Chapter HQ

COAL QUALITY AND GEOCHEMISTRY, HANNA AND CARBON BASINS, WYOMING

By G.D. Stricker and M.S. Ellis

in U.S. Geological Survey Professional Paper 1625-A

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COAL QUALITY AND GEOCHEMISTRY, HANNA AND CARBON BASINS, WYOMING

Actively mined coal in the Hanna and Carbon Basins, Wyoming (fig. HQ-1) is considered to be a "clean coal." It is a low-contaminant, subbituminous to bituminous coal resource. The Hanna and Carbon Basins have three coalfields that contain ten coal zones: (1) the Ferris coalfield in the Hanna Basin with the Ferris 23, 25, 31, 50, and 65 coal zones, (2) the Hanna coalfield in the Hanna Basin with the Hanna 77, 78, 79, and 81 coal zones, and (3) the South Carbon coalfield in the Carbon Basin with the Johnson-107 coal zone. For the location and description of basins and coal zones, see Chapter HF-Framework Geology of Fort Union coal in the Hanna and Carbon Basins. Because there is a limited amount of data available, coal quality data for these ten assessment units have been merged together into a single unit for chemical evaluation for both basins. The unit has the following arithmetic mean values (on an as-received basis) for coal that is not presently being mined or under lease to be mined in the future: **moisture**–11.61 percent, **ash yield**–12.48 percent, **total sulfur**–0.96 percent, **calorific value**–10,090 Btu/lb, **pounds of SO_2 per million Btu**–2.07, and **moist, mineral-matter-free Btu**–11,640. This chemical evaluation unit also has the following arithmetic mean concentration (in parts per million and on whole-coal and remnant-moisture basis) for elements of environmental concern: **antimony**–0.49, **arsenic**–4.4, **beryllium**–0.36, **cadmium**–0.28, **chromium**–11, **cobalt**–2.0, **lead**–4.6, **manganese**–46, **mercury**–0.07, **nickel**–5.4, **selenium**–0.80, and **uranium**–1.9. Coal from the Hanna Basin is developed from 3 mines and utilized for electric power generation. Currently, there is no coal production from the Carbon Basin.

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1999 Resource assessment of selected Tertiary coal beds and zones in the Northern Rocky Mountains and Great Plains region, U.S. Geological Survey Professional Paper 1625-A

Table HQ-1 is a summary of coal quality in the Hanna and Carbon Basins, Wyoming.

Much of the coal quality data in these two basins is proprietary. Both proprietary and public data are used in the summary data table. Only public data is shown on location maps and other graphic displays. A common problem in statistical summaries of trace-element data arises when element values are below the limits of detection. This results in a censored distribution. To compute unbiased estimates of censored data for the elements in this table, we adopted the protocol of reducing all "less than" values by 50 percent to generate a real value for these data. Summary statistics of range (minimum, with an "L" indicating "less than", and maximum values) and arithmetic means were generated using the modified data. Moisture values are reported on an as-received basis (American Society for Testing and Materials, 1994b, designation D3180-89). Because no equilibrium moisture values are available for this report, apparent ranks can not reliably be determined.

Between 1974 and 1994, the U.S. Geological Survey analyzed samples of coal for major-, minor-, and trace-element contents. Prior to performing the analyses, most of the coal samples were dried at room temperature and humidity for as much as 80 hours. Some samples, however, may have only been dried enough to allow grinding (to less than 100 mesh). Moisture content in the samples is unknown, although moisture contents were probably similar to that which would remain after air-dry loss determination (American Society for Testing and Materials ASTM Standards, 1994c, designation D3302-91).). Since the actual moisture content of the samples analyzed between 1974 and 1994 is unknown and can not be determined, the major-, minor-, and trace-element contents are reported on a remnant moisture basis. Also, the elemental analysis of the samples cannot be

converted to any other moisture basis. In addition, these analyses can only provide an approximation of load factors (such as, pounds of mercury per trillion Btu).

For the following graphical displays, figures HQ-2 to HQ-97, show public data locations and values for variables listed in table HQ-1, except for calorific value and moisture, for the assessment units Ferris 23, 25, 31, 50, and 65 coal zones; Hanna 77, 78, 79, and 81 coal zones; and Johnson-107 coal zone. There is no public coal quality data available for some of the coal zones in the following illustrations. The locations of public data points used in the summary table are shown on figure HQ-2. When more than one analysis was available per location, the analytical values were weight averaged on coal sample thickness. For ash (figs. HQ-3 through HQ-8) and total sulfur (figs. HQ-9 through HQ-14), the values are color coded low, medium, and high, following guidelines established in U.S. Geological Survey Circular 891 (Wood and others, 1983). For and moist, mineral-matter-free, which is used in conjunction with other factors to determine apparent rank (fig. HQ-15 through HQ-20), we utilized the apparent rank designations established by American Society for Testing and Materials, (1994a), designation D388-92a. For pounds of SO_2 per million Btu (figs. HQ-21 through HQ-26), values are color coded according to the U.S. Environmental Protection Agency's Phase I, Phase II, and non-compliant limits for sulfur emission from coal-fired power plants (U.S. Environmental Protection Agency, 1996).

No guidelines have been established for the elements of environmental concern (also referred to as "hazardous air pollutants" or "HAPs"). Analytical values for these elements are color coded based on the following parameters: (1) each element of environmental concern was ranked from the lowest to highest value for all data in the Northern Rockies and Great Plains region, and (2) quartiles were

established for each element such that low represents those values that are less than the .25 quartile (also known as the lower quartile or the 25th percentile), medium represents those values that are within the .25 to .75 quartiles (two quartiles representing 50 percent of the values or between the 25th to 75th percentile), high represents those values that are in the upper .25 quartile (or greater than the 75th percentile). Figures HQ-27 through HQ-67 show the elements of environmental concern. Figures HQ-27 through HQ-38 are Ferris 25 coal zone, Ferris coalfield; figures HQ-39 through HQ-50 are for the Ferris 50 coal zone, Ferris coalfield; figures HQ-51 through HQ-62 are for the Hanna 77 coal zone, Hanna coalfield; figures HQ-63 through HQ-73 are for the Hanna 78 coal zone, Hanna coalfield; figures HQ-74 through HQ-85 are for the Hanna 79 coal zone, Hanna coalfield; and figures HQ-86 through HQ-97 are for the Johnson-107 coal zone, South Carbon coalfield.

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_____1994b, Annual book of ASTM Standards, Section 5, Petroleum products, lubricants and fossil fuels, vol. 05.05 Gaseous fuels; coal and coke; section D3180-89; Standard Practice for Calculating Coal and Coke Analysis from As-Determined to Different Bases: American Society for Testing and Materials, Philadelphia, Pennsylvania, p. 360-366.

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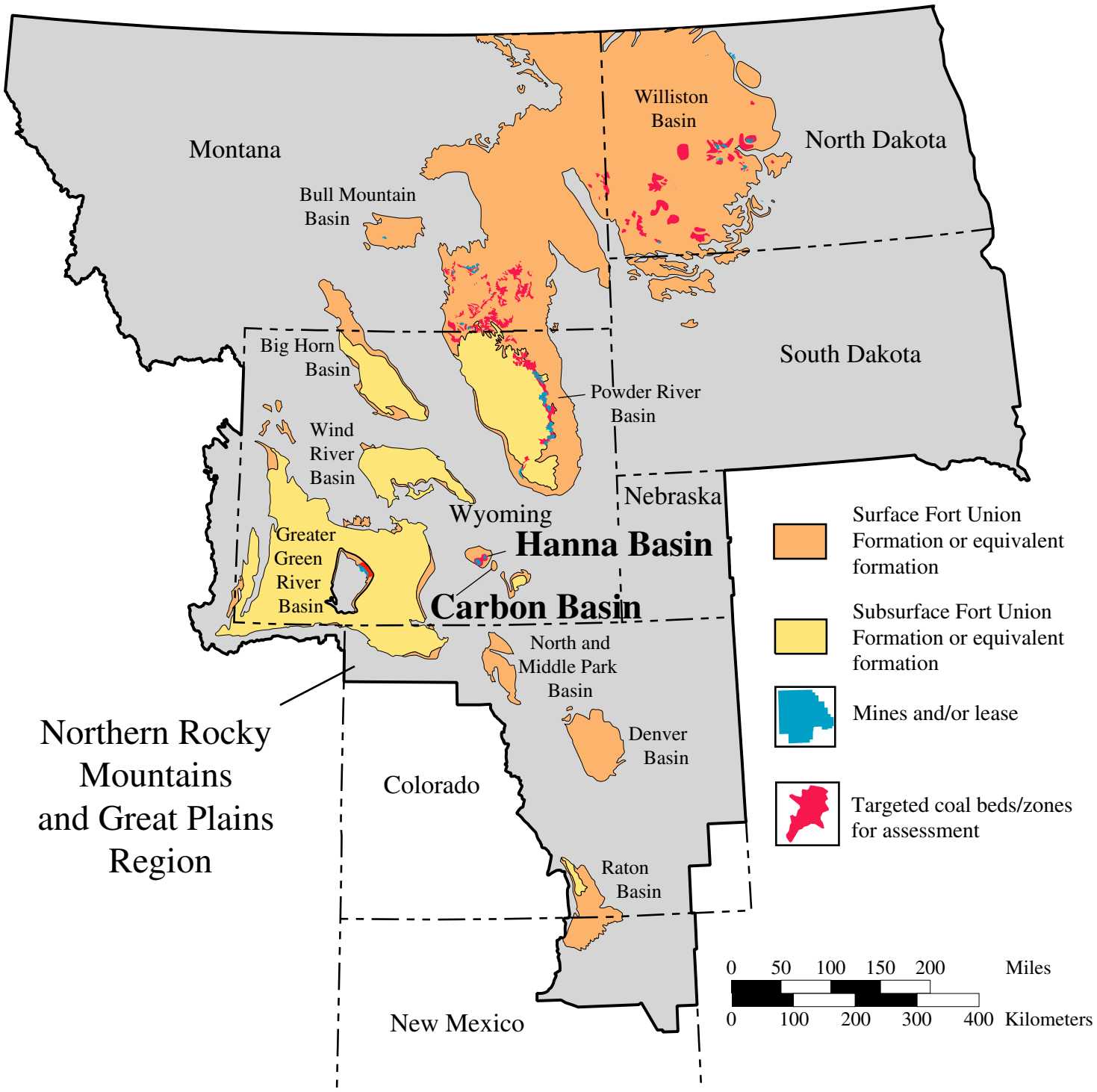

