CONSTRUCTION

In Buchanan County, Columbia Gas Corp. constructed a feeder line of 125 feet of two-inch and 225 feet of four-inch diameter pipe to connect one well to its existing pipeline.

In Dickenson County, EREX, Inc. constructed 24,351 feet of two-inch, 1325 feet of three-inch, 3799 feet of four-inch and 1182 feet of twelve-inch diameter pipe to connect 20 wells within the Nora field.

Penn Virginia Resources added 8228 feet of four-inch and 2980 feet of two-inch pipe in Scott County with 1500 feet of two-inch pipe added in Washington County to connect three wells to its existing system in the Early Grove field.

In Wise County, ANR Production Co. constructed 148,125 feet of six-inch, 926 feet of eight-inch, and 2924 feet of four-inch diameter pipe to connect four wells in the High Knob field to its present system. In addition, 25,480 feet of pipeline constructed of two-inch diameter plastic pipe was laid to conduct a deliverability test for four ANR Production Co. wells that are near the Nora field.

EREX, Inc. laid 36,494 feet of four-inch, 11,317 feet of three-inch, and 5364 feet of two-inch diameter pipe to connect the six wells in the Coeburn field to its present pipeline system.

INDUSTRIAL AND METALLIC COMMODITIES

CEMENT

Three companies, one each in Warren and Botetourt Counties and in the City of Chesapeake, produce cement in Virginia. Riverton Corporation in Warren County produces masonry cement at their plant north of Front Royal (Figure 1). There, crushed limestone (Edinburg Formation) is calcined, hydrated, and mixed with portland cement from out-of-state sources. Sales are made to building supply dealers in Virginia and surrounding states. Roanoke Cement Company operates a plant in western Botetourt County. The facility manufactures portland cement from locally mined limestone and shale and iron scale from Roanoke Electric Steel Company. Burned calcium and iron aluminate clinker is manufactured in five coal-fired kilns and ground into cement. Three-fourths of the cement is sold to ready-mix companies. LaFarge Calcium Aluminate, Inc. operates a cement manufacturing plant in the City of Chesapeake. Cement clinker is imported, ground, and made into six types of calcium aluminate cement at the facility. The advantages of this cement include rapid hardening, resistance to wear and corrosion, and the capacity to be used under a wide range of temperatures.

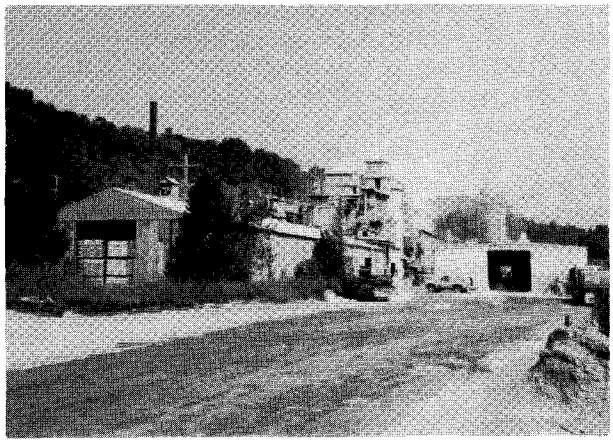

Figure 1. Bagging plant for masonry cement at Riverton Corporation, Riverton, Warren County.

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Residual and transported clay, weathered phyllite and schist, and shale are used as raw material to produce almost one-half billion bricks in Virginia annually when all the

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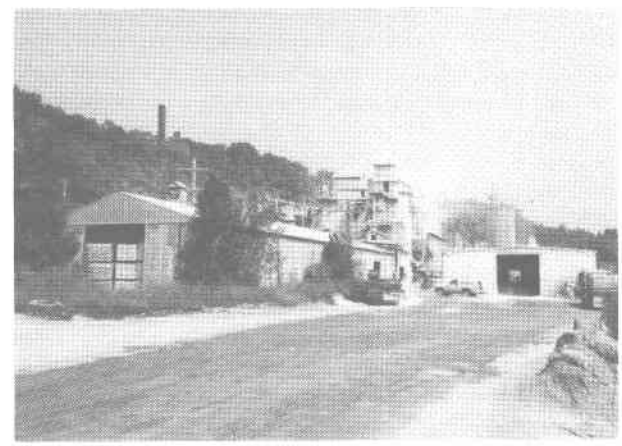

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Table 14. Virginia well completions, 1988.

County	No.	Permit No.	Operator	Well Name	7.5' Quadrangle	Latitude	Longitude	Well Class	Total Depth (feet)	Formation at T.D.	Producing Formation*	Initial Flow (Mcfd)	Final Flow (Mcfd)
Buchanan	BU-232	1,249	Ashland Exploration	Elswick A #1	Harman	13700'S 37 22 30	7125'W 82 10 00	D	4356	Dev	Bl, B	34	1860
	BU-233	1,250	Ashland Exploration	Elswick A #2	Harman	11350'S 37 22 30	6325'W 82 10 00	D	4495	Dev	B, Maxon	40	692
	BU-239	1,145	Ashland Exploration	Ritter-Rogers #1	Patterson	11750'S 37 20 00	10320'W 81 52 30	D	5156	Dev	B	18	188
Dickenson	DI-271	877	Philadelphia Oil Co.	P-233	Haysi	3330'S 37 10 00	9140'W 82 15 00	D	4738	Dev	B	0	1020
	DI-303	920	Philadelphia Oil Co.	P-239	Haysi	13300'S 37 12 30	9875'W 82 15 00	D	4932	Dev	B	0	1289
	DI-400	1,089	Philadelphia Oil Co.	P-428	Clintwood	13050'S 37 12 30	510'W 82 25 00	D	5646	Wildcat Valley ss	B, Dev	26	875
	DI-404	1,093	Philadelphia Oil Co.	P-400	Clintwood	13465'S 37 15 00	3246'W 82 22 30	WC	2691	Blue-stone			P & A
	DI-405	1,098	Philadelphia Oil Co.	P-338	Haysi	11610'S 37 10 00	3650'W 82 20 00	D	5025	Dev	B, Dev	0	1601
	DI-410	1,107	Philadelphia Oil Co.	P-393	Haysi	13040'S 37 15 00	10270'W 82 17 30	D	4724	Dev	B, U Dev	Show	479
	DI-417	1,126	Philadelphia Oil Co.	P-388	Haysi	11700'S 37 15 00	5520'W 82 20 00	D	4531	Dev	B	60	493
	DI-423	1,143	Philadelphia Oil Co.	P-462	Haysi	7700'S 37 10 00	7375'W 82 20 00	D	4920	Dev	Bl, B	260	515, 1409
	DI-424	1,147	PECO Resources	P-466	Caney Ridge	3487'S 37 07 30	3638'W 82 22 30	D	4802	Dev	Bl, B	60	1174, 133
	DI-425	1,148	PECO Resources	P-468	Caney Ridge	10269'S 37 02 30	729'W 82 22 30	D	5152	Dev	B	44	442
	DI-428	1,153	EREX, Inc.	P-467	Caney Ridge	5490'S 37 07 30	1780'W 82 22 30	D	4761	Dev	R, B, U Dev	60	492, 60
	DI-430	1,155	EREX, Inc.	P-471	Haysi	11875'S 37 12 30	1350'W 82 20 00	D	4828	Dev	Bl, B	60	1765, 852
	DI-431	1,158	EREX, Inc.	PC-1	Caney Ridge	15020'S 37 05 00	2725'W 82 22 30	WC	2750	Blue-stone	Pocahontas	0	27
	DI-432	1,159	EREX, Inc.	P-335	Haysi	1350'S 37 10 00	11430'W 82 15 00	D	4796	Dev	B, Dev	103	603
	DI-433	1,166	EREX, Inc.	P-381	Haysi	9100'S 37 12 30	7340'W 82 17 30	D	4743	Dev	B	60	894
	DI-434	1,172	EREX, Inc.	P-444	Nora	4300'S 37 07 30	11110'W 82 20 00	D	4875	Dev	Bl, B	119	2054, 620
	DI-435	1,188	EREX, Inc.	PC-101	Nora	8210'S 37 05 00	3690'W 82 15 00	WC	2134	Poca-hontas	Pocahontas, Lee	0	157
	DI-436	1,192	EREX, Inc.	P-300	Haysi	15110'S 37 10 00	8775'W 82 20 00	D	5336	Dev	B, Dev	0	972
	DI-437	1,194	EREX, Inc.	P-464	Haysi	2080'S 37 10 00	11415'W 82 17 30	D	4849	Dev	B, U Dev	44	292
	DI-438	1,203	EREX, Inc.	P-476	Haysi	2560'S 37 12 30	4025'W 82 20 00	D	4675	Dev	B, U Dev	22	1880

* Abbreviations: B=Berea; BL=Big Lime; UML Dev.=Upper, Middle, Lower Devonian; R=Ravencliff; W=Weir

Table 14. Virginia well completions, 1988 (continued).

