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Special Edition

STRATIGRAPHIC DISTRIBUTION OF SELENIUM IN UPPER KANAWHA-LOWER ALLEGHENY FORMATION STRATA AT A LOCATION IN SOUTHWESTERN WEST VIRGINIA

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Reported recent findings of dissolved selenium in stream waters below mine-created valley fills in southwestern West Virginia have raised issues as to the potential impact such selenium may have upon aquatic life; whether the potential release of selenium is an inescapable result of mountain-top mining; and whether selenium enrichment is zoned such that the materials could be identified and specifically-handled, or whether it is evenly or randomly distributed throughout the stratigraphic section. Some preliminary results of limited core analyses have reportedly suggested that selenium may be fairly evenly distributed throughout the rock strata of that interval, a circumstance which would, if true, have serious implications in attempts to minimize selenium mobilization through selective handling techniques during surface mining.

This paper documents the occurrence and distribution of selenium in rock strata at a mine site in southwestern West Virginia, based on intense sampling and analysis of discrete sections of core ranging from 0.20 to 5.0 feet in thickness, from multiple boreholes over a 300 feet thick interval of strata including sandstones, shales, mudstones, coals, and intermediary and interbedded facies of these lithotypes.

Statistical evaluation of the results from over 400 samples indicates that coals, and shales situated near to coal beds, exhibit higher selenium concentrations than do other strata. Sandstones display the lowest concentrations (often non-detectable at a 0.05 mg/kg detection limit). These results, if representative of the southwest West Virginia coalfield area as a whole, suggest that selenium-enriched strata are not randomly-distributed, can be readily identified and delineated, and thus are amenable to selective handling techniques in the disposition of mine overburden.

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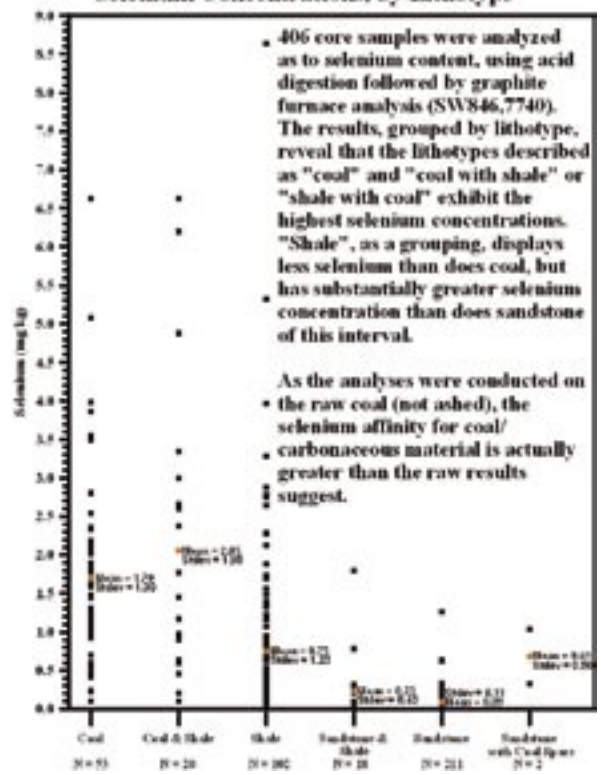
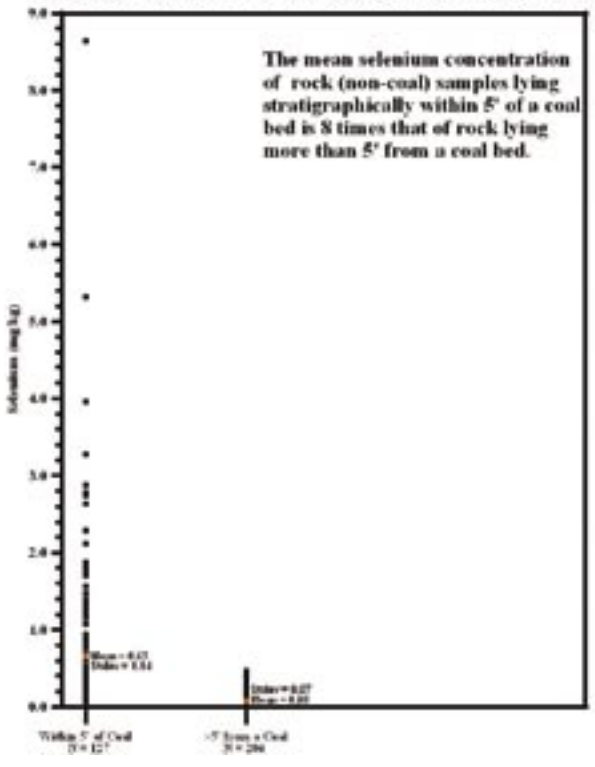
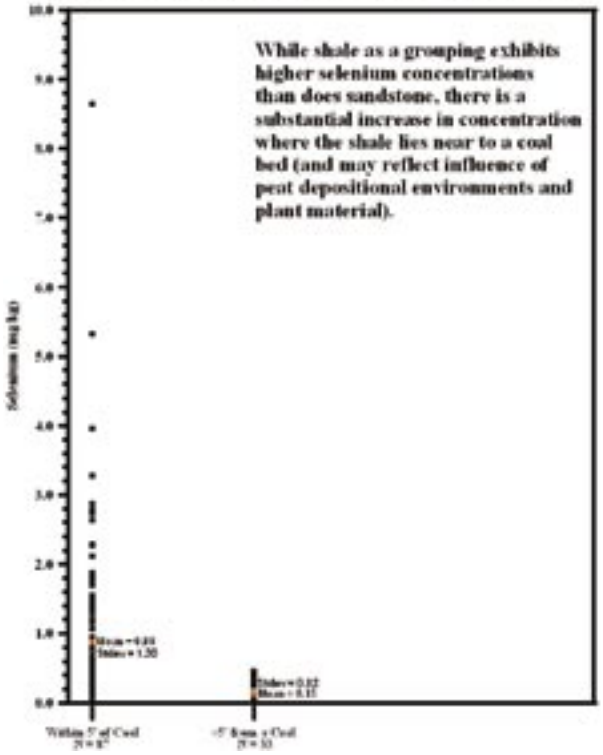
Selenium Concentrations, by Lithotype