Figure HQ-1. Index map showing the Hanna and Carbon Basins, Wyoming

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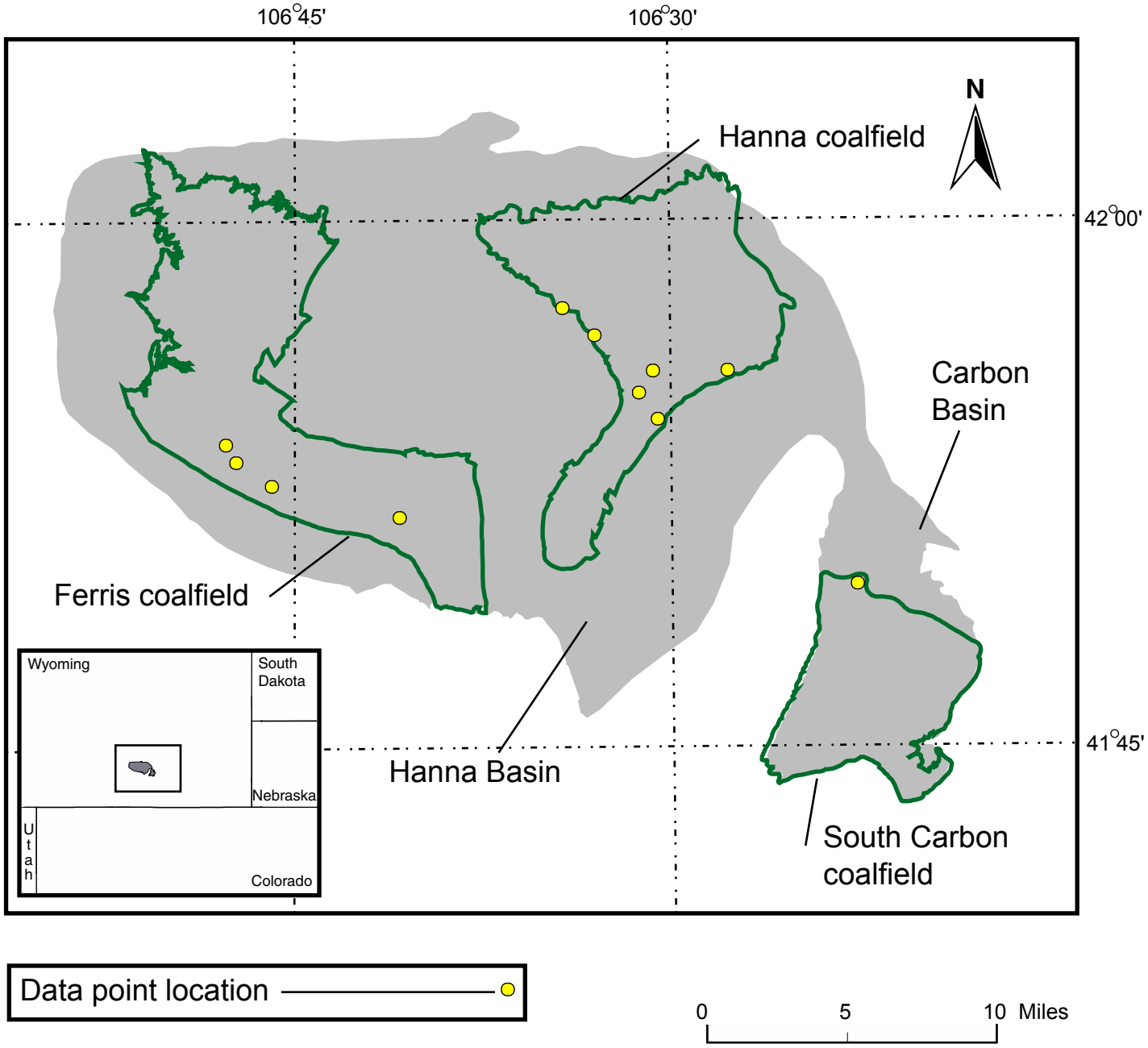

Figure HQ-2. Index map showing coal quality data distribution in the Hanna and Carbon Basins, Wyoming.

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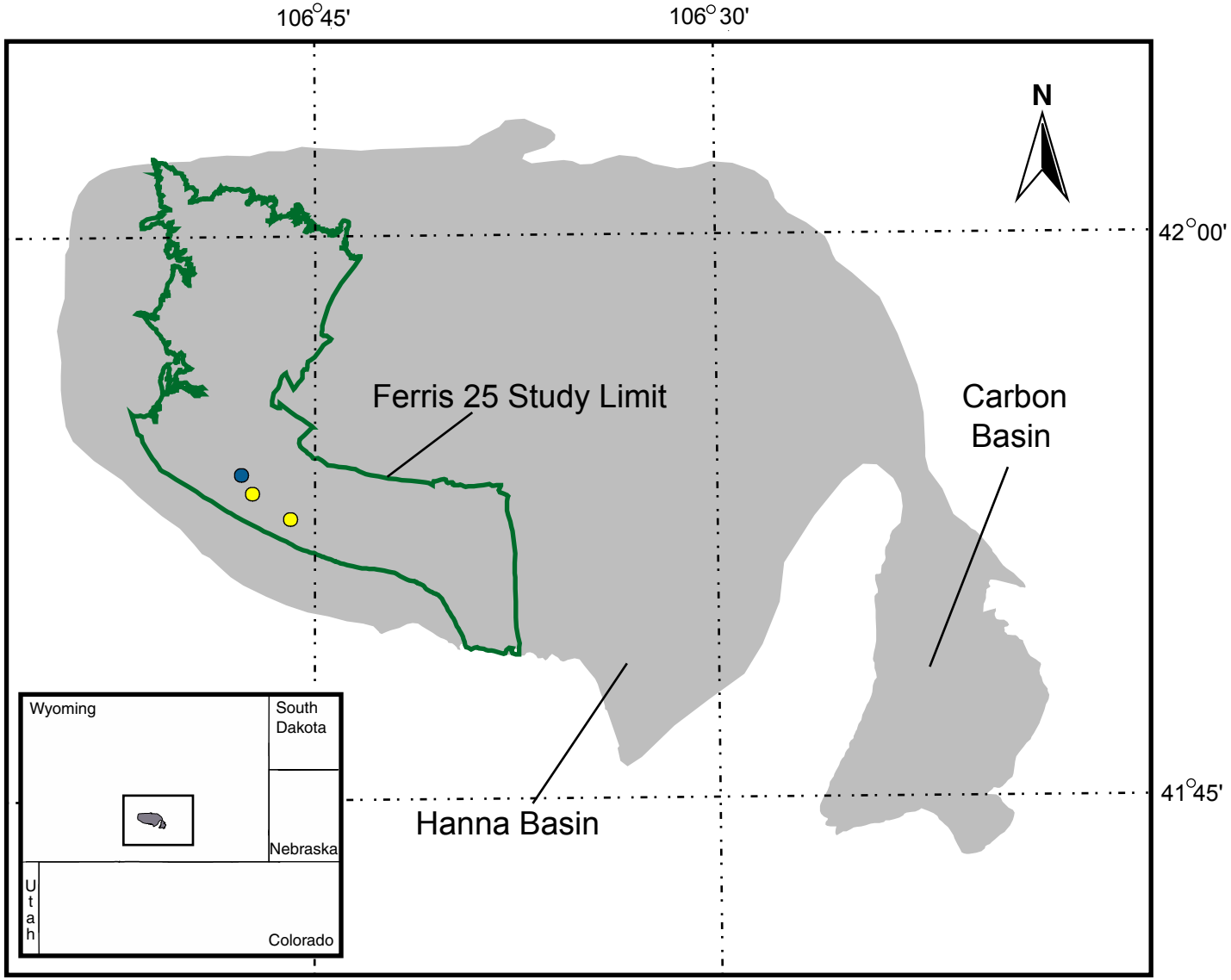

Figure HQ-3. Ash yield in the Ferris 25 coal zone, Ferris coalfield, Hanna Basin, Wyoming.

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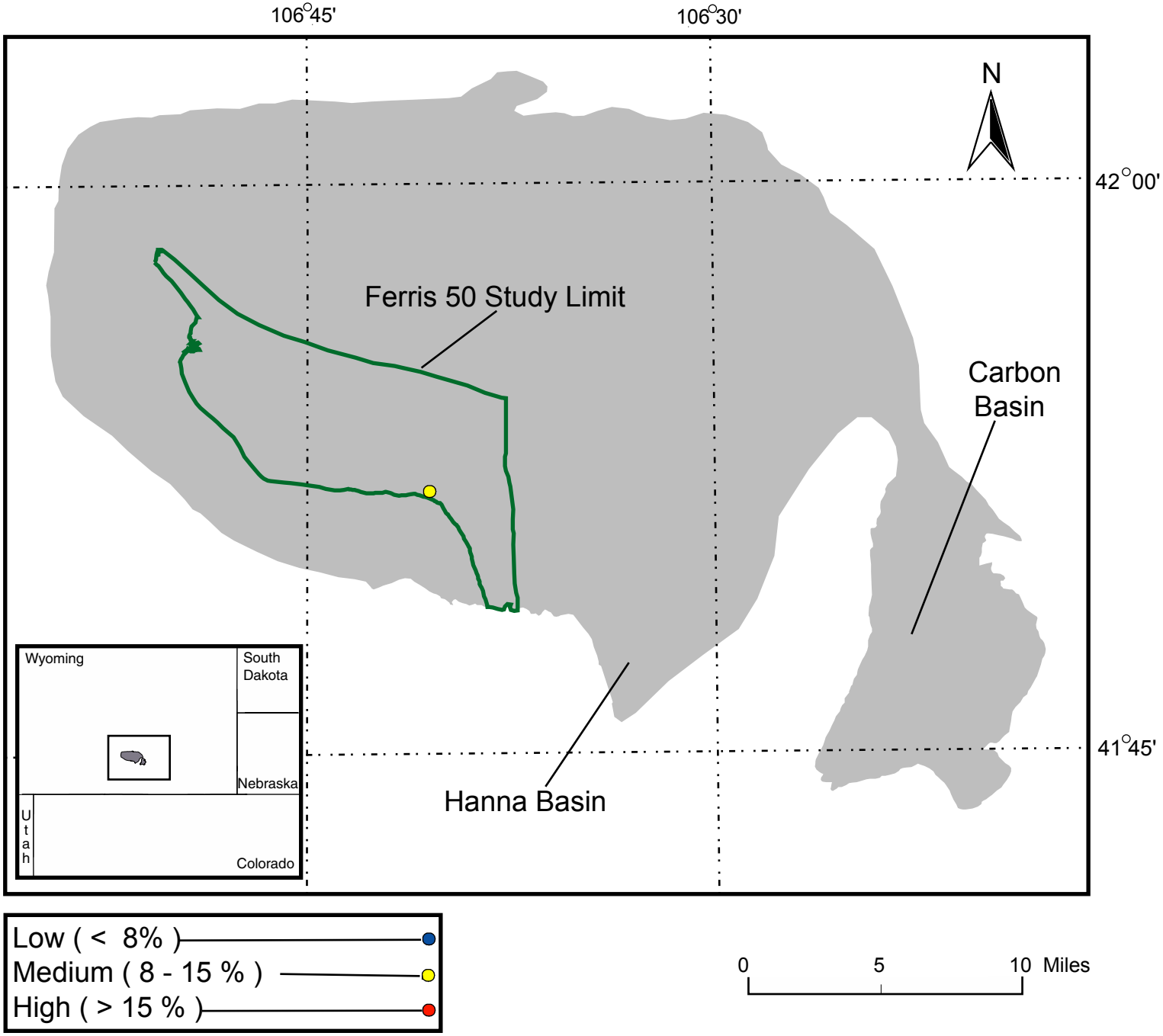

Figure HQ-4. Ash yield in the Ferris 50 coal zone, Ferris coalfield, Hanna Basin, Wyoming.