County	No.	Permit No.	Operator	Well Name	7.5' Quadrangle	Latitude	Longitude	Well Class	Total Depth (feet)	Formation at T.D.	Producing Formation*	Initial Flow (Mcfd)	Final Flow (Mcfd)
Lee	LE-160	1,182	Penn Va. Resources	8827	Rose Hill	700'S 36 40 00	7720'W 83 20 00	WC	4400	Knox		Show	P & A
	LE-161	1,186	Penn Va. Resources	8810	Rose Hill	14000'S 36 42 30	7175'W 83 17 30	WC	4041	Knox	Knox	30	60
	LE-162	1,190	Penn Va. Resources	8829	Rose Hill	12200'S 36 42 30	2700'W 83 20 00	WC	2641	Trenton	Trenton	500	40 80PD
	LE-163	1,193	Penn Va. Resources	8828	Rose Hill	13300'S 37 40 00	10950'W 83 17 30	WC	5065	Knox			P & A
	LE-165	1,205	Penn Va. Resources	8840	Back Valley	5900'S 36 37 30	11300'W 83 20 00	WC	3200	Knox			Eval
Pulaski	PU-08	1,139	Valley Basin Gas Association	Neuhoff #2	Radford North	4800'S 37 10 00	1050'W 80 35 00	WC	4500	Price			P & A
	PU-09	1,140	Valley Basin Gas Association	Kegley #2	Pulaski	170'S 37 07 30	30'W 80 47 30	WC	5000	Price			P & A
Scott	SC-26	1,142	Penn Va. Resources	8714	Mendota	10500'S 36 40 00	2700'W 82 20 00	D	4113	Price	Price	3925	3925
	SC-27	1,151	Penn Va. Resources	8806	Mendota	7150'S 36 40 00	1350'W 82 20 00	D	4110	Price	Little Valley, Price	100	1517, 24
	SC-28	1,157	Penn Va. Resources	8807	Mendota	12300'S 36 40 00	2900'W 82 20 00	D	4248	Price	Price	1078	1078
	SC-29	1,176	Penn Va. Resources	8818	Mendota	11700'S 36 40 00	5100'W 82 20 00	WC	6300	Dev			P & A
	SC-30	1,178	Penn Va. Resources	8819	Mendota	13600'S 36 40 00	5700'W 82 20 00	D	4554	Price			P & A
Washington	WA-12	1,173	Penn Va. Resources	8808	Mendota	3175'S 36 50 00	700'W 82 17 30	D	4519	Price	Price	0	94
Wise	WS-263	1,164	EREX, Inc.	P-349	Coeburn	8975'S 36 57 30	5600'W 82 25 00	D	5371	Dev	Bl, B U Dev		215, 1078
	WS-265	1,167	ANR Production Co.	10967	Wise	10900'S 36 55 00	4275'W 82 30 00	D	5040	Wildcat Valley ss.	B, U & L Dev	0	774
	WS-267	1,175	EREX, Inc.	P-343	Coeburn	7190'S 36 57 30	4680'W 82 25 00	D	5581	Dev	Bl, B, U Dev	15	304, 1195
	WS-268	1,177	Amvest Oil & Gas	#3 Glamorgan	Pound	9700'S 37 02 30	4800'W 82 32 30	WC	6175	Wildcat Valley ss.	Dev	0	358
	WS-269	1,180	Amvest Oil & Gas	#2 Glamorgan	Pound	14000'S 37 02 30	1250'W 82 35 00	WC	5365	Dev	Bl, W, Dev	0	516
	WS-273	1,191	Amvest Oil & Gas	#1 Glamorgan	Pound	15130'S 37 02 30	4575'W 82 35 00	D	6141	Wildcat Valley ss.	Bl	15	508
	WS-274	1,212	Amvest Oil & Gas	#5 Glamorgan	Wise	2990'S 37 00 00	8760'W 82 32 30	WC	6243	Wildcat Valley ss.			Eval
	WS-275	1,218	Amvest Oil & Gas	#7 Glamorgan	Wise	1780'S 37 00 00	980'W 82 35 00	D	6130	Wildcat Valley ss.			Eval
	WS-276	1,225	Amvest Oil & Gas	#6 Glamorgan	Wise	2780'S 37 00 00	4090'W 82 35 00	D	5875	Wildcat Valley ss.			Eval

plants are operating at full capacity. The clay-material industry in the western part of the state mines Paleozoic-age shale, with the primary end product being face brick. Face-brick producers in the central-to-eastern part of Virginia mine Triassic-age shale and clay residuum in Orange and Prince William Counties and Precambrian-age schist and residual and transported clay in Amherst, Brunswick, Chesterfield, Greensville, and Henrico Counties.

Lightweight aggregate is produced in Botetourt, Buckingham, and Pittsylvania Counties. Weblite Corporation in Botetourt County mines shale from the Rome Formation to produce lightweight aggregate by the sintering process, using semi-anthracite waste coal from Montgomery County to fire the kilns. They utilize about 100 tons of coal per day to yield a lightweight-product having a weight as low as 31 lb/ft^3 for particle sizes of 5/16 to 3/4 inches. Solite Corporation in northern Buckingham County uses the Arvonia Slate to produce lightweight aggregate. Triassic-age shale is used by Virginia Solite Company southwest of Danville, Pittsylvania County, to obtain a similar product.

Clay from the Cold Spring kaolin deposit in southeastern Augusta County is utilized intermittently by James River Limestone Company, Inc. to mix with crushed dolomite at their operation near Buchanan, Botetourt County to produce various grades of filler material and as an ingredient in white cement.

Bennett Mineral Company in the Walkerton area of King and Queen County in eastern Virginia mines and processes montmorillonite clay to produce an industrial and sanitary absorbent. The facility uses wood wastes as a plant fuel to dry the clay in a rotary kiln.

FELDSPAR

The Feldspar Corporation operates a mine and plant near Montpelier in Hanover County in east-central Virginia and produces a material marketed as "Virginia aplite," which is sold to the glass industry. The "aplite" improves the workability of the molten glass and imparts a chemical stability to the finished glassware. Feldspar is mined from medium- to coarse-grained meta-anorthosite by open pit methods. The rock is trucked to the plant adjacent to the mine for crushing, grinding, classifying, and drying (Figure 2). After this processing, the aplite is stored in silos. Clay minerals are removed by gravity concentration. The heavy minerals in the feldspar (ilmenite, rutile, and sphene) are removed by electrostatic processing and magnets. These minerals were stockpiled until the early 1980s but are currently being placed in settling ponds. The processed feldspar is shipped by truck and rail to markets in New Jersey, Pennsylvania, Ohio, and Indiana.

Clay and silt, with a high percentage of kaolinite and mica, has accumulated in settling ponds. This "tailings" waste material was evaluated in the mid-1960s and was found to be suitable for use in face brick and drain tile; the material fires dark brown to gray. Fines may have potential as a flux material for the brick industry. About 75,000 to 100,000 tons of this material are added to settling ponds per year.

Feldspar in Amherst County is marketed as aggregate by the W. W. Boxley Company, Blue Ridge Stone Corporation, Piney River Quarry. The fines that result from the crushing of feldspar are stockpiled. Feldspar has been mined from several pegmatite bodies in the Piedmont province in the past, including those in Amelia and Bedford Counties.

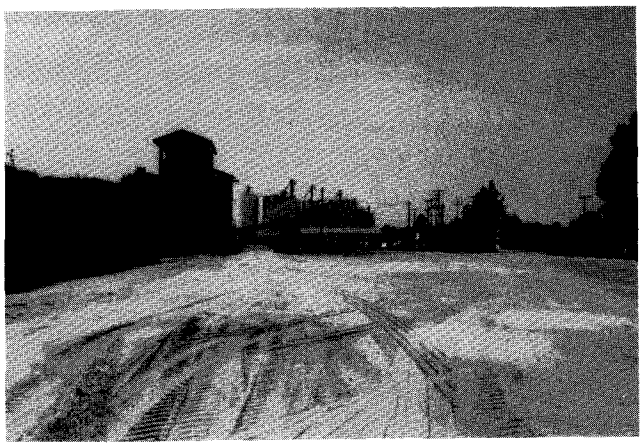


Figure 2. Processing plant for glass-grade feldspar at The Feldspar Corporation, Montpelier, Hanover County.

GEM STONES

Mines and collectors in Virginia generated an estimated value of $20,000 of natural gem stones in 1988. The Morefield pegmatite in Amelia County is open to the public for collecting on a fee basis by Piedmont Mining Company; the company also mines and sells "hand picked" mica. Blue-green amazonstone, beryl, topaz, tantalite, tourmaline, and zircon are some of the minerals found in the pegmatite. Hopkins Enterprises opened a fee basis collecting operation in Patrick County in southern Virginia. Staurolite crystals (fairystone crosses) are the main interest of collectors at this site.