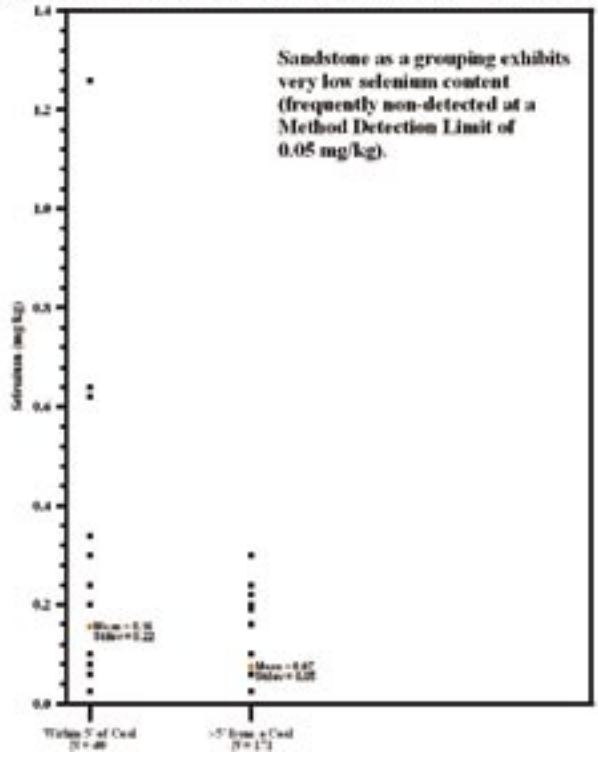
All Rock Within 5' of Coal vs All Rock >5' from Coal



Shale Within 5' of Coal vs Shale >5' from Coal



Sandstone Within 5' of Coal vs Sandstone >5' from Coal



Stratigraphic Interval

The stratigraphic interval involved in the sampling includes the No. 6 Block and No. 5 Block coals of the Allegheny (Charleston) Formation, and the Stockton and Coalburg coal beds of the Kanawha Formation. This interval is of high interest because of its economic importance and because it is the principal focus of "mountain-top mining" in southwestern West Virginia. The question of selenium distribution in rock strata that are excavated and replaced as fill during the mining process may have bearing upon the feasibility of selective handling and selective placement to prevent or minimize leaching (similar to the approaches currently taken to prevent or minimize acid drainage generation).