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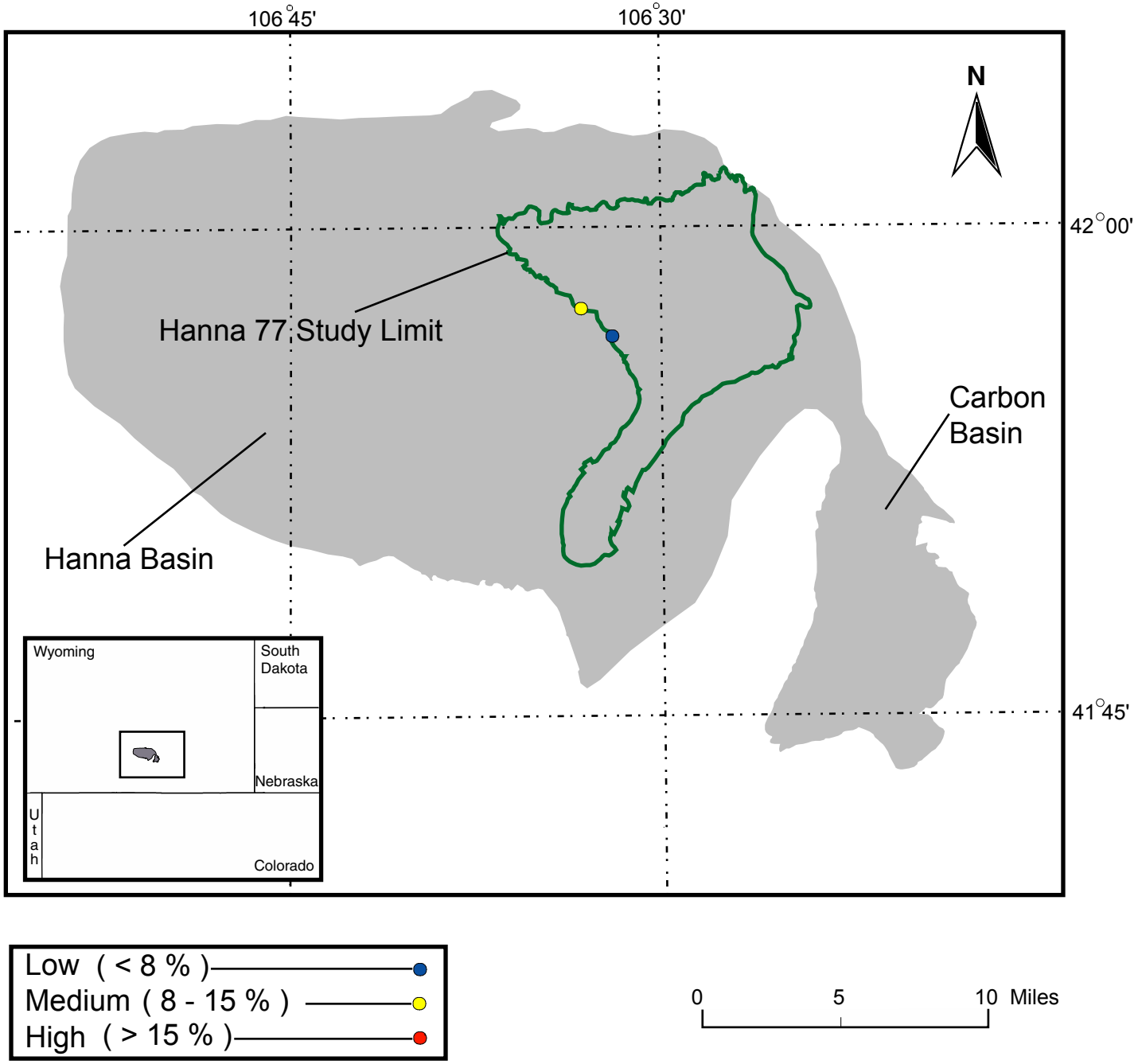

Figure HQ-5. Ash yield in the Hanna 77 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

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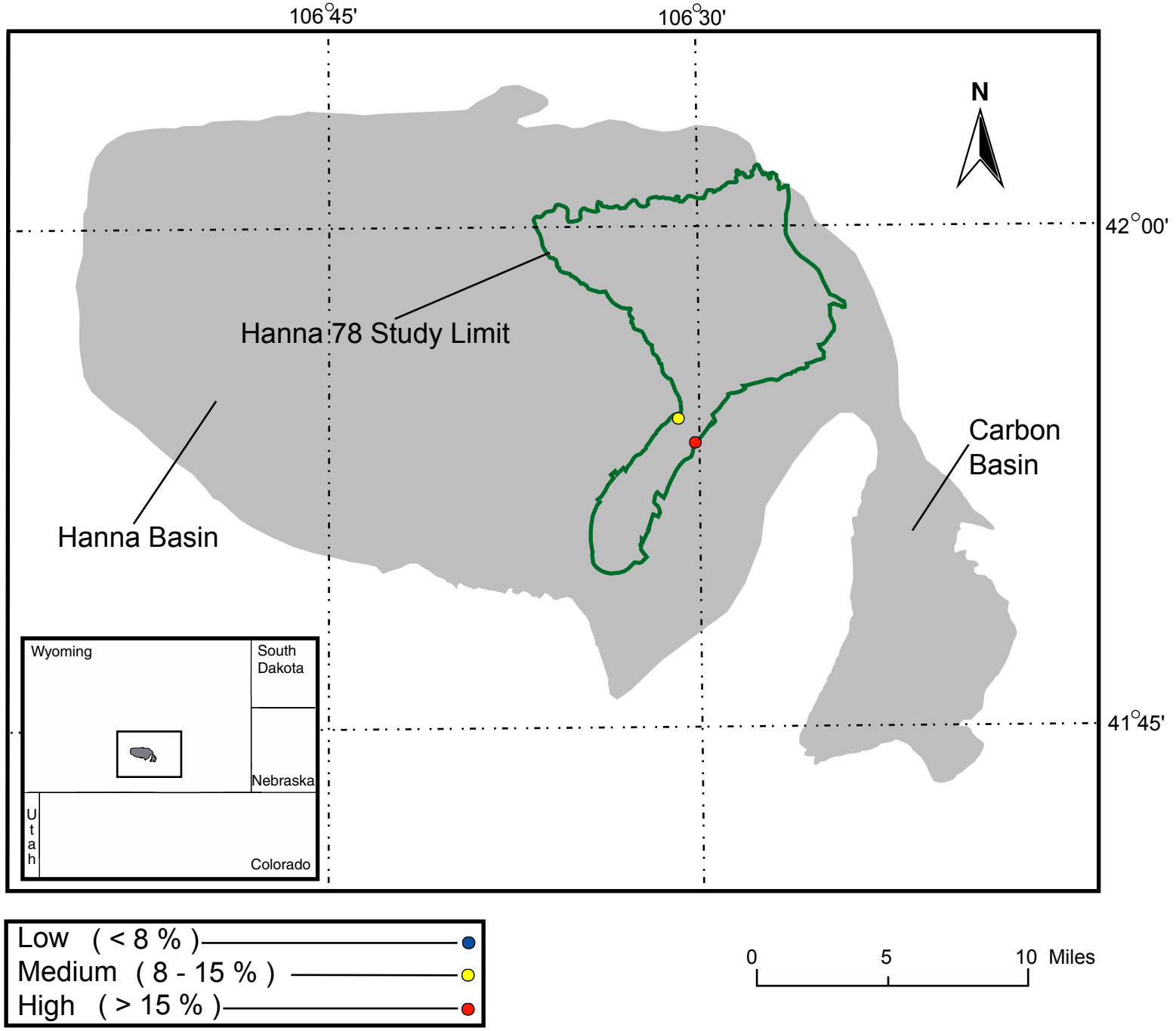

Figure HQ-6. Ash yield in the Hanna 78 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