GYPSUM

U.S. Gypsum Company operates a mine and plant in the southwestern part of the state and a processing plant in Norfolk. The underground mine is located at Locust Cove, Smyth County. The Locust Cove mine is a slope-entry, multilevel operation. Isolated masses of gypsum in the Maccrady Formation are mined by a modified stoping system. The gypsum is trucked to their processing plant located at Plasterco, near Saltville, in adjacent Washington County. The Plasterco plant manufactures wallboard that is used in construction.

The Norfolk plant processes crude gypsum from Nova Scotia to produce wallboard and other gypsum-based products. The plant also produces a fertilizer (land plaster) for the peanut industry. The Norfolk facility receives a few shipments of anhydrite from Nova Scotia for sale to cement manufacturers. The anhydrite is used as a source of sulfur in producing cement clinker.

plants are operating at full capacity. The clay-material industry in the western part of the state mines Paleozoic-age shale, with the primary end product being face brick. Face-brick producers in the central-to-eastern part of Virginia mine Triassic-age shale and clay residuum in Orange and Prince William Counties and Precambrian-age schist and residual and transported clay in Amherst, Brunswick, Chesterfield, Greensville, and Henrico Counties.

Lightweight aggregate is produced in Botetourt, Buckingham, and Pittsylvania Counties. Weblite Corporation in Botetourt County mines shale from the Rome Formation to produce lightweight aggregate by the sintering process, using semi-anthracite waste coal from Montgomery County to fire the kilns. They utilize about 100 tons of coal per day to yield a lightweight-product having a weight as low as 31 lb/ft^3 for particle sizes of 5/16 to 3/4 inches. Solite Corporation in northern Buckingham County uses the Arvonia Slate to produce lightweight aggregate. Triassic-age shale is used by Virginia Solite Company southwest of Danville, Pittsylvania County, to obtain a similar product.

Clay from the Cold Spring kaolin deposit in southeastern Augusta County is utilized intermittently by James River Limestone Company, Inc. to mix with crushed dolomite at their operation near Buchanan, Botetourt County to produce various grades of filler material and as an ingredient in white cement.

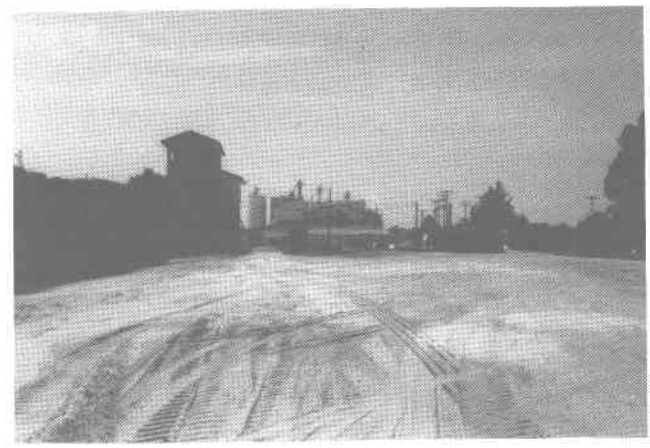
Bennett Mineral Company in the Walkerton area of King and Queen County in eastern Virginia mines and processes montmorillonite clay to produce an industrial and sanitary absorbent. The facility uses wood wastes as a plant fuel to dry the clay in a rotary kiln.

FELDSPAR

The Feldspar Corporation operates a mine and plant near Montpelier in Hanover County in east-central Virginia and produces a material marketed as "Virginia aplite," which is sold to the glass industry. The "aplite" improves the workability of the molten glass and imparts a chemical stability to the finished glassware. Feldspar is mined from medium- to coarse-grained meta-anorthosite by open pit methods. The rock is trucked to the plant adjacent to the mine for crushing, grinding, classifying, and drying (Figure 2). After this processing, the aplite is stored in silos. Clay minerals are removed by gravity concentration. The heavy minerals in the feldspar (ilmenite, rutile, and sphene) are removed by electrostatic processing and magnets. These minerals were stockpiled until the early 1980s but are currently being placed in settling ponds. The processed feldspar is shipped by truck and rail to markets in New Jersey, Pennsylvania, Ohio, and Indiana.

Clay and silt, with a high percentage of kaolinite and mica, has accumulated in settling ponds. This "tailings" waste material was evaluated in the mid-1960s and was found to be suitable for use in face brick and drain tile; the material fires dark brown to gray. Fines may have potential as a flux material for the brick industry. About 75,000 to 100,000 tons of this material are added to settling ponds per year.

Feldspar in Amherst County is marketed as aggregate by the W. W. Boxley Company, Blue Ridge Stone Corporation, Piney River Quarry. The fines that result from the crushing of feldspar are stockpiled. Feldspar has been mined from several pegmatite bodies in the Piedmont province in the past, including those in Amelia and Bedford Counties.



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IRON-OXIDE PIGMENTS

Virginia is one of four states that produce natural iron-oxide pigments. Hoover Color Corporation in Pulaski County produces ocher, umber, and sienna. The company is the only operation in the United States producing sienna. Raw materials are mined by open pit methods from deposits near the contact of the Erwin Formation with the overlying Shady Dolomite. Deposits, which may be associated with Cambrian-age gossans, are concentrated in pockets with insoluble clay and iron oxide. Some iron is also concentrated by precipitation from groundwater. The raw material is trucked to the company plant at Hiwassee where it is pulverized, dried, ground, air separated, blended, and packaged prior to shipping. The finished product, used as a coloring agent in a variety of products, is shipped throughout the United States and to Canada and Mexico. Virginia Earth Pigments Company mines a small quantity of iron oxide from the Brubaker No. 1 mine in southeastern Wythe County. The majority of this material is sold to Hoover Color Corporation.

Blue Ridge Talc Company, Inc. imports crude iron-oxide pigments from a supplier near the Great Lakes. The pigments are ground and calcined for use in paints and fertilizers and for cement and mortar coloring. Their markets are both domestic and foreign.

KYANITE

Kyanite, an aluminum silicate, was first produced in Prince Edward County in the 1920s. Since September, 1986, Virginia is the only state producing kyanite. The majority of the world's kyanite is produced by Kyanite Mining Corporation from their deposit in Buckingham County. The company produces a concentrate grade with a maximum of 61.8 percent alumina and a minimum iron content of 0.16 percent. Calcined kyanite is converted to mullite at temperatures greater than 3000 degrees Fahrenheit. The mullite is a super-duty refractory with a pyrometric cone equivalent of 36 to 37. Products, which are sold in 35, 48, 100, 200, and 325 mesh sizes, are used in the refractory, ceramic, glass, metallurgical, and foundry industries. Mullite aids ceramics and glass to resist cracking, warping, slagging, and deforming from high temperatures.

Kyanite Mining Corporation operates two surface mines and processing plants in central Buckingham County, one at Willis Mountain and one at East Ridge (Figure 3). Kyanite-bearing quartzite is quarried from open pits, run through primary crushers, a log washer to remove clay, and onto the classifiers to remove kyanite. The material then passes through a rod mill which reduces it to a minus 35-mesh size, and then through froth flotation cells where the kyanite is skimmed off. The kyanite is de-watered and dried; the high temperature of the drier converts the sulfide minerals that are present in the quartzite to oxides. Pyrite is converted to ferrous iron oxide (Fe_3O_4) or magnetite, which is then removed by magnetic separators and stockpiled.

The Willis Mountain plant processes the raw kyanite which is then trucked to the East Ridge facility for calcining. Mullite is ground and bagged at the company's Dillwyn Plant and raw kyanite is ground and bagged at Willis Mountain.

Approximately 40 percent of the production is shipped through the ports in the Hampton Roads area to customers worldwide. The company also markets a by-product sand obtained from the processing of kyanite. It is sold for golf course, masonry, and concrete sand and for other applications.

Figure 3. View from southwest side of Willis Mountain, site of a Kyanite Mining Corporation quarry and plant, Buckingham County.

LIME

Virginia's lime industry is located in Frederick, Giles, Shenandoah, and Warren Counties. Production in 1988 was 741,000 short tons valued at almost 34-million dollars. In northwestern Virginia, two companies, W. S. Frey Company, Inc. and Chemstone Corporation quarry and calcine the high-calcium New Market Limestone; Riverton Corporation in Warren County quarries and calcines limestone from the Edinburg Formation (Figure 4). Shenvalley Lime Corporation in Stephens City, Frederick County purchases quicklime and produces a hydrated lime. Two companies in western Giles County (APG Lime Corporation and Virginia Lime Company) operate underground mines in the Five Oaks Limestone. Both companies calcine the Five Oaks Limestone in rotary kilns. Principal sales are to the paper and steel industries.

The paper industry uses lime for regeneration of sodium hydroxide and for the neutralization of sulfate water. Lime is used in iron furnaces to remove impurities and to purify water. During the last few years, lime has been used to neutralize acid mine water. It is used also for mason's lime, sewage treatment, and agricultural purposes.