Sample Collection

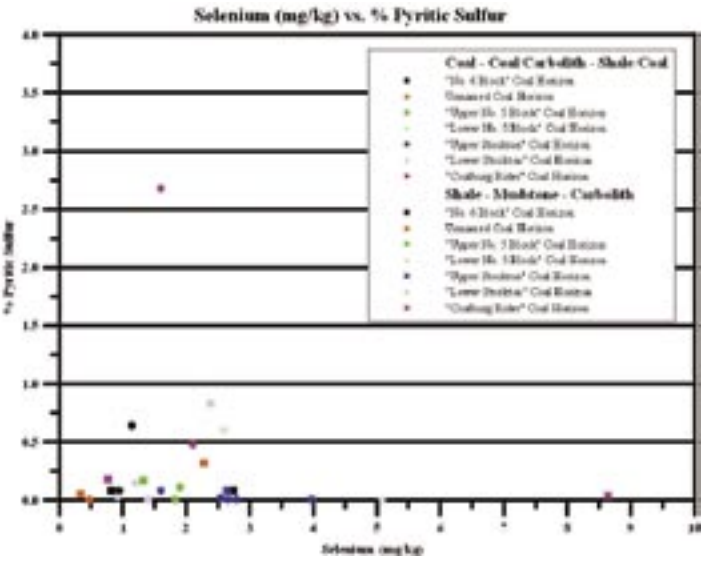
Samples were extracted from five continuous core borings. Samples were collected with each significant lithologic change, or at least one sample per five feet of section, consistent with state regulatory guidelines for sampling for Acid-Base Accounting purposes. Sampled sections ranged in thickness from 0.2 to 5.0 feet. Samples 0.5 feet or less in length were crushed in their entirety and a portion was taken for analysis. Longer samples were composited by selecting three segments per foot, crushing and blending the segments to make a composite sample for the interval, then extracting a portion for analysis.

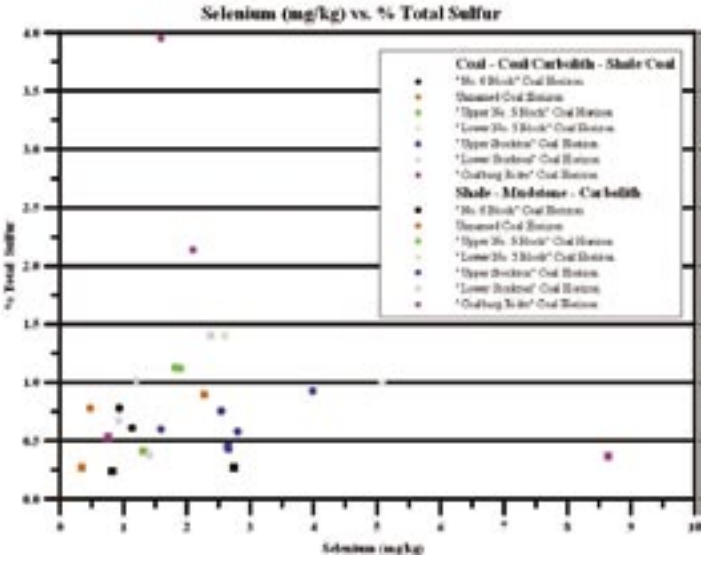
Selenium-Sulfur Relationships

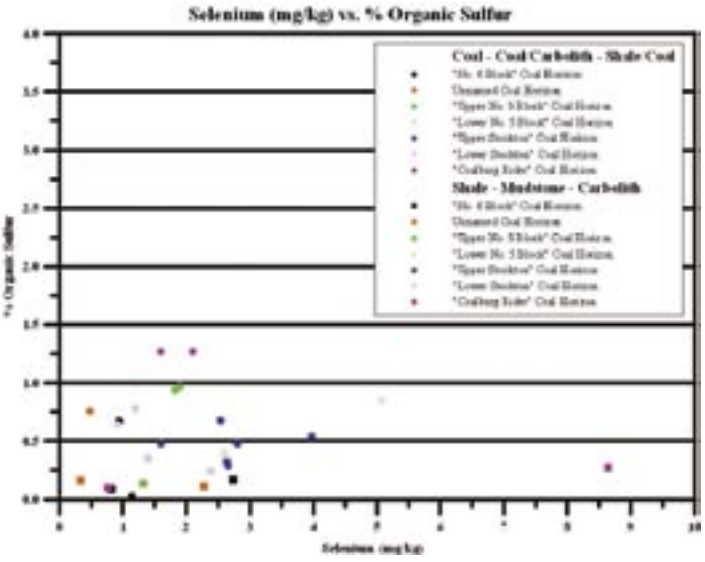
Some investigators have suggested some correlation between selenium and pyrite concentrations. The data generated in the subject investigation do not appear to support such correlation. The sulfur forms data set is much smaller than that generated for selenium concentration, but indicates no particular affinity for selenium to either pyritic or organic sulfur concentrations.