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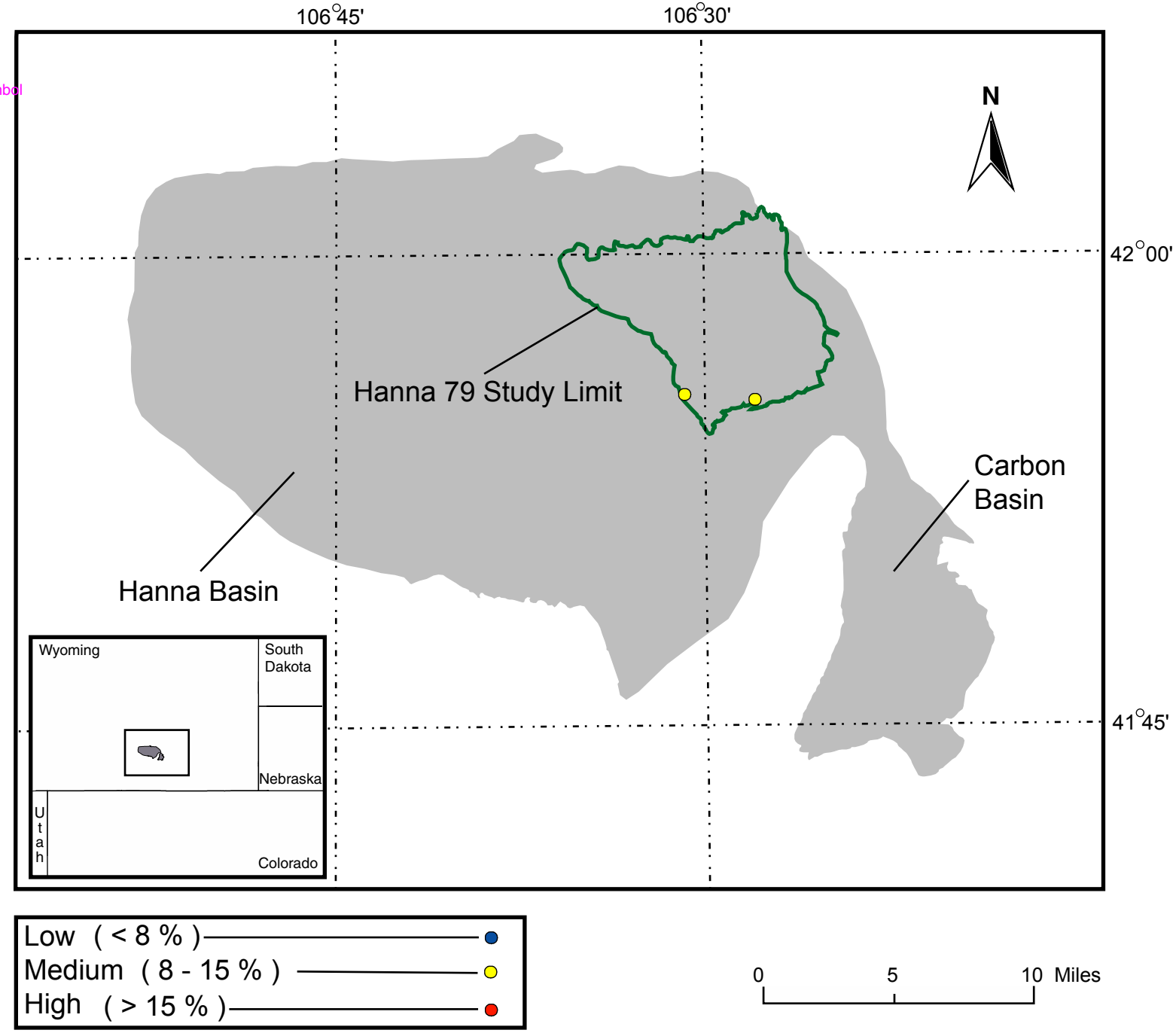

Figure HQ-7. Ash yield in the Hanna 79 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

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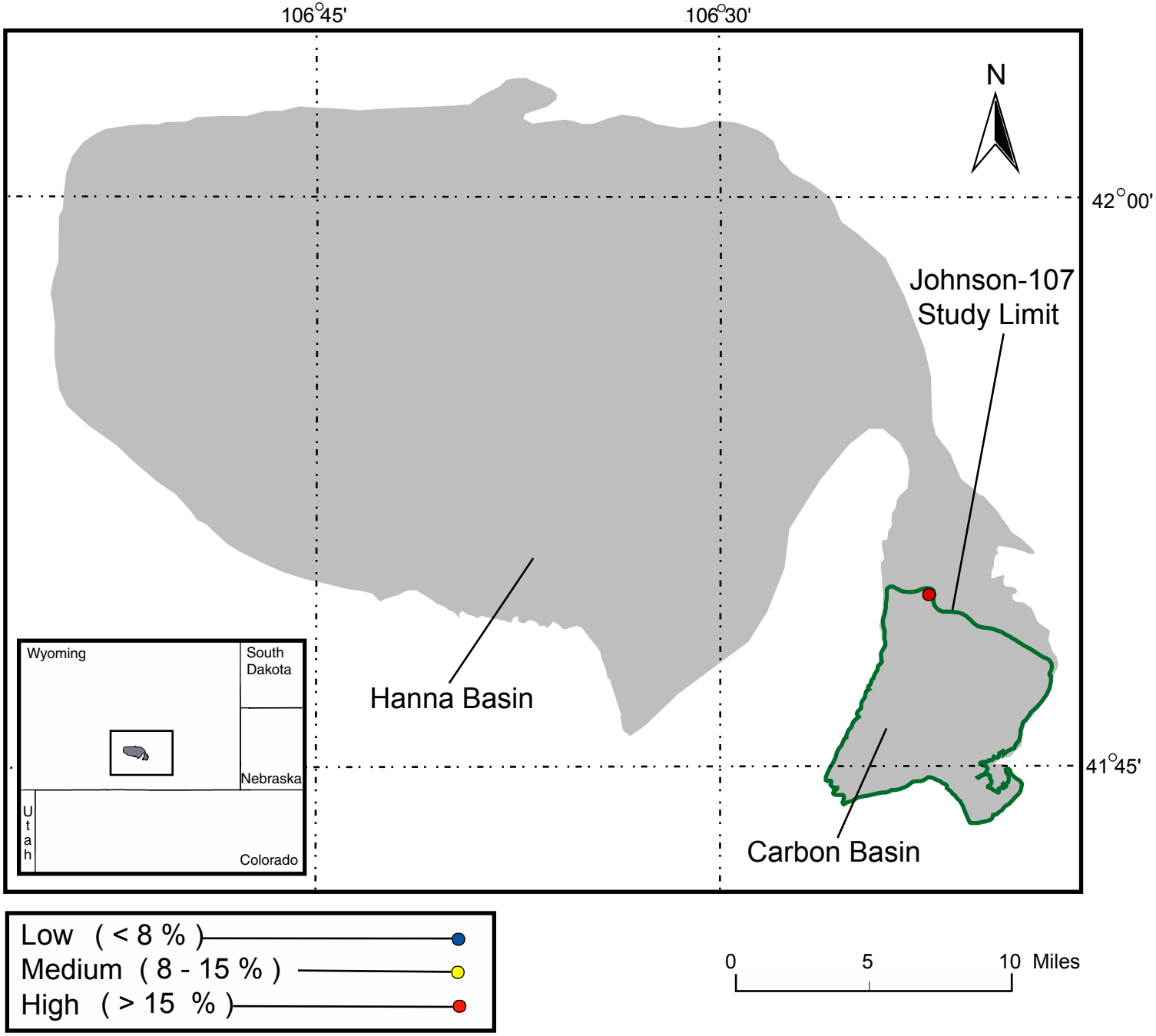

Figure HQ-8. Ash yield in the Johnson-107 coal zone, South Carbon coalfield, Carbon Basin, Wyoming.

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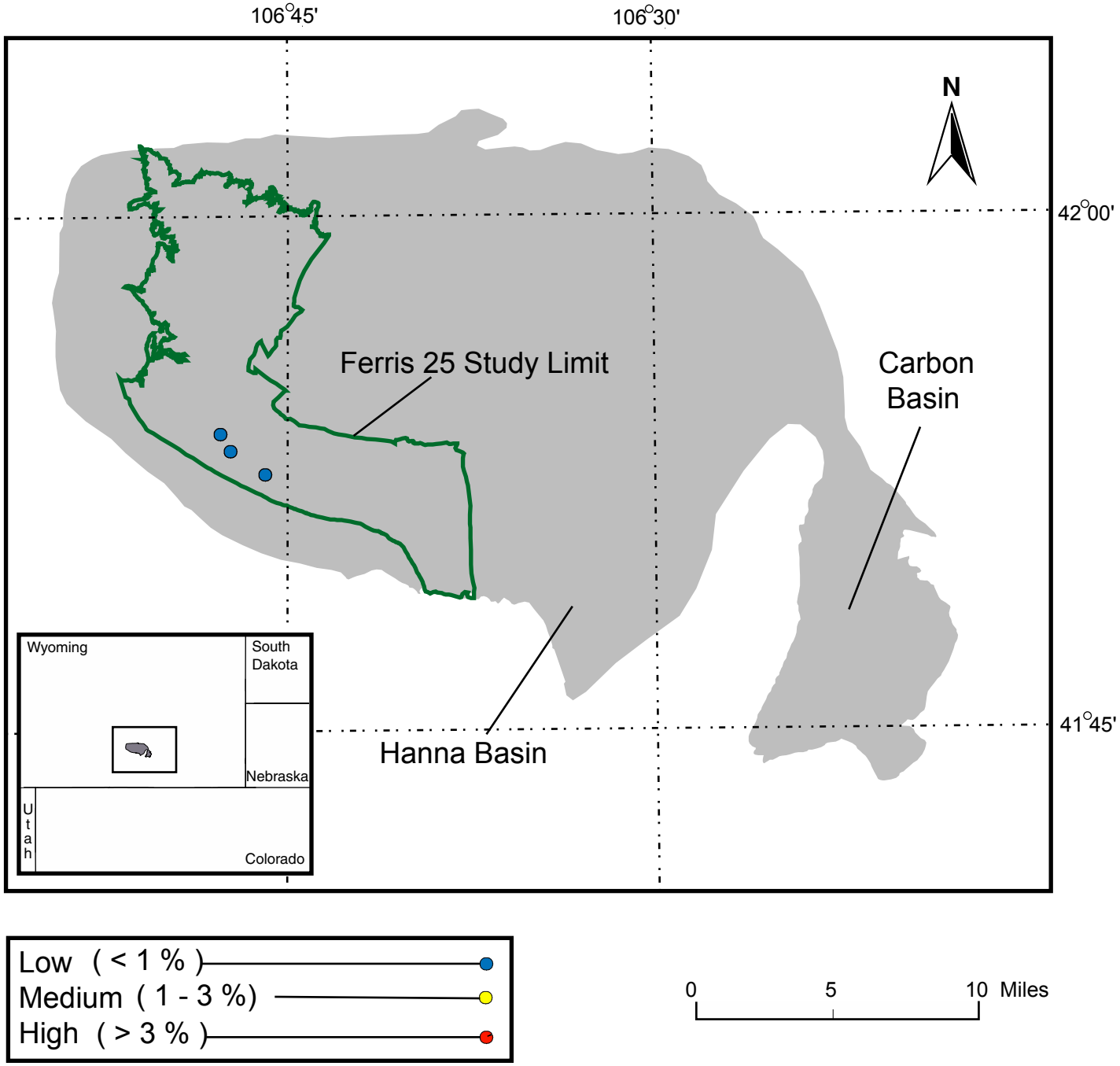

Figure HQ-9. Sulfur content in the Ferris 25 coal zone, Ferris coalfield, Hanna Basin,Wyoming.