LITHIUM

Cyprus Foote Mineral Company processes lithium carbonate from brines in Nevada with calcium hydroxide from various sources to produce lithium hydroxide at their Sunbright plant in Scott County. Lithium hydroxide is used in

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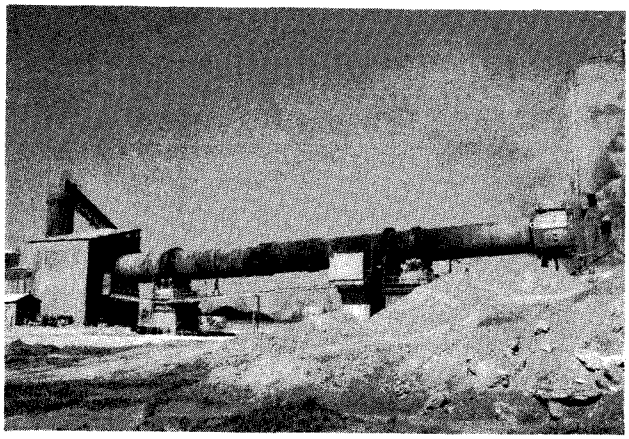


Figure 4. High-calcium lime is produced from a coal-fired rotary kiln at W.S. Frey Company, Inc., Clearbrook, Frederick County.

multipurpose grease. In the past, limestone from an underground mine at the Sunbright site was utilized in the manufacturing process and a calcium carbonate precipitate was formed as a waste product. This material remains on the site and may have a potential use. The approximate analysis of the material is 43 to 50 percent $CaCO_3$, 3 to 6 percent $Ca(OH)_2$, and 40 to 48 percent H_2O.

MAGNETITE

Reiss Viking Corporation in Tazewell County processes out-of-state magnetite for use in cleaning coal. The magnetite is obtained from New York, with minor amounts being imported. Magnetite is dried, ground in a ball mill, classified, and graded by percentage of material passing a 325- mesh sieve; grades produced are 40, 70, 90, 96.5, and 99. The magnetite is marketed in Virginia and Kentucky. In the coal cleaning process, magnetite is mixed with water to form a heavy-media slurry into which raw coal is fed. The heavier impurities sink with the magnetite whereas the lighter coal floats and is recovered. About two pounds of magnetite are used for every ton of coal that is cleaned.

MANGANESE

Eveready Battery Company, Inc. operates a manganese processing facility in the City of Newport News. Manganese ore, imported from Mexico and Africa, is dried, crushed, ground, and shipped to other company facilities for use in the manufacture of batteries.

MICA

Asheville Mica Company and an affiliate, Mica Company of Canada, process mica at facilities in Newport News. The crude mica is imported from Madagascar and India. Asheville Mica Company produces fabricated plate-mica; Mica Company of Canada uses splittings from the Asheville operations to produce reconstituted plate-mica. Mica has been produced in the past from pegmatite bodies in several counties in Virginia, including Amelia, Henry, and Powhatan. Mica is mined and "hand picked" in Amelia County by Piedmont Mining Company.

ORNAMENTAL AGGREGATE

Dolomite and quartzite from Botetourt and Rockbridge Counties are marketed as exposed-aggregate materials. Rock materials, such as black limestone (Edinburg Formation) from the Valley and Ridge province and greenstone from the Piedmont province, have been used for terrazzo in the past. Exposaic Industries, Inc. in Spotsylvania County utilizes a variety of rock materials for exposed panels, including greenstone from Albemarle County and Triassic-age sandstone from Culpeper County.

Several rock types have been utilized for ornamental aggregate in past years. Vein quartz was quarried in Albemarle, Buckingham, Fauquier, Fluvanna, Greene, and Rappahannock Counties, and quartz pebbles were extracted from the flood plain along the Mattaponi River in Caroline County.

PERLITE

Manville Sales Corporation operates a plant at Woodstock in Shenandoah County to expand perlite (volcanic glass with high water content and "onion-skin" appearance) obtained from Grants, New Mexico. Expanded perlite is used in the manufacture of roof insulation board, which is marketed throughout the eastern United States.

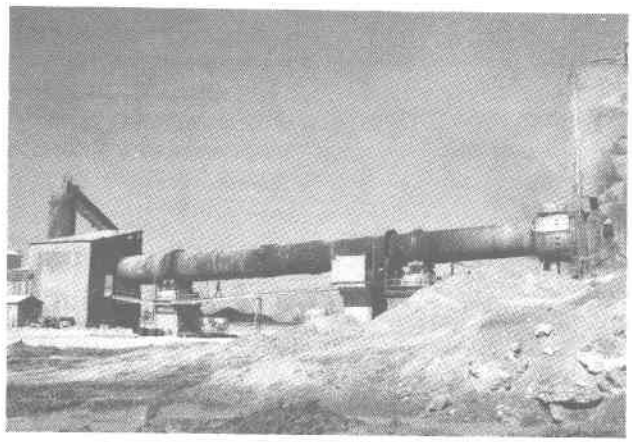
PHOSPHATE ROCK

TexasGulf, Inc. ships phosphate rock from its Lee Creek operation in North Carolina to Glade Spring, Washington County. It is then transported by truck to the TexasGulf plant in Saltville, Smyth County. A coal-fired rotary kiln is used to defluorinate the phosphate rock. The product is marketed as a poultry and animal feed supplement in the southern and midwestern states.

SAND AND GRAVEL

CONSTRUCTION

Construction sand and gravel producers accounted for the majority of the 12.5-million short tons of material produced in 1988. Sand and gravel is extracted from river terraces and dredged from the rivers of the major drainages in central and eastern Virginia. Large tonnages of construction



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sand and gravel from an area southeast of Fredericksburg are shipped by rail into the northern Virginia-Washington, D.C. market area. A large portion of the production by Sadler Materials Corporation and Tarmac Virginia, Inc., both located near Richmond, is barged down the James River to the Norfolk area. Shipments are also made by rail and truck to the western part of the state. Construction sand (concrete and masonry) is produced also from operations that crush and process sandstone. Sayers Sand Company in Smyth County produces construction sand from the Erwin Formation.

INDUSTRIAL SAND

J.C. Jones Sand Company at Virginia Beach produces industrial sand for use in foundry-casting applications and as a traction medium. Traction sand is produced also in Dickenson County by Howard L. Daniels Sand Company. Glass sand is produced by Unimin Corporation near Gore, Frederick County, from the Ridgeley Sandstone of Devonian age. CED Process Minerals Inc., Gore, recrystallizes sand purchased from U.S. Silica in a rotary kiln to produce cristobalite. The product is marketed as a fine grit.

STONE

CRUSHED

Crushed limestone, dolomite, sandstone, quartzite, granite, gneiss, diabase, basalt, greenstone, amphibolite, slate, "Virginia aplite," and marble, valued at more than 326-million dollars, were produced in Virginia in 1988. Virginia was the fourth leading producer of crushed stone in 1988, behind Pennsylvania, Florida, and Texas.

Limestone, dolomite, shale, and sandstone and quartzite producers are located in the Valley and Ridge and Plateau provinces in the western part of the state (Figures 5 and 6). Principal end uses of these products are for roadstone, concrete aggregate, asphalt stone, and agricultural applications. Mine safety dust (335,000 short tons in 1980) is produced in southwest Virginia from limestone. The more recent production figures for safety dust have been combined with those for acid-water treatment material in the stone production total (Table 1 & 2). Safety dust is used in coal mines to prevent explosions. The dust should contain less than 5 percent SiO_2 and 100 percent should pass through 20 mesh, with 70 percent passing through minus 200 mesh. Finely-ground dolomite and limestone is marketed also by several operations for use as a filler material.

Shale is excavated in Frederick and Rockingham Counties for use as local roadstone and fill material. Sandstone and quartzite are quarried in Carroll, Culpeper, Pittsylvania, Rockbridge, and Wythe Counties for the production of roadstone, concrete aggregate, asphalt stone, and manufactured fine aggregate.

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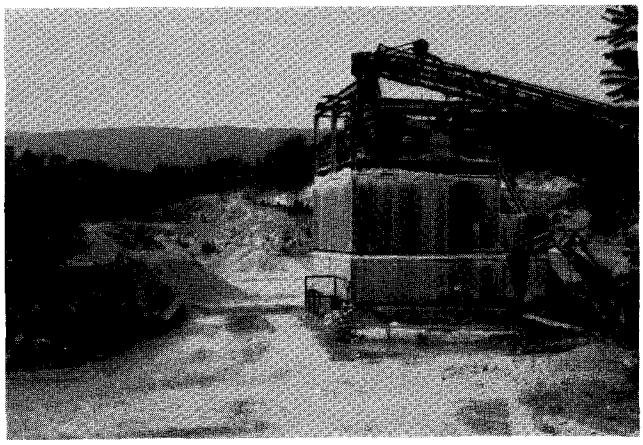

Figure 5. Limestone crushing plant at C.S. Mundy Quarries, Inc., Broadway Plant, Rockingham County.