Summary and Conclusions

Extensive analyses from the 350 feet of section from the No. 6 Block through Coalburg coal horizons show selenium to be preferentially distributed in and around carbonaceous strata. Sandstones in this interval rarely contain detectable selenium. Shales contain non-detectable to very low (<0.5 mg/kg) selenium concentrations except where proximal to or associated with coal.







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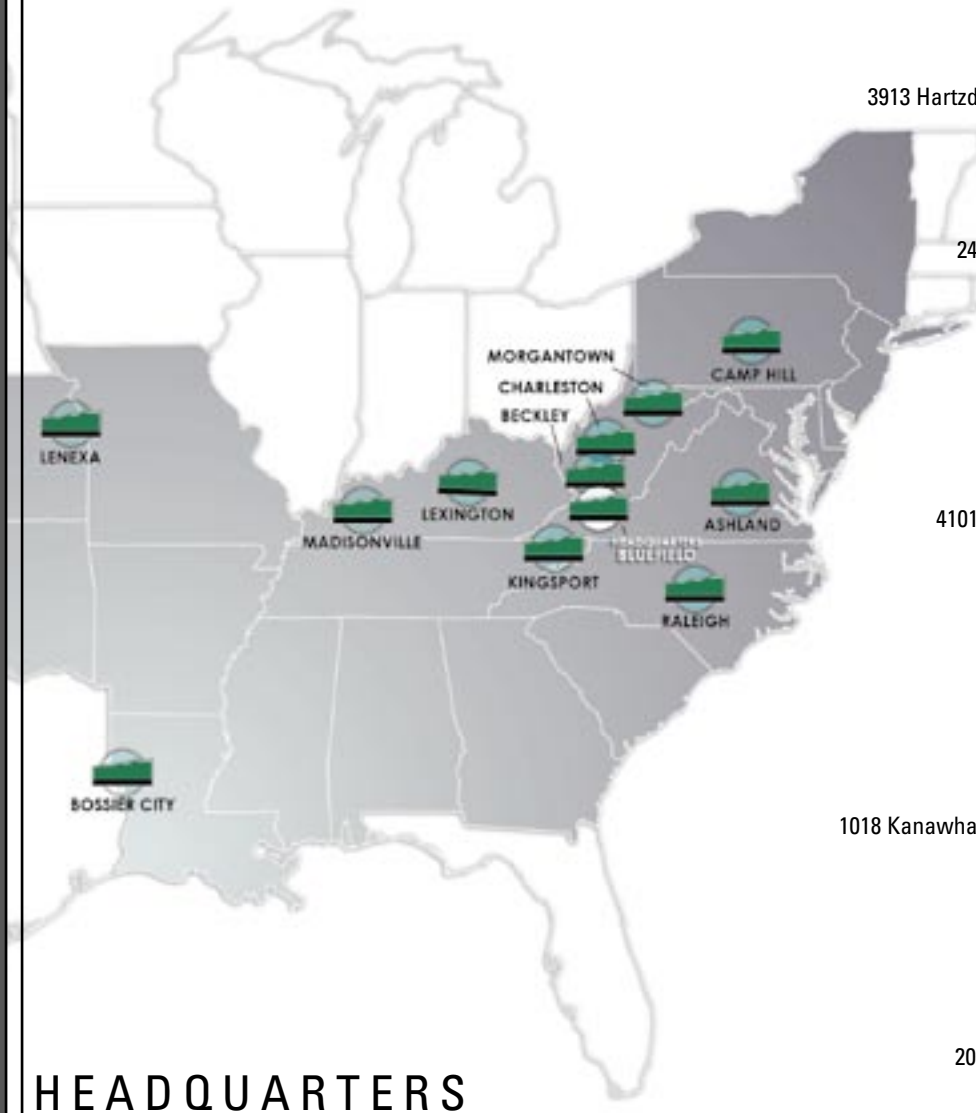

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