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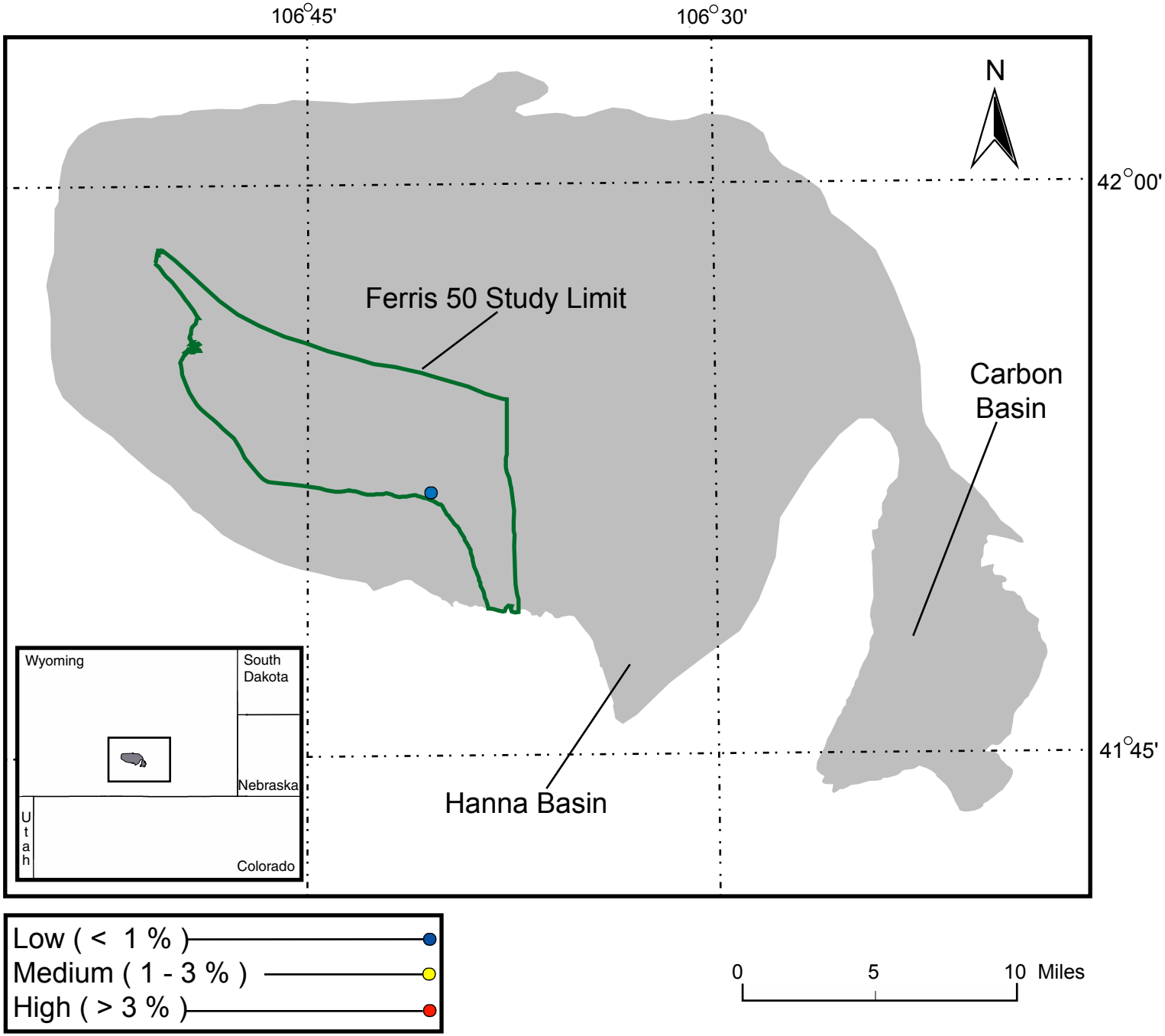

Figure HQ-10. Sulfur content in the Ferris 50 coal zone, Ferris coalfield, Hanna Basin, Wyoming.

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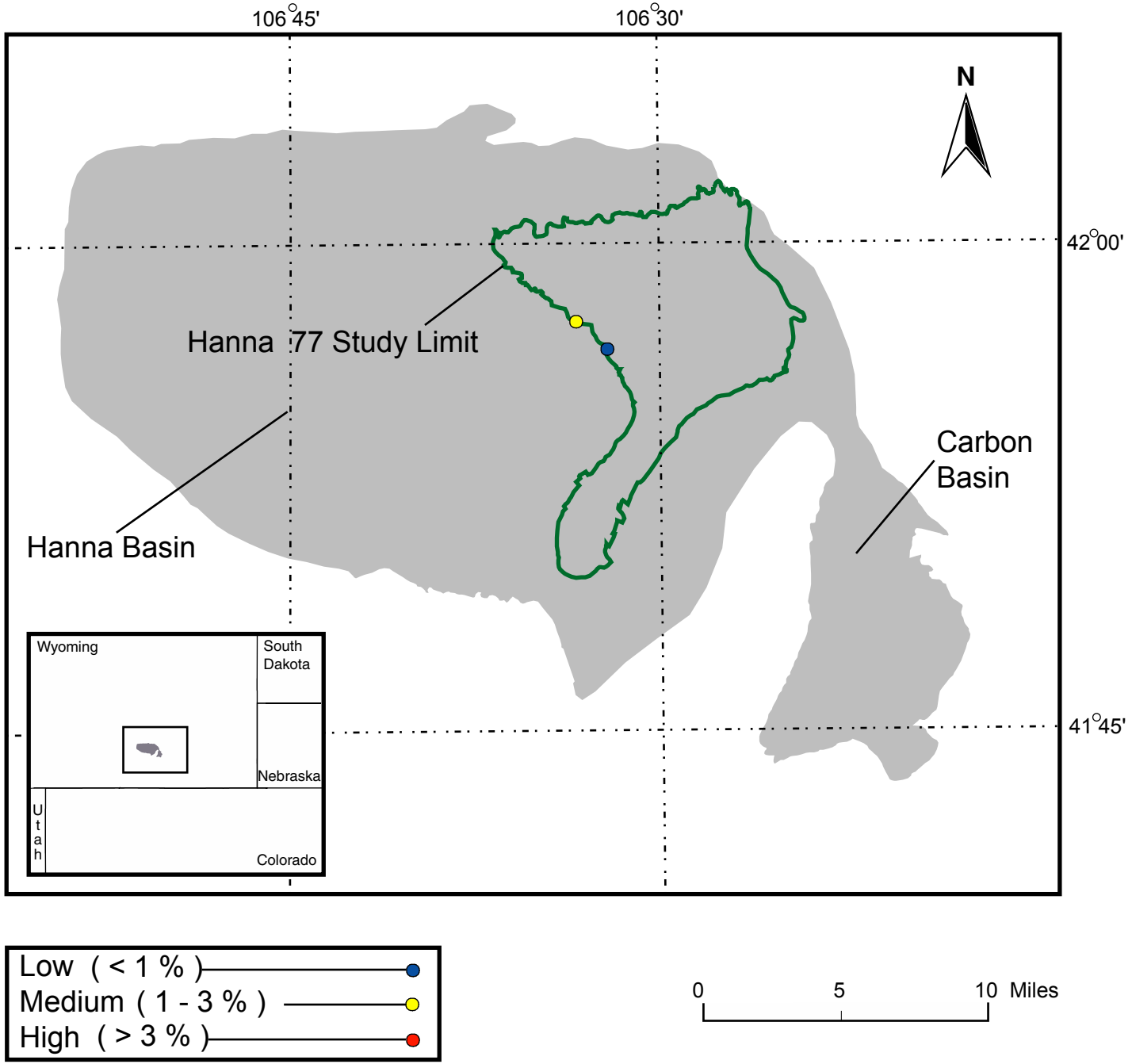

Figure HQ-11. Sulfur content in the Hanna 77 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

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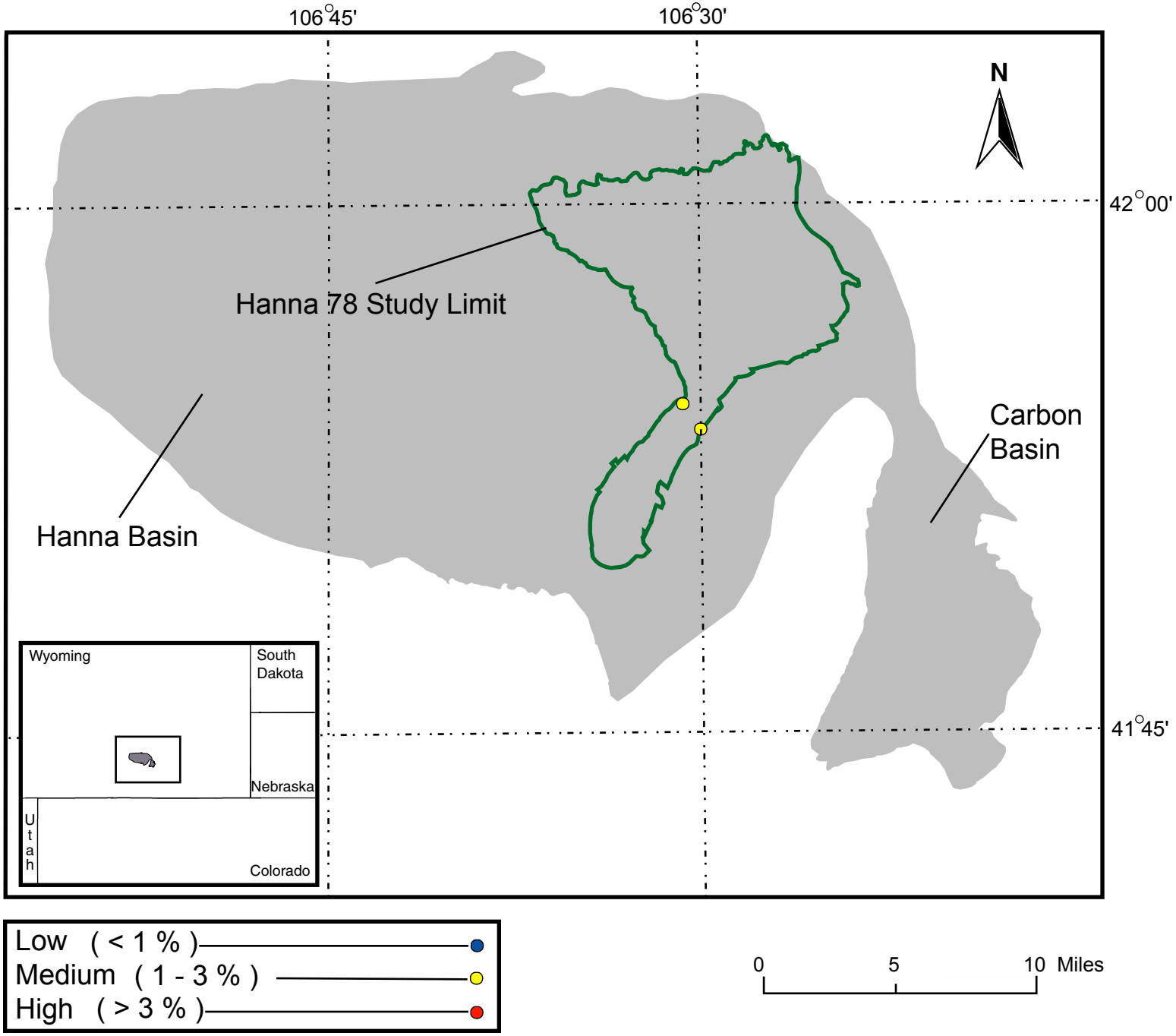