Figure 6. Crushed stone is produced from basalt, as shown in this highwall at the Vulcan Materials Company, Sanders Quarry, Warrenton, Fauquier County.

Fines produced at granite quarries in the southern part of Virginia have been used as a low-grade fertilizer in central Virginia (D. Via, personal communication). Chemical analyses of granitic materials from Brunswick and Nottoway Counties in the southern Piedmont province indicate K_2O (potash) percentages are greater than 10 percent. Potash silicates (orthoclase feldspar) common in igneous and metamorphic rocks release potassium upon weathering.

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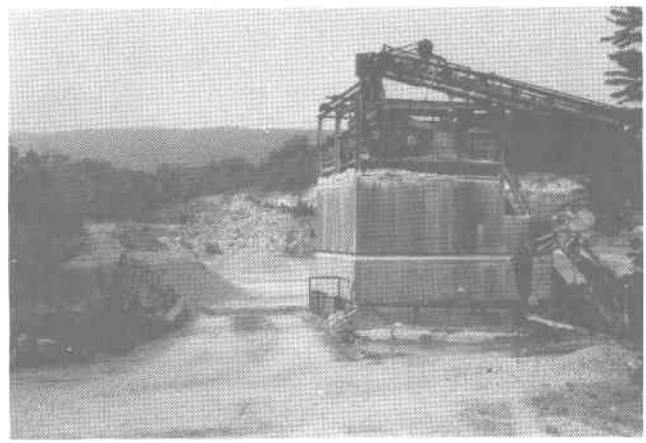

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DIMENSION

Dimension stone production was valued at 2.9-million dollars in 1988. Slate, diabase, quartzite, and soapstone were quarried in the Piedmont province; slate was the leading stone type quarried, in terms of volume (cubic feet) and value. LeSueur-Richmond Slate Corporation mines slate from two quarries in the Arvonia area of Buckingham County (Figure 7). Arvonia slate production dates from the late 1700s when slate was quarried for use as roofing tile for the State Capitol in Richmond. Slate producers supply the building trade with a variety of products ranging from material for exterior applications, such as roofing tile and flooring, to interior uses such as flooring, hearths, and sills. Diabase for use as monumental stone is produced by Virginia Granite Company in southern Culpeper County (Figure 8). Quartzite used as flagging material was extracted from two quarries by Carter Stone Company in Campbell County, south of Lynchburg, and by Mower Quarries in Fauquier County, north of Warrenton. The New Alberene Stone Company, Inc. is quarrying soapstone from a quarry at Alberene and expects to open a new quarry in late 1989. Their products include soapstone fireplaces, woodstoves, cooking ware, and other products of solid soapstone.

Figure 7. Quarrying of dimension slate at LeSueur-Richmond Slate Corporation, Arvonia, Buckingham County.

SULFUR

Elemental sulfur is recovered from hydrogen sulfide gas by the Claus process during crude-oil refining by Amoco Oil Company. The refinery is adjacent to the York River, near Yorktown. Crude oil is heated in a furnace and fed under pressure into a cylinder where it vaporizes, expands, and condenses into liquid. Hydrogen sulfide is produced and is converted into elemental sulfur. About 50 short tons of sulfur are produced per day and are marketed for use in fertilizer.

Figure 8. Diabase blocks for monumental stone, being removed at Virginia Granite Corporation, Buena, Culpeper County.

VERMICULITE

Virginia is one of three states in which vermiculite, a hydrated magnesium-iron-aluminum silicate, is mined. Virginia Vermiculite, Ltd. operates an open-pit mine and processing facility near Boswells Tavern in Louisa County. The vermiculite is mined with a backhoe and front-end loader and transported by trucks to the adjacent plant where pieces greater than four inches across are removed. They are washed and run through a rod mill to shear the vermiculite thin. Biotite, feldspar, and other impurities are removed by washing over a riffle table. The vermiculite is further concentrated by flotation cells, dewatered, dried in a rotary kiln, and screened to produce four basic sized products. Most of the crude vermiculite is shipped by rail in unexfoliated form to North Carolina, West Virginia, Ohio, and other eastern states. Uses for the exfoliated material include packing, insulation, lightweight aggregate, and potting material.

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1989

COAL[3]

A total of 43,855,231 short tons (Table 3) of coal were produced from the southwest Virginia coalfields (Plate 1) in Buchanan, Dickenson, Lee, Russell, Scott, Tazewell, and Wise Counties from approximately 507 surface and underground mines. The majority of the bituminous coal from the southwest fields was produced from the Pocahontas No. 3 coal bed. Included in this production total are 5008 short tons of semi-anthracite coal produced from two additional surface mines in the Valley Coal field, Montgomery County. Tables 15 through 18 provide production data by county and coal bed, employment statistics, and coal mine fatal-accident data.

OIL AND GAS[4]

Crude oil production totaled 21,271 barrels in 1989, a decline of 15 percent from the 1988 production of 24,952 barrels. Production was by nine companies from 43 wells in three fields (Plate, Table 19). The average price paid by refineries for Virginia oil in 1989 was 18.17 dollars per barrel.

Natural gas production in 1989 was a total of 17,935,376 Mcf from 752 wells in Buchanan, Dickenson, Russell, Scott, Tazewell, Washington, and Wise Counties (Table 20). This was a 4 percent decline from the 1988 production of 18,682,530 Mcf. The average price paid to Virginia gas producers in 1989 was 2.19 dollars per Mcf.

DRILLING ACTIVITY

In 1989, a total of 40 wells (exploratory and developmental) were drilled in Virginia. This represents an 11 percent decrease from the 45 wells drilled in 1988. The total footage drilled in 1989 was 178,993 (Table 21). In 1989 the average depth for three exploratory wells was 6337 feet and 4324 feet for the 37 developmental wells. Of the 40 wells drilled during 1989, 36 were completed as producers and four were dry holes. Table 22 provides 1989 well completion data.

BUCHANAN COUNTY

Edwards & Harding Petroleum Co. drilled four successful developmental wells in the Glick field with a total footage of 21,049. CDG Development of Pikeville, Kentucky drilled to a depth of 189 feet before abandoning a developmental well in the Hurley field.

DICKENSON COUNTY

EREX, Inc. commenced development of the Nora Coalbed Methane Gas field in 1989. A total of 11 wells were drilled as coal-bed methane (CBM) wells in two different areas of Dickenson County. Total developmental footage drilled for the eight conventional and 11 coal-bed methane wells was 66,535.

EREX, Inc. drilled an exploratory well on the Sourwood Mountain anticline in the eastern part of Dickenson County. Total depth was 5184 feet. The well was unsuccessful in finding gas in the conventional gas bearing zones of the Mississippian-age formations and was plugged back; they successfully tested a new Pennsylvanian-age coal seam.

LEE COUNTY

Penn Virginia Resources plugged and abandoned an exploratory well drilled to a depth of 3692 feet. The well was located south of the Rose Hill oil field.

SCOTT COUNTY

A developmental well was completed in the Early Grove gas field by Penn Virginia Resources. The total depth for this well was 4403 feet.

TAZEWELL COUNTY

EXCEL Energy drilled a successful developmental well in the Berwind field. The total depth for this well was 5581 feet.

WESTMORELAND COUNTY

Texaco drilled an exploratory well in the Taylorsville basin of eastern Virginia (Plate). The well was plugged and abandoned after drilling into basement complex rock of an undetermined age. The total footage of this well was 10,135. Seismic exploratory work has continued in the Taylorsville basin.

WISE COUNTY

ANR Production Co. successfully completed two wells in the Roaring Fork field, three wells in the High Knob field and two wells in the Nora field. EREX, Inc. drilled two developmental wells in the Coeburn field. Penn Virginia Resources plugged and abandoned a developmental well in the Roaring Fork field that was purchased from ANR Production Co.

METALLIC COMMODITIES

The exploration for heavy minerals was continued by several companies in the southern Piedmont and western Coastal Plain provinces of Virginia. Large acreages have been leased in Dinwiddie, Greensville, and Sussex Counties. Approximately 8-million tons of heavy minerals have been discovered. Ilmenite, leucoxene, rutile, and zircon comprise nearly 80 percent of the heavy-mineral concentrate; the value of these minerals will be several billion dollars.

[3] Information supplied by Division of Mines, 219 Wood Avenue, Big Stone Gap, Virginia 24219.
[4] Information supplied by Division of Gas and Oil, P. O. Box 1416, Abingdon, Virginia 24210.

Table 15. Summary of coal mine production in Virginia, 1989.

