

Identification and Characterization of Coal Containing High Rare Earth Element Concentrations - Rocky Mountain Basin

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Abstract

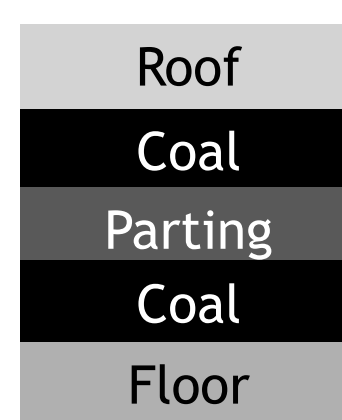
Tetra Tech, Inc. is conducting sampling and characterization of Rocky Mountain Basin coal and coal-related associated materials in search of high concentrations of Rare Earth Elements (REE) (minimum concentration of 300 parts per million (ppm)). Coal and coal-related materials are defined as run-of-mine coal; roof rock; overburden clays; shale interlayer formations; mine seam underclays; coal preparation plant refuse; etc.; and other coal-like materials as mined.

Based on previous REE work elevated REE coal and coal related lithologies have been recorded in the Colorado Raton Basin, igneous material in or adjacent to the basin also exhibited high REE content, notably in lamprophyre dikes, igneous sills, and tonsteins associated with the coals of the Raton Basin. The eastern Uinta Basin of Colorado and Utah may hold similar potential as documented quasi-commercial REE deposits are present in the Iron Hill carbonatite complex near Powderhorn, CO which is just south of the Grand Mesa in Colorado and is near many of the mining districts in the basin, as well as reported REE-enriched pegmatites near Montrose, CO.

Background

Previous investigations by Tetra Tech of the North American craton (a part of the Earth's crust that has attained stability, and has been little deformed for a prolonged period) in the Rocky Mountain Region as well as in the Rocky Mountain forelands has shown that elevated Rare Earth Elements (REE) content exists in several coal basins where igneous activity associated with anatexis, emplacement of type-A (alkaline-anhydrous magma) granitoid intrusives, development of low-temperature SEDEX structures, and late-stage extrusive volcanic activity has occurred. While these features may not be in and of themselves sources for the elevated REE occurrences that have been previously noted in coal samples found in coal basins in Colorado, (Gray et al., 2015, Bryan et al., 2015¹, Bryan et al., 2015²) the proximity of rare earth-bearing lithologies within these coal basins suggests that these areas hold a higher potential for finding REE in concentrations of greater than 300 ppm than in more quiescent regions of the craton.

Figure 1 Example of Coal Sample Cross Section



Investigation Areas

Canyon City Embayment

In the Canyon City Embayment samples were taken in Fremont County in Colorado, Raton Formation. Figure 2 shows the sample locations in the Canyon City