Figure HQ-12. Sulfur content in the Hanna 78 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

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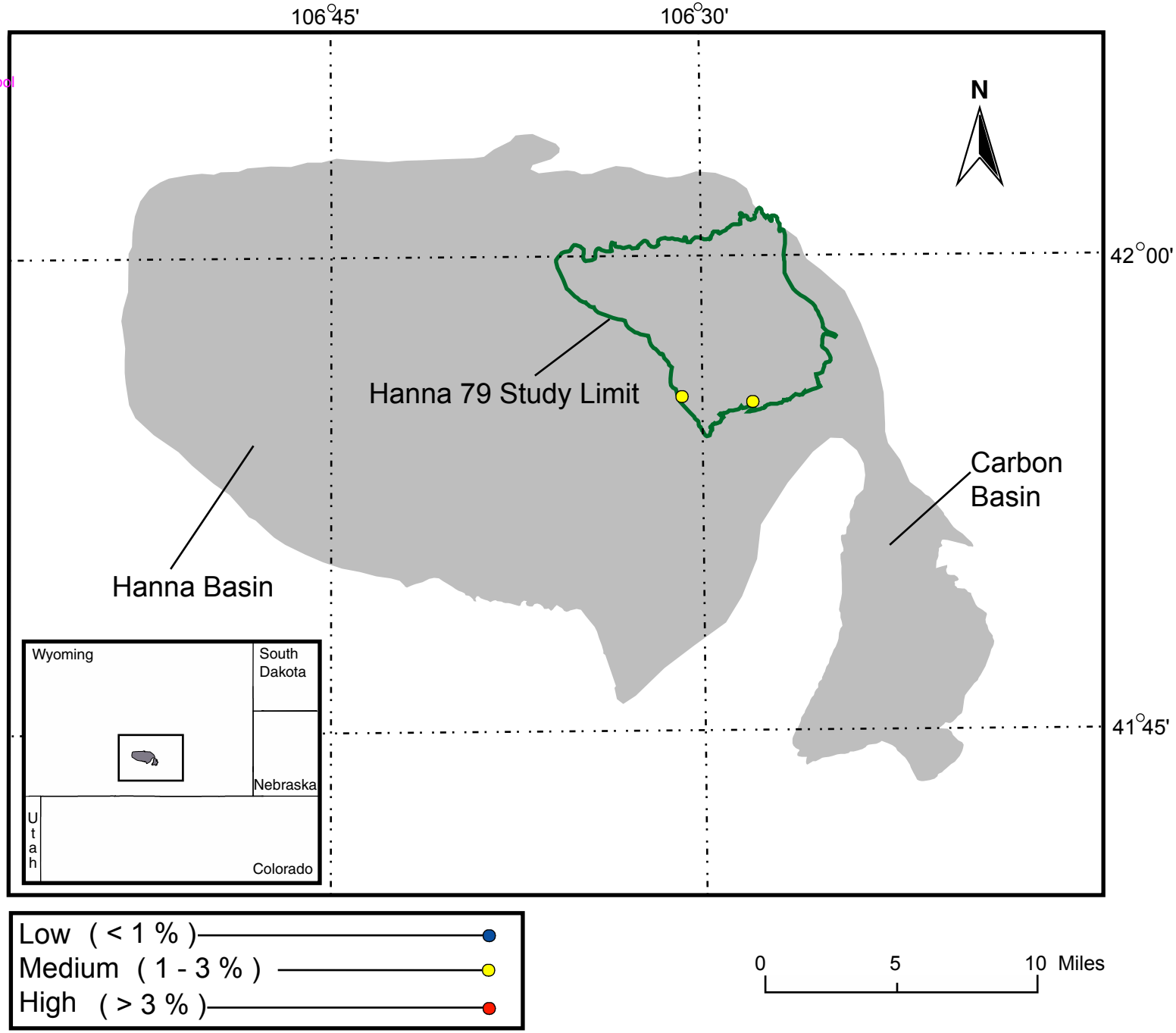

Figure HQ-13. Sulfur content in the Hanna 79 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

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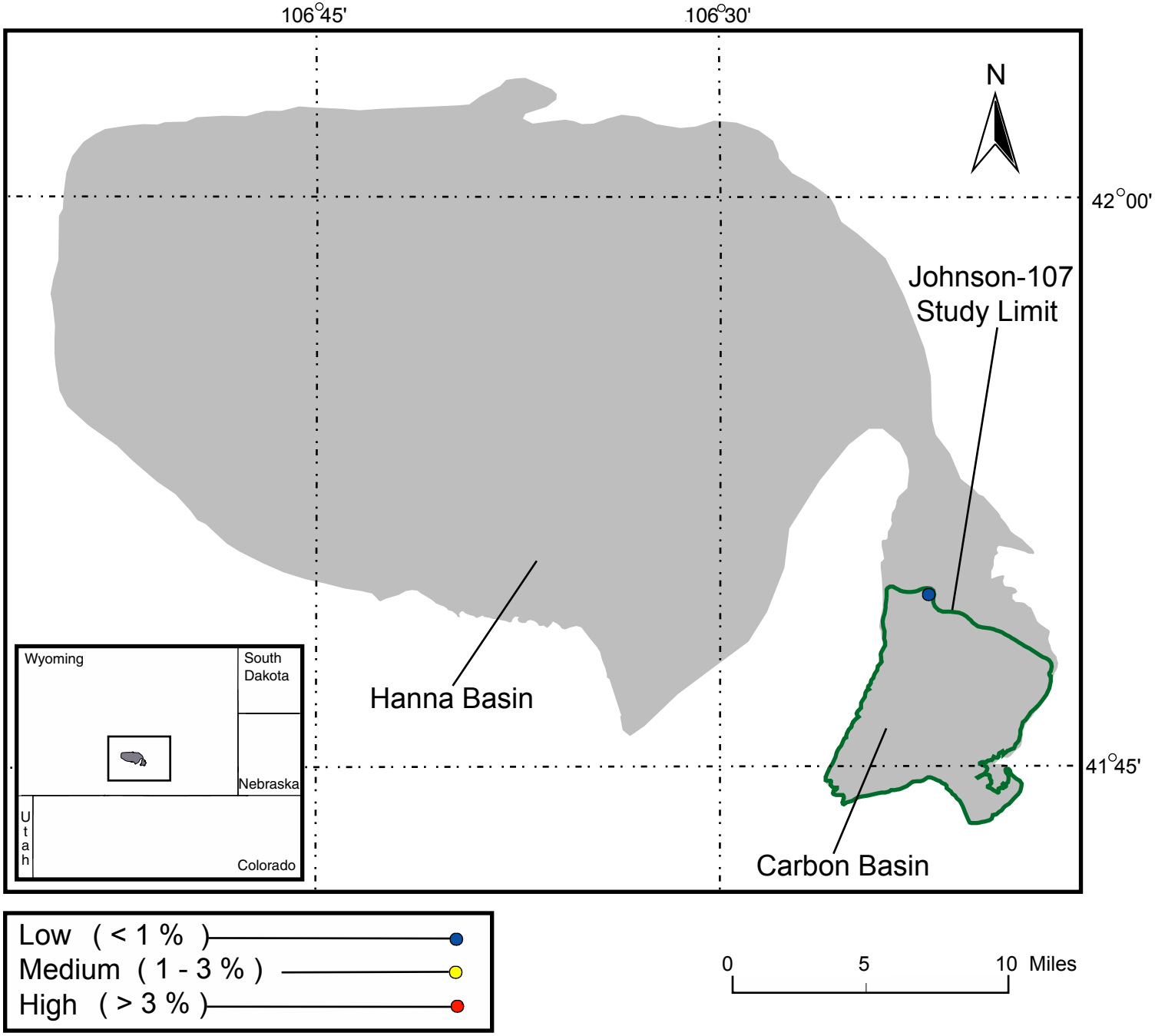

Figure HQ-14. Sulfur content in the Johnson-107 coal zone, South Carbon coalfield, Carbon Basin, Wyoming.

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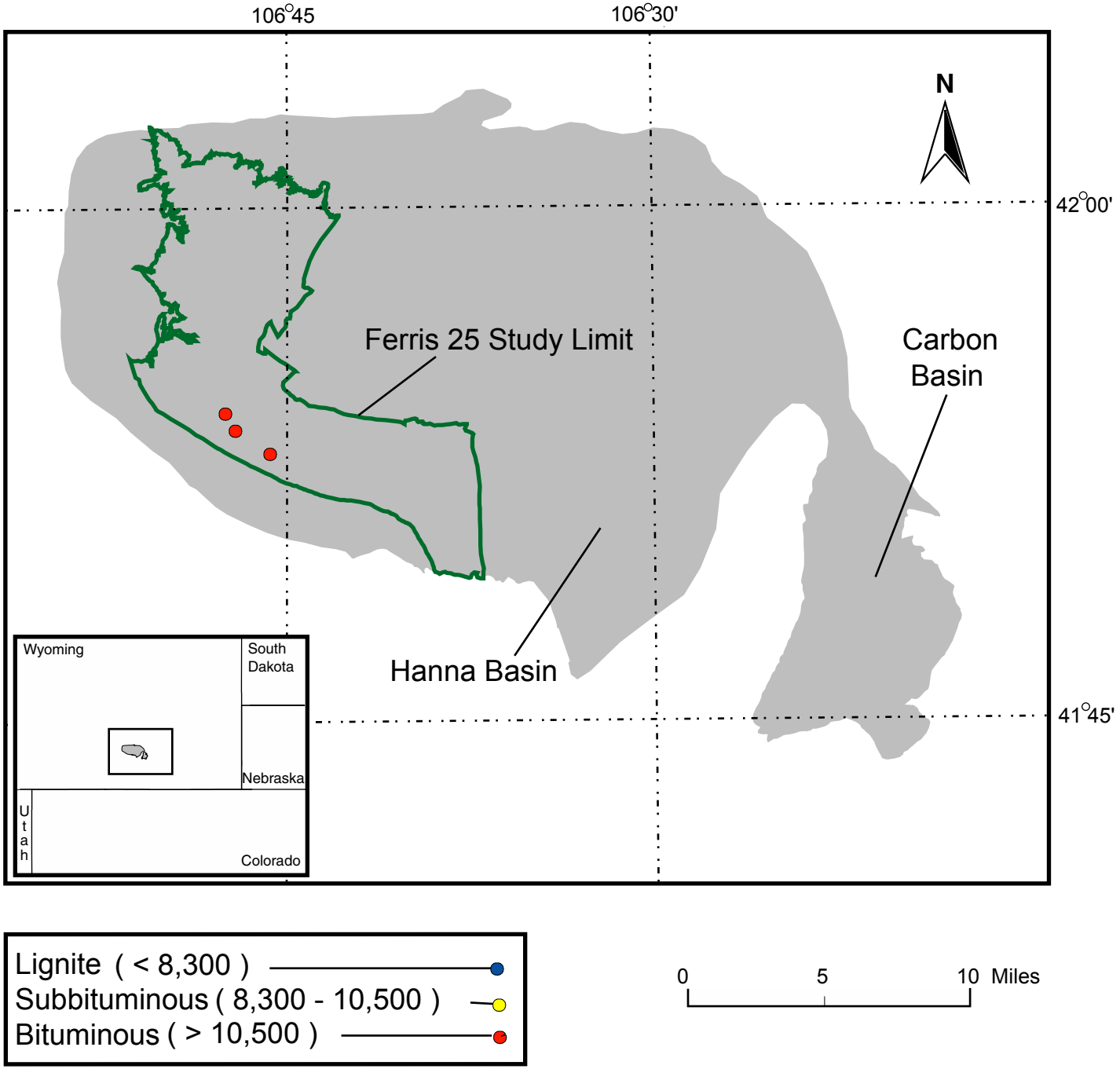