	Buchanan	Dickenson	Lee	Montgomery	Russell	Scott	Tazewell	Wise	Total
Number of Mines									
Auger	3	3	8	0	1	0	0	14	29
Strip	30	26	7	2	4	0	1	53	123
Surface Total	33	29	15	2	5	0	1	67	152
Tipple	14	9	1	0	3	0	3	4	34
Truck	169	50	24	0	8	1	28	43	323
Underground Total	183	59	25	0	11	1	31	47	357
Total	216	88	40	2	16	1	32	114	509
Tonnages									
Auger	4,334	35,660	49,616	0	47	0	0	76,357	166,014
Strip	995,644	831,775	216,817	5,008	80,426	0	0	4,667,461	6,797.131
Surface Total	999,979	867,434	266,433	5,008	80,473	0	0	4,743,818	6,963,145
Tipple	8,982,102	1,623,089	1,329,019	0	0	0	345,554	1,523,499	13,803,263
Truck	9,196,986	3,335,578	1,464,263	0	526,398	40,861	2,582,535	5,942,202	23,088,822
Underground Total	18,179,088	4,958,667	2,796,070	0	526,398	40,861	2,928,089	7,465,701	36,894,873
Total	19,179,066	5,826,102	3,059,714	5,008	606,871	40,861	2,928,089	12,209,519	43,855,231
Mining Methods									
Underground									
Longwall									
Tipple	6,072,080	988,452	1,195,379	0	0	0	0	846,614	9,102,525
Truck	0	291,284	0	0	0	0	0	0	291,284
Total	6,072,080	1,279,736	1,195,379	0	0	0	0	846,614	9,393,809
Continuous Miner									
Tipple	2,910,022	634,637	133,640	0	0	0	345,554	676,885	4,700,738
Truck	8,644,749	2,688,384	1,341,468	0	526,398	40,861	2,523,195	5,552,249	21,317,304
Total	11,554,771	43,323,021	1,475,108	0	526,398	40,861	2,868,749	6,229,134	26,018,042
Other									
Tipple	0	0	0	0	0	0	0	0	0
Truck	552,237	355,910	125,583	0	0	0	59,340	389,953	1,483,022
Total	552,237	355,910	125,583	0	0	0	59,340	389,953	1,483,022
Underground Total	18,179,088	4,958,667	2,796,070	0	526,398	40,861	2,928,089	7,465,701	36,894,873
Surface									
Auger	4,334	35,660	49,616	0	47	0	0	76,357	166,014
Strip	995,644	825,431	216,817	5,008	80,426	0	0	4,635,040	6,758,366
Surface Total	999,978	861,091	266,433	5,008	80,473	0	0	4,711,397	6,924,380

Table 16. Summary of coal mining in Virginia, by coal bed, 1989 (short tons)*.

	Buchanan	Dickenson	Lee	Montgomery	Russell	Scott	Tazewell	Wise	Total
Aily	0	0	0	0	0	0	0	70,974	70,974
Big Fork	0	0	0	0	44,785	0	0	0	44,785
Blair	1,292,526	0	0	0	0	0	0	503,921	1,796,448
Campbell Creek	61,588	0	0	0	0	0	0	581,281	642,869
Cedar Grove	2,334	0	0	0	0	0	0	25,329	27,663
Clintwood	20,959	447,225	9,712	0	0	0	0	1,866,215	2,344,771
Cove Creek	0	0	0	0	0	40,861	0	0	40,861
Dorchester	189,284	520,937	0	0	0	0	0	3,578,192	4,288,413
Eagle	803,379	45,529	0	0	0	0	0	0	850,008
Gin Creek	0	0	1,922	0	0	0	0	0	1,922
Greasy Creek	0	0	0	0	0	0	615,676	0	615,676
Hagy	621,779	0	0	0	0	0	0	0	621,779
High Splint	0	0	0	0	0	0	0	278,439	278,439
Jawbone	2,288,694	809,472	0	0	304,819	0	3,811	298,973	3,705,768
Kelly	0	6,344	38,637	0	0	0	0	1,198,316	1,243,297
Kennedy	1,430,618	0	0	0	137,937	0	0	0	1,568,555
Lower Banner	50,730	1,104,242	0	0	2,225	0	0	2,003	1,159,200
Lower Horsepen	0	0	0	0	0	0	114,172	0	114,172
Low Splint	0	0	26,714	0	0	0	0	548,492	575,206
Lower Seaboard	0	0	0	0	0	0	345,554	0	345,554
Lower St. Charles	0	0	432,413	0	0	0	0	0	432,413
Lyons	0	0	0	0	0	0	0	385,483	385,483
Merrimac	0	0	0	5,008	0	0	0	0	5,008
Morris	0	0	0	0	0	0	0	77,657	77,657
Middle Seaboard	0	0	0	0	0	0	26,075	0	26,075
Pardee	0	0	210,590	0	0	0	0	583,832	794,422
Phillips	0	0	260,401	0	0	0	0	167,516	427,917
Pinhook	0	0	0	0	0	0	0	42,785	42,785
Pocahontas #3	8,982,102	0	0	0	0	0	274,692	0	9,256,794
Pocahontas #5	0	0	0	0	0	0	137,019	0	137,019
Raven	1,041,807	562,314	0	0	95,039	0	410,358	8,412	2,117,930
Splashdam	2,294,128	808,159	0	0	0	0	0	18,728	3,121,015
Taggart	0	0	1,382,551	0	0	0	0	849,670	2,232,221
Taggart Marker	0	0	0	0	0	0	0	16,895	16,895
Tiller	99,139	0	0	0	0	0	105,806	0	204,945
Upper Banner	0	1,520,120	0	0	22,066	0	0	354,745	1,896,931
Upper Horsepen	0	0	0	0	0	0	894,926	0	894,926
Upper Standiford	0	0	173,221	0	0	0	0	751,662	924,882
Wax	0	0	523,554	0	0	0	0	0	523,554
	19,769,236	5,826,102	3,059,714	5,008	606,871	40,861	2,928,089	12,209,519	43,855,231

* Coal bed and county totals may differ slightly because of rounding.

Table 17. Summary of coal employment in Virginia, 1989.

	Buchanan	Dickenson	Lee	Montgomery	Russell	Scott	Tazewell	Wise	Total
Production Employees									
Auger	6	6	29	0	2	0	0	24	67
Strip	248	230	79	3	34	0	0	725	1,319
Surface Total	254	236	108	3	36	0	0	749	1,386
Tipple	1,626	524	155	0	0	0	121	384	2,810
Truck	2,764	850	328	0	104	17	469	1,181	5,713
Underground Total	4,390	1,374	483	0	104	17	590	1,565	8,523
Total	4,644	1.610	591	3	140	17	590	2,314	9,909
Man Days									
Auger	111	520	1,746	0	2	0	0	1,372	3,751
Strip	35,914	45,290	10,007	864	7,447	0	0	156,527	256,049
Surface Total	36,025	45,810	11,753	864	7,449	0	0	157,899	259,800
Tipple	392,352	124,203	35,340	0	0	0	22,875	87,552	662,322
Truck	495,091	171,114	62,744	0	24,904	2,397	106,573	273,539	1,136,362
Underground Total	887,443	295,317	98,084	0	24,904	2,397	129,448	361,091	1,798,684
Total	923,468	341,127	109,837	864	32,353	2,397	129,448	518,990	2,058,484
Man Hours									
Auger	864	4,853	21,945	0	8	0	0	17,962	45,632
Strip	317,512	324,092	95,436	4,306	54,631	0	0	1,457,649	2,253,626
Surface Total	318,376	328,945	117,381	4.306	54,639	0	0	1,475,611	2,299,258
Tipple	3,664,183	1,116,170	294,388	0	0	0	187,367	681,289	5,943,397
Truck	3,996,033	1,439,167	615,241	0	199,988	20,835	807,908	2,147,935	9,227,107
Underground Total	7,660,216	2,555,337	909,629	0	199,988	20,835	995,275	2,829,224	15,170,504
Total	7,978,592	2,884,282	1,027,010	4,306	254,627	20,835	995,275	4,304,835	17,469,762
Production Wages									
Auger	6,960	53,250	394,525	0	135	0	0	253,100	707,970
Strip	3,760,861	3,513,869	1,128,590	32,690	468,084	0	0	18,968,384	27,872,478
Surface Total	3,767,821	3,567,119	1,523,115	32,690	468,219	0	0	19,221,484	28,580,448
Tipple	61,394,538	15,282,423	6,113,509	0	0	0	3,018,755	16,276,654	102,085,879
Truck	52,664,984	20,729,126	9,338,723	0	3,072,528	220,828	11,018,615	32,171,563	129,216,367
Underground Total	114,059,522	36,011,549	15,452,232	0	3,072,528	220,828	14,037,370	48,448,217	231,302,246
Total	117,827,343	39,578,668	16,975,347	32,690	3,540,747	220,828	14,037,370	67,669,701	259,882,694
Office Employees									
Auger	0	1	0	0	0	0	0	0	1
Strip	8	15	2	1	6	0	0	65	97
Surface Total	8	16	2	1	6	0	0	65	98
Tipple	24	11	5	0	0	0	0	12	52
Truck	140	18	31	0	6	1	14	43	253
Underground Total	164	29	36	0	6	1	14	55	305
Total	172	45	38	1	12	1	14	120	403
Office Wages									
Auger	0	875	0	0	0	0	0	0	875
Strip	126,100	134,665	15,000	25,000	105,959	0	0	1,540,351	1,947,075
Surface Total	126,100	135,540	15,000	25,000	105,959	0	0	1,540,351	1,947,950
Tipple	729,546	307,140	150,207	0	0	0	0	474,954	1,661,847
Truck	3,870,587	347,750	261,348	0	201,395	4,400	258,042	1,074,784	6,018,306
Underground Total	4,600,133	654,890	411,555	0	201,395	4,400	258,042	1,549,738	7,680,153
Total	4,726,233	790,430	426,555	25,000	307,354	4,400	258,042	3,090,089	9,628,103

Table 18. Fatal accidents in coal mines, 1989.