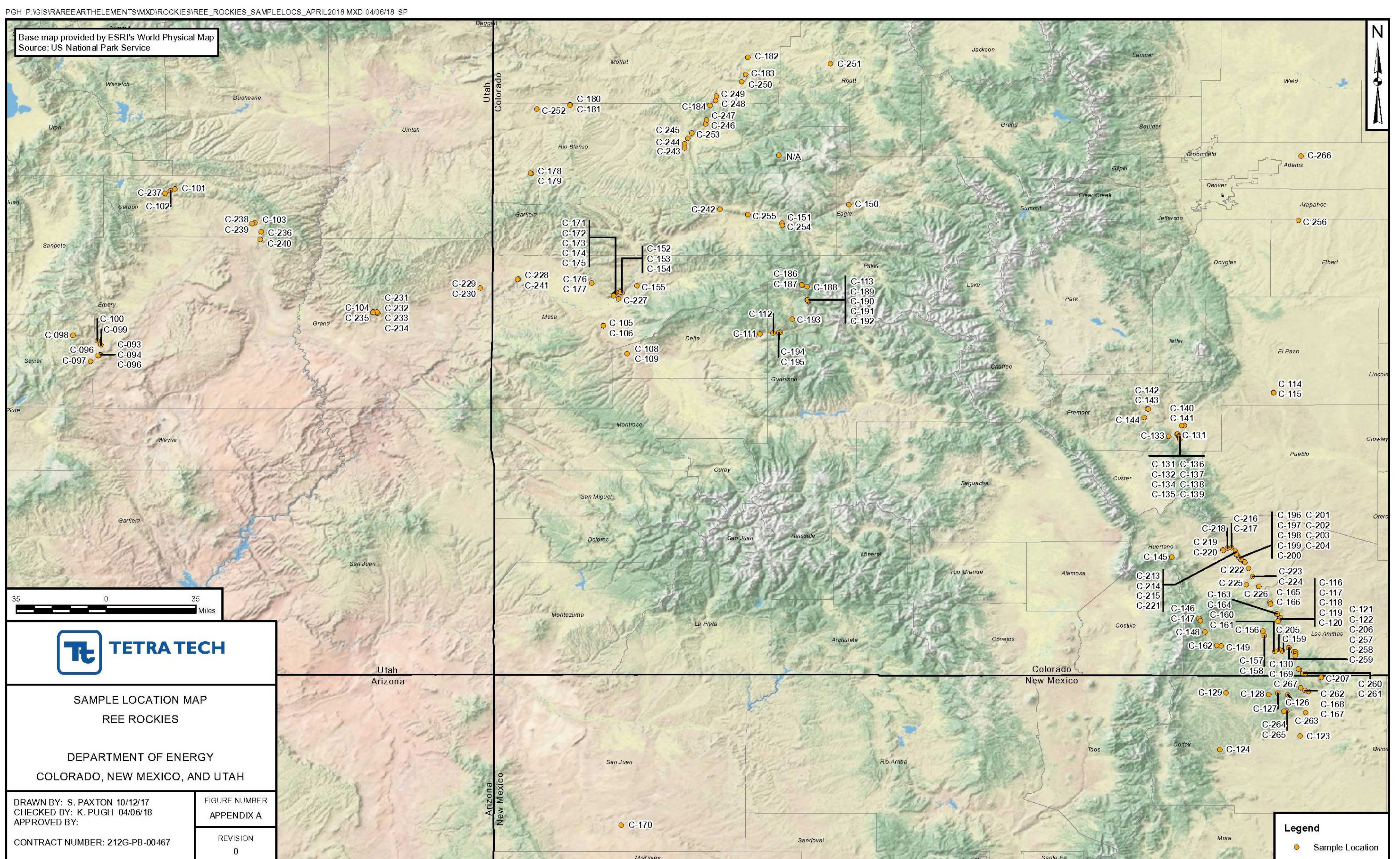
Raton Basin

In the Raton Basin samples were taken in 4 counties in New Mexico and Colorado in the Vermejo formation. Figure 2 shows the sample locations in the Raton Basin on the Colorado, New Mexico State Line. Refer to Table 1 for Results

Uinta Piceance Basin

In the Uinta basin samples were taken in 14 counties in Utah and Colorado in the Mesaverde formation. Figure 2 shows the sample locations in the Piceance Basin in Western Colorado and Utah. Refer to Table 2 for Results

Figure 2 Sample Location Map



Results to Date

Table 1 Raton Basin

Strata	Average TREE in PPM	Max TREE in PPM
Roof	252	+850
Coal	144	+400
Parting	295	+450
Floor	328	+650
Other	185	+500

Table 2 Piceance Basin

Strata	Average TREE in PPM	Max TREE in PPM
Roof	189	+800
Coal	139	+400
Parting	158	+250
Floor	194	+600
Other	192	+700

References

Bryan, R.C., Richers, D., Andersen, H.T., and Gray, T., 2015, Study on the Utilization of Portable Hand-Held XRF Spectroscopy as a Screening Tool for Rare Earth Elements in Coal and Coal Waste Products, For Leonardo Technologies Inc., Document No: 114-910178X-100-REP-R001-01, 52 p.

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Gray, T., Andersen, H.T., Bryan, R., and Richers, D., 2015, Rare Earth Occurrences Proximal to the Cretaceous/Tertiary Boundary, presented at AIChE 2015 Annual Meeting, Advances in Fossil Energy R&D, Salt Lake City, Utah