Figure HQ-15. Moist, mineral-matter-free Btu/lb in the Ferris 25 coal zone, Ferris coalfield, Hanna Basin, Wyoming.

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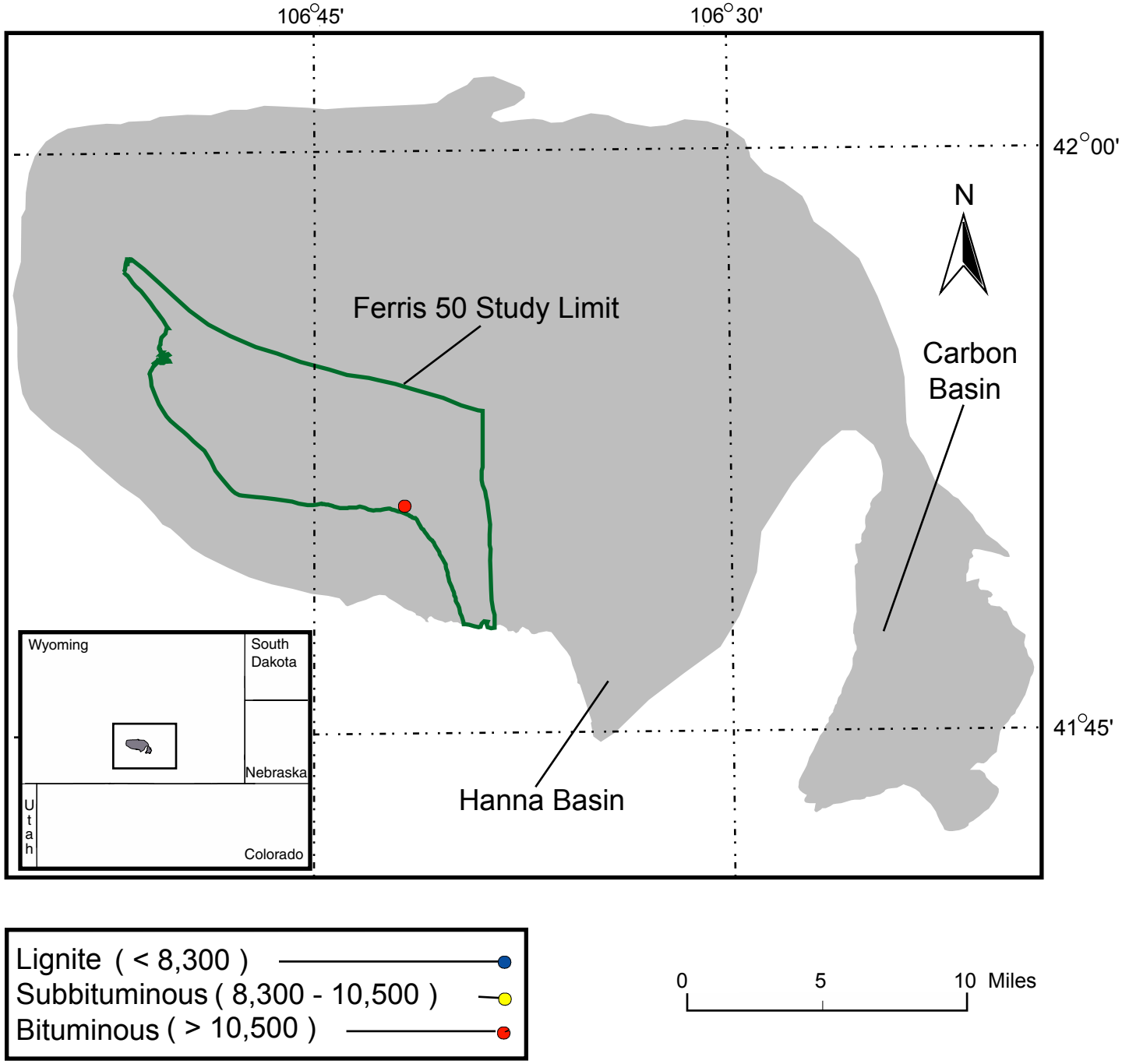

Figure HQ-16. Moist, mineral-matter-free Btu/lb in the Ferris 50 coal zone, Ferris coalfield, Hanna Basin, Wyoming.

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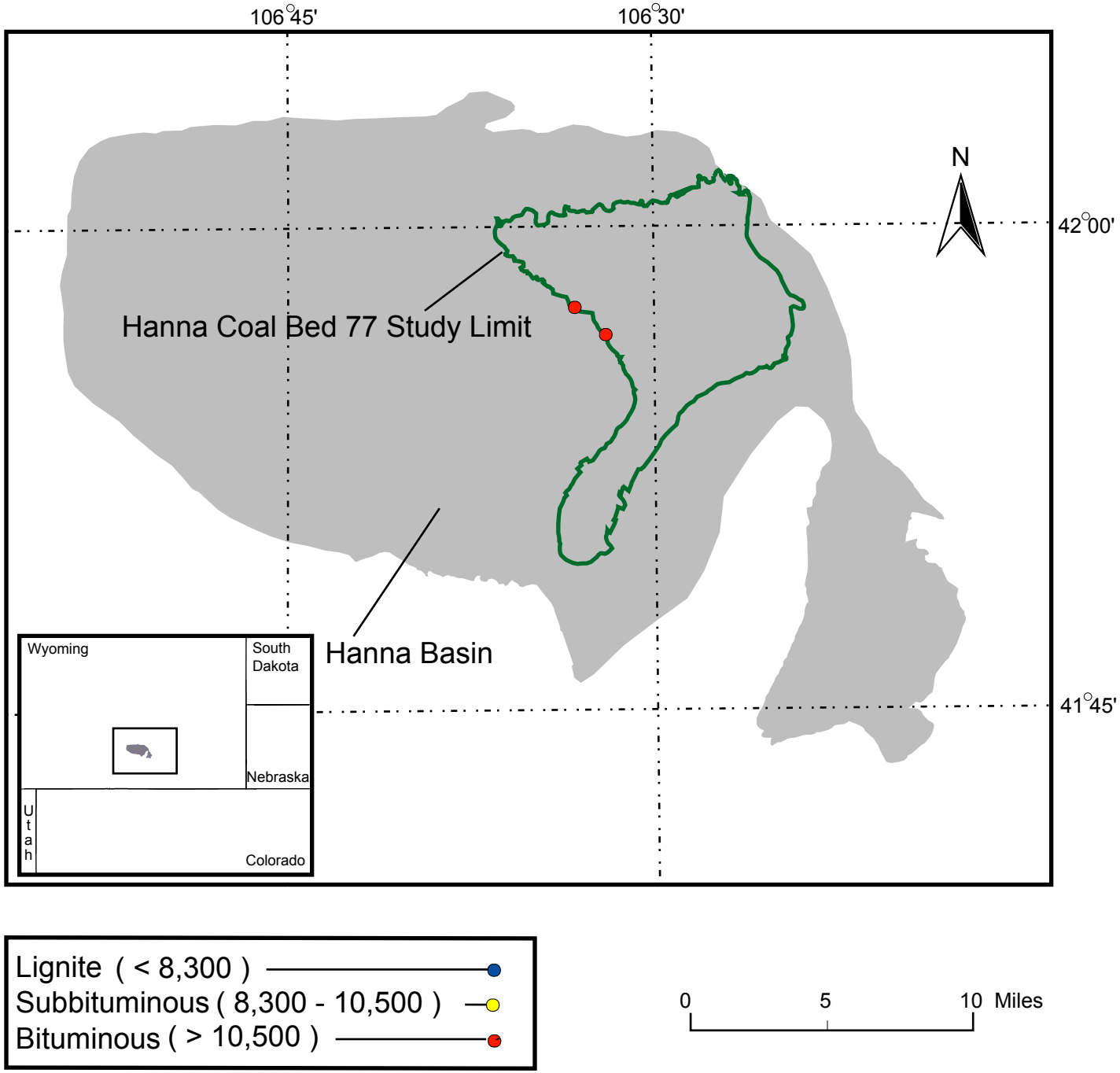

Figure HQ-17. Moist, mineral-matter-free Btu/lb in the Hanna 77 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