TOTAL	10
Age:	
20 to 30	6
31 to 40	1
41 to 65	3
Total Years Mining Experience:	
0 to one year	2
One to ten years	3
Ten years and over	3
? or N/A	2
Cause:	
Rock Fall (Outside)	0
Roof Fall	4
Haulage	1
Prep Plant	1
Rib Roll	1
Material	1
Machinery	2
Occupation:	
Beltman	0
Continuous Miner Operator	0
Continuous Miner Operator - Helper	1
Cutting Machine	0
Feeder Operator	1
General Laborer	0
Longwall Jack Machine Operator	0
Longwall Jack Setter	0
Mine/Section Foreman	1
Roof Bolter	2
Roof Bolter - Helper	1
Unemployed	1
Truck Driver	2
Shuttle Car Operator	1

Table 19. Oil production by field and company, 1989.

Field	Company	Wells Producing	Shut-in	Volume Bbls.
BEN HUR				
	APACO Petroleum	5	1	1,324.27
	Ben Hur Oil	5	0	2,041.00
	Eastern States	1	0	2,044.00
	Mountain Empire	0	1	0.00
	Penn Virginia Resources	3	2	1,904.11
	Southern Exploration	1	0	519.80
	Stonewall Gas	1	0	96.00
	Witt Oil & Gas	1	0	53.00
ROSE HILL				
	Penn Virginia Res.	2	0	7,400.68
	Pride Oil Company	1	0	1,830.68
	Sovereign	0	1	0.00
	Stonewall Gas	2	0	925.00
ROARING FORK				
	ANR Production	21	0	3,132.76
	TOTALS	43	6	21,271.30

Table 20. Natural gas production by company in each county, 1989.

County	Company	Number of Wells	Volume Produced (Mcf)
BUCHANAN			
	Ashland Exploration	43	567,187
	Berea Oil & Gas	1	66,057
	Cabot Oil & Gas	1	12,393
	Columbia Gas	101	2,044,604
	EHPC	3	24,119
	NRM	4	47,805
	Oxy USA	1	10,727
	P&S	6	37,567
	Panther Creek Ltd.	2	31,963
	Peake Operating	1	59,670
	Total	163	2,902,092
DICKENSON			
	ANR Production	2	112,450
	Columbia Gas	32	792,944
	W. E. Elliott	2	31,907
	EREX	311	7,257,370
	Pine Mountain	9	115,582
	Total	356	8,310,253
RUSSELL			
	Pine Mountain	1	16,077
SCOTT			
	ANR Production	1	7,280
	Penn Virginia Resources	13	174,664
	Total	14	181,944
TAZEWELL			
	CNG Development	1	4,438
	Columbia Gas	6	183,481
	Consol Ray	13	258,198
	R&B Petroleum	2	33,455
	Scott Oil & Gas	2	43,698
	Total	24	523,270
WASHINGTON			
	Penn Virginia Resources	6	29,365
WISE			
	ANR Production	170	5,404,464
	EREX	18	567,911
	Total	188	5,972,375
	TOTAL	752	17,935,376

Table 21. Gas wells and footage drilled, 1989.

County	Exploratory No.	Exploratory Footage	Development No.	Development Footage	Total Footage Drilled
Buchanan	0	0	5	21,238	21,238
Dickenson	1	5,184	19	66,535	71,719
Lee	1	3,692	0	0	3,692
Scott	0	0	1	4,403	4,403
Tazewell	0	0	1	5,581	5,581
Westmoreland	1	10,135	0	0	10,135
Wise	0	0	11	62,225	62,225
Totals	3	19,011	37	159,982	178,993

Table 22. Virginia well completions, 1989.

County	No.	Permit No.	Operator	Well Name	7.5' Quadrangle	Latitude	Longitude	Well Class	Total Depth (feet)	Formation at T.D.	Producing Formation*	Initial Flow (Mcfd)	Final Flow (Mcfd)
Buchanan	BU-244	1,243	Edwards & Harding Petroleum Co.	EH-8	Patterson	12300'S 37 17 30	12100'W 81 52 30	D	5327	Dev	B	133	1008
	BU-245	1,269	CDG Development	DB-VA-1	Hurley	5800'S 37 29 00	2200'W 82 03 00	D	189				P & A
	BU-247	1,289	Edwards & Harding Petroleum Co.	EH-11	Patterson	13050'S 37 17 30	2300'W 81 55 00	D	5180	Dev	B	189	784
	BU-248	1,295	Edwards & Harding Petroleum Co.	EH-9	Patterson	13450'S 37 17 30	9740'W 81 52 30	D	5440	Dev	B	103	400
	BU-257	1,317	Edwards & Harding Petroleum Co.	EH-16	Patterson	6450'S 37 17 30	720'W 81 52 30	D	5102	Dev	Bl, B	119	1356
Dickenson	DI-318	939	EREX, Inc.	P-257	Haysi	11700'S 37 12 30	11860'W 82 15 00	D	4788	Dev	B	0	348
	DI-439	1,213	EREX, Inc.	PC-102	Nora	9410'S 37 05 00	2680'W 82 15 00	D	2260	Lee	Penn Coal	21	103
	DI-440	1,235	EREX, Inc.	P-477	Haysi	3710'S 37 12 30	1790'W 82 20 00	D	4505	Dev	B, U Dev	15	603
	DI-443	1,247	EREX, Inc.	P-480	Clintwood	7750'S 37 12 30	9965'W 82 22 30	D	5589	Wildcat Valley ss.	Bl, B, U & L Dev	84	84, 920
	DI-444	1,252	EREX, Inc.	P-474	Haysi	6450'S 37 12 30	6775'W 82 17 30	D	4634	Dev	B	60	516
	DI-445	1,256	EREX, Inc.	P-478	Haysi	11275'S 37 12 30	8110'W 82 15 00	D	4793	Dev	B	33	3156
	DI-446	1,257	EREX, Inc.	PC-103	Nora	6370'S 37 05 00	3735'W 82 15 00	D	2255	Lee	Penn Coal	189	174
	DI-447	1,258	EREX, Inc.	PC-104	Nora	8120'S 37 05 00	1880'W 82 15 00	D	2257	Lee	Penn Coal	33	103
	DI-448	1,259	EREX, Inc.	PC-105	Nora	7650'S 37 05 00	5320'W 82 15 00	D	2310	Lee	Penn Coal	0	133
	DI-449	1,270	EREX, Inc.	PC-3	Caney Ridge	480'S 37 02 30	2680'W 82 22 30	D	2641	Lee	Penn Coal	15	60
	DI-450	1,271	EREX, Inc.	P-484	Clintwood	14990'S 37 15 00	4720'W 82 22 30	D	5609	Dev	B, U & L Dev	60	746
	DI-451	1,273	EREX, Inc.	PC-5	Caney Ridge	12500'S 37 05 00	2900'W 82 22 30	D	2559	Lee	Penn Coal	84	Show
	DI-452	1,274	EREX, Inc.	PC-2	Caney Ridge	13820'S 37 05 00	4310'W 82 22 30	D	2640	Lee	Penn Coal	21	Show
	DI-453	1,275	EREX, Inc.	PC-4	Caney Ridge	3890'S 37 05 00	1390'W 82 22 30	D	2662	Lee	Penn Coal	103	Show
	DI-454	1,282	EREX, Inc.	PC-106	Nora	11120'S 37 05 00	4220'W 82 15 00	D	2400	Lee	Penn Coal	0	Show
	DI-456	1,293	EREX, Inc.	P-488	Duty	10850'S 37 05 00	7530'W 82 07 30	WC	5184	Weir	Penn Coal		Eval

* Abbreviations: B=Berea; BL=Big Lime; UML Dev.=Upper, Middle, Lower Devonian; R=Ravencliff; W=Weir

Table 22. Virginia well completions, 1989 (continued).

County	Permit No.	Operator	Well Name	7.5' Quadrangle	Latitude	Longitude	Well Class	Total Depth (feet)	Formation at T.D.	Producing Formation*	Initial Flow (Mcfd)	Final Flow (Mcfd)
Dickenson (continued)	DI-458	1,301 EREX, Inc.	P-465	Clintwood	12280'S 37 12 30	2920'W 82 22 30	D	4617	Dev	Bl, B, Dev	267	1237
	DI-459	1,304 EREX, Inc.	P-495	Clintwood	13920'S 37 12 30	4350'W 82 22 30	D	4752	Dev	Bl, B, Dev	103	750
	DI-461	1,321 EREX, Inc.	PC-114	Nora	4650'S 37 05 00	5910'W 82 15 00	D	2170	Lee	Penn Coal	58	Show
	DI-464	1,324 EREX, Inc.	PC-128	Duty	12620'S 37 05 00	9900'W 82 12 30	D	3094	Lee	Penn Coal		Eval
Lee	LE-164	1,204 Penn Va. Resources	8830	Rose Hill	14900'S 36 40 00	8075'W 83 20 00	WC	3692	Knox		0	P & A
Scott	SC-33	1,185 Penn Va. Resources	8809	Mendota	8700'S 36 40 00	3075'W 82 20 00	D	4403	Price	Little Valley	90	73
Tazewell	TA-38	1,294 EXCEL Energy	Laforce #1	Amonate	4110'S 37 12 30	5670'W 81 40 00	D	5581	Dev	Gordon ss., B	60	373
Westmore-land	WM-3	1,246 Texaco	Wilkins #1	Dahlgren	12200'S 38 17 30	3470'W 77 00 00	WC	10,135	Basement		0	P & A
Wise	WS-245	1,085 ANR Production Co.	10933	Coeburn	3575'S 36 55 00	11225'W 82 27 30	D	5184	Wildcat Valley ss.	Bl, B, U & L Dev	0	730
	WS-256	1,128 ANR Production Co.	10153	Appalachia	6500'S 36 57 30	8300'W 82 50 00	D	6964	Wildcat Valley ss.	W, U & L Dev	0	712,
	WS-262	1,163 ANR Production Co.	10925	Wise	7350'S 36 55 00	7350'W 82 30 00	D	4505	Wildcat Valley ss.	Bl, B, U & L Dev	0	581
	WS-279	1,262 ANR Production Co.	10019	Appalachia	2850'S 36 55 00	10100'W 82 47 30	D	5685	Wildcat Valley ss.	Bl, B, U & L Dev	0	492
	WS-280	1,281 Penn Va. Resources	10274 (ANR)	Appalachia	200'S 39 00 00	7100'W 82 45 00	D	6151	Wildcat Valley ss.		Show	P & A
	WS-281	1,272 ANR Production Co.	10913	Coeburn	5750'S 36 55 00	300'W 82 27 30	D	5592	Wildcat Valley ss.	Bl, B, U & L Dev	60	1858
	WS-282	1,278 ANR Production Co.	V6 #2	Coeburn	7937'S 37 00 00	6098'W 82 25 00	D	6844	Wildcat Valley ss.	B, U Dev	0	215
	WS-283	1,279 ANR Production Co.	V6 #4	Coeburn	9399'S 37 00 00	11004'W 82 22 30	D	6130	Wildcat Valley ss.	R, B, U Dev	0	823
	WS-284	1,280 EREX, Inc.	P-344	Coeburn	6920'S 36 57 30	920'W 82 25 00	D	5414	Dev	B	267	2398
	WS-286	1,298 EREX, Inc.	P-346	Coeburn	10850'S 36 57 30	10470'W 82 22 30	D	5466	Dev	B	60	1384
	WS-288	1,305 ANR Production Co.	CO T8#6	Wise	8550'S 36 55 00	1470'W 82 30 00	D	4290	Dev	B, U Dev	0	411

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF MINES, MINERALS AND ENERGY
DIVISION OF MINERAL RESOURCES

PUBLICATION 114

COAL, OIL AND GAS FIELDS AND INDUSTRIAL AND METALLIC MINERAL INDUSTRY MAP, VIRGINIA

Palmer C. Sweet

1991

SCALE 1:1 000 000

QUARRIES — crushed stone

- Amphibolite
- Basalt and related rocks
- Diabase
- Feldspar
- Granite and related rocks
- Limestone — dolomite
- Metavolcanic rocks
- Quartzite — sandstone
- Shale
- Slate

QUARRIES — dimension stone

- Diabase
- Quartzite
- Slate
- Soapstone

PITS

- Clay
- Sand and gravel
- Schist
- Shale

PITS, MINES, AND QUARRIES WITH PROCESSING PLANTS

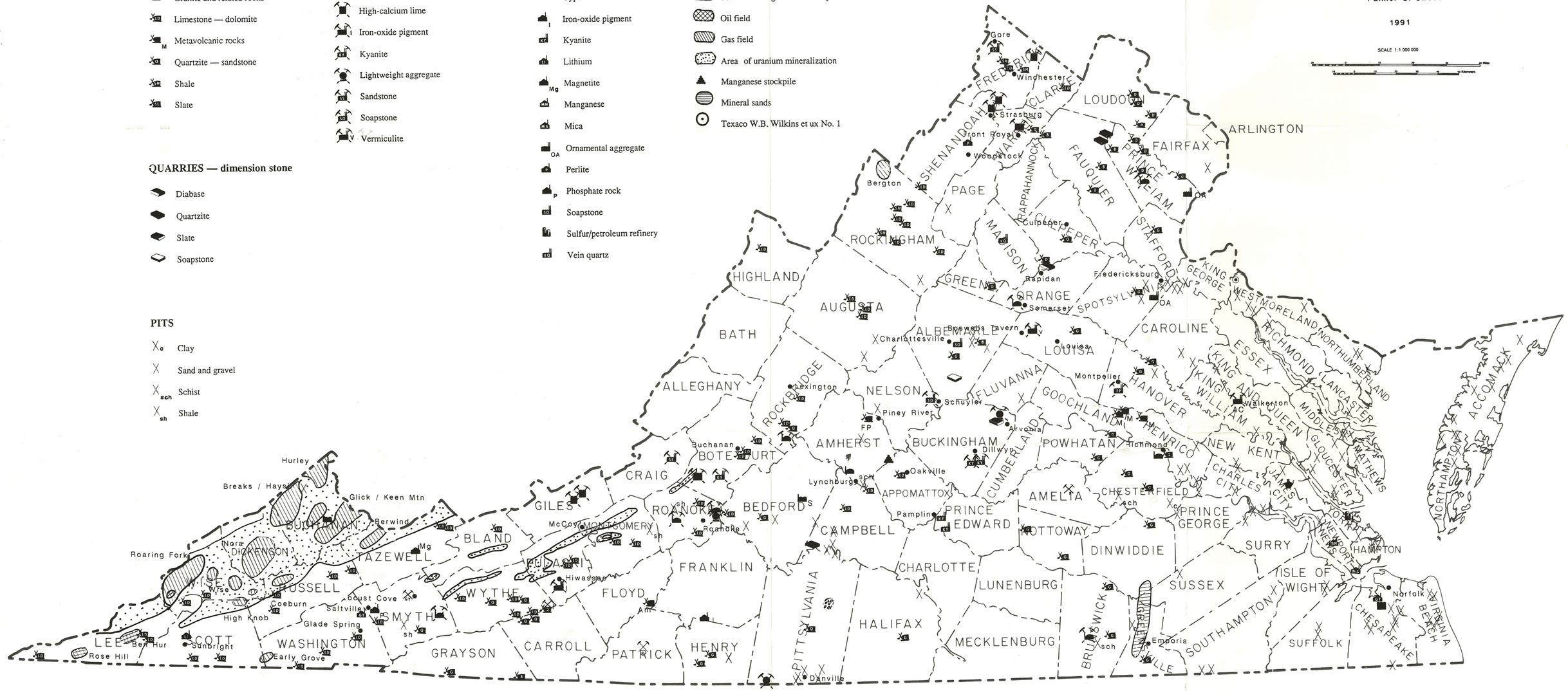
- Absorbent clay
- Brick
- Cement
- Feldspar
- High-calcium lime
- Iron-oxide pigment
- Kyanite
- Lightweight aggregate
- Sandstone
- Soapstone
- Vermiculite

PROCESSING PLANT

- Brick
- Cement
- Coke
- Coke screening
- Gypsum
- Iron-oxide pigment
- Kyanite
- Lithium
- Magnetite
- Manganese
- Mica
- Ornamental aggregate
- Perlite
- Phosphate rock
- Soapstone
- Sulfur/petroleum refinery
- Vein quartz

OTHER MINES, MINERALS, AND FUELS

- Gypsum mine
- Iron-oxide pigment mine
- Pegmatite mine
- Staurolite mine
- Southwest Virginia and Valley coalfields
- Oil field
- Gas field
- Area of uranium mineralization
- Manganese stockpile
- Mineral sands
- Texaco W.B. Wilkins et ux No. 1



COAL, OIL AND GAS, AND INDUSTRIAL AND METALLIC MINERALS INDUSTRIES IN VIRGINIA, 1988-1989 – VIRGINIA DIVISION OF MINERAL RESOURCES – PUBLICATION 114