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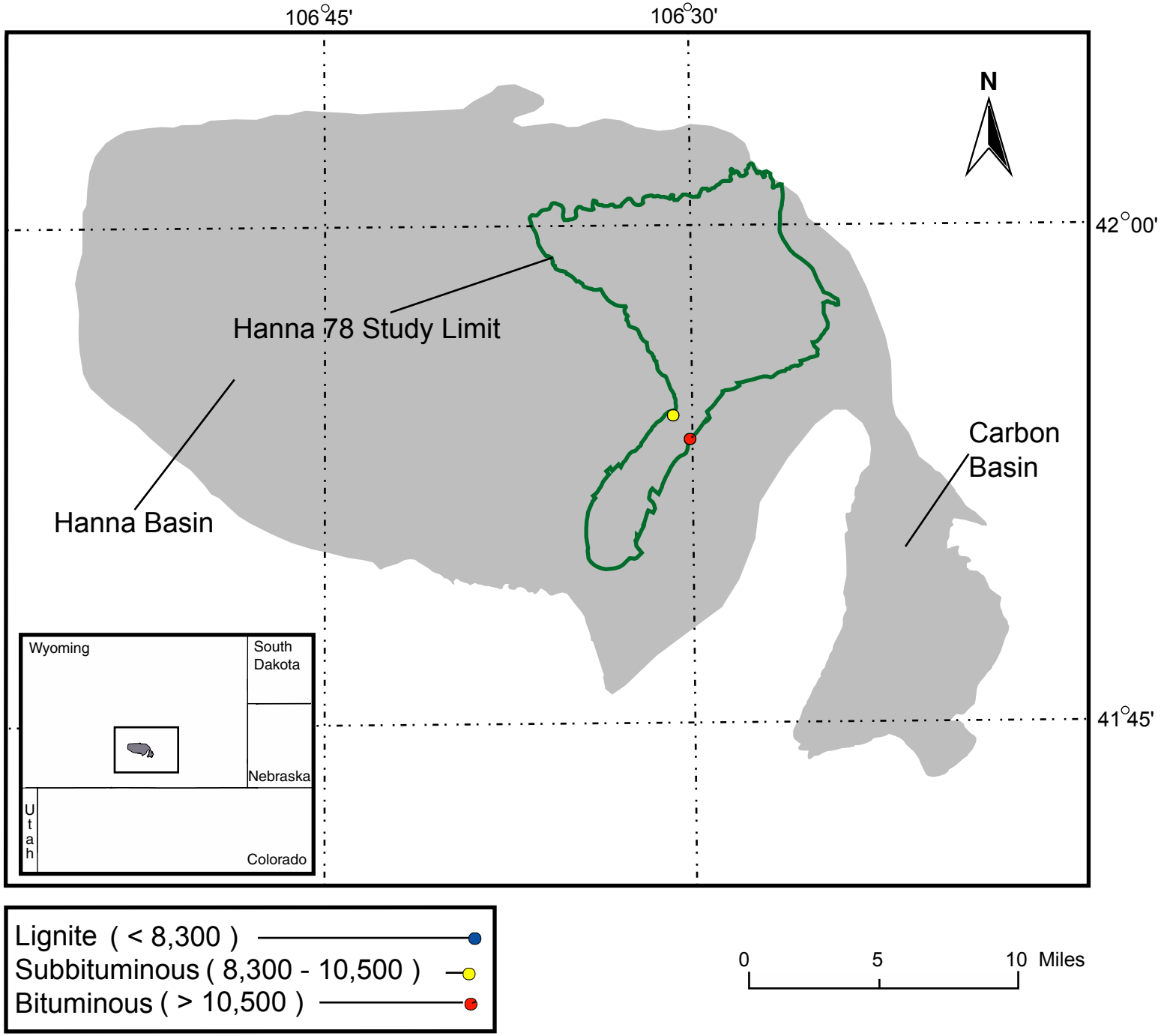

Figure HQ-18. Moist, mineral-matter-free Btu/lb in the Hanna 78 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

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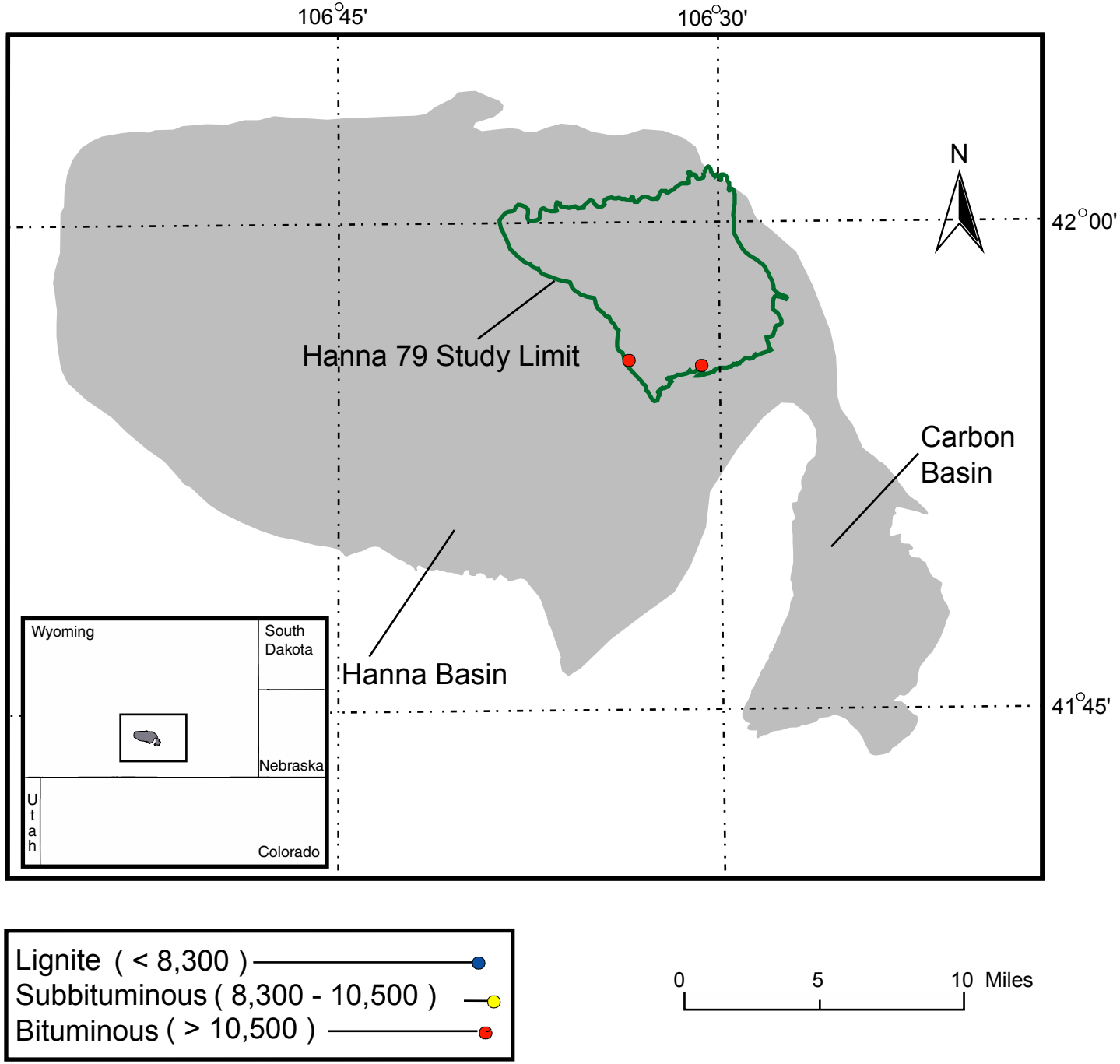

Figure HQ-19. Moist, mineral-matter-free Btu/lb in the Hanna 79 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

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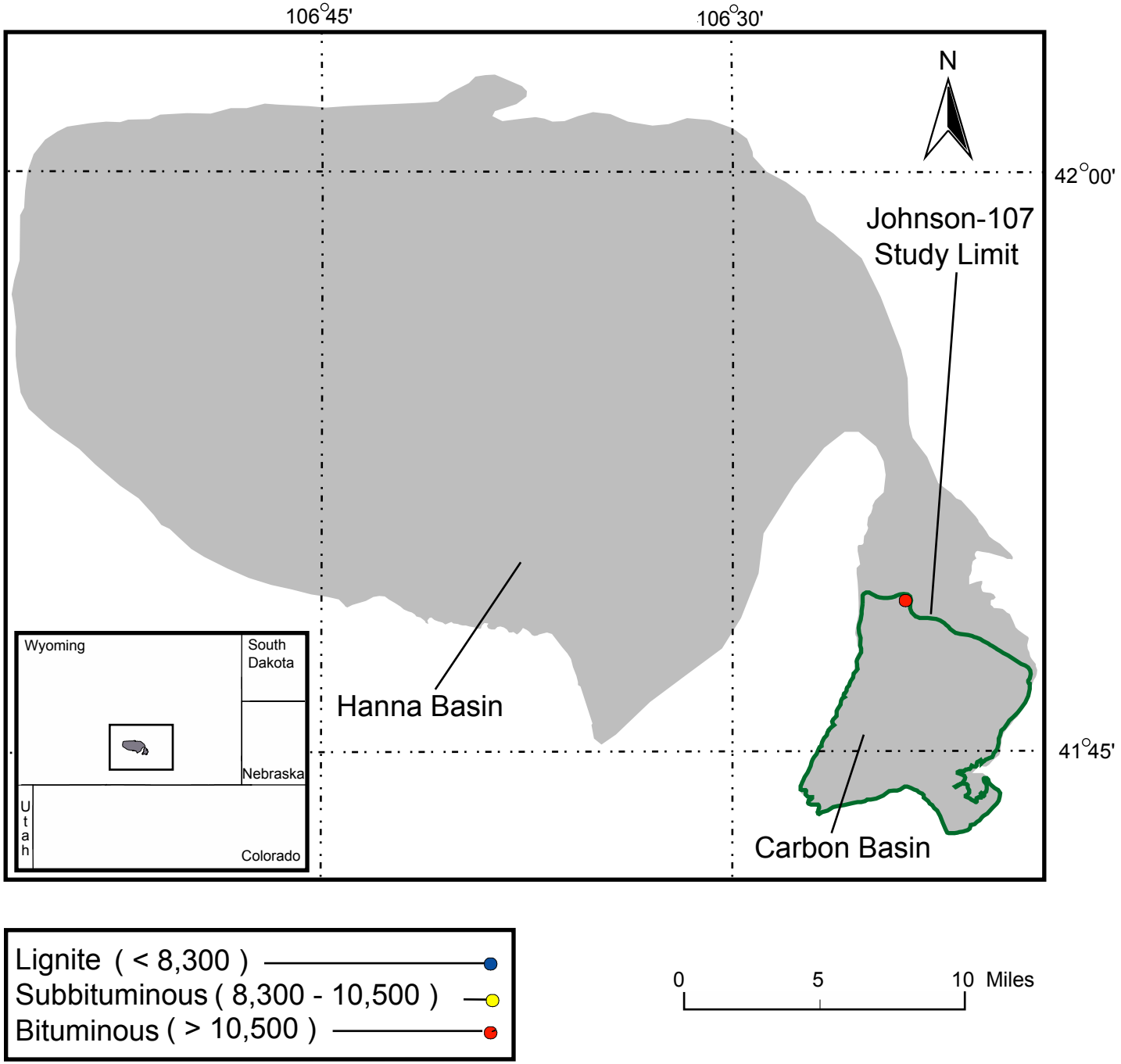

Figure HQ-20. Moist, mineral-matter-free Btu/lb in the Johnson-107 coal zone, Southern Carbon Basin, Wyoming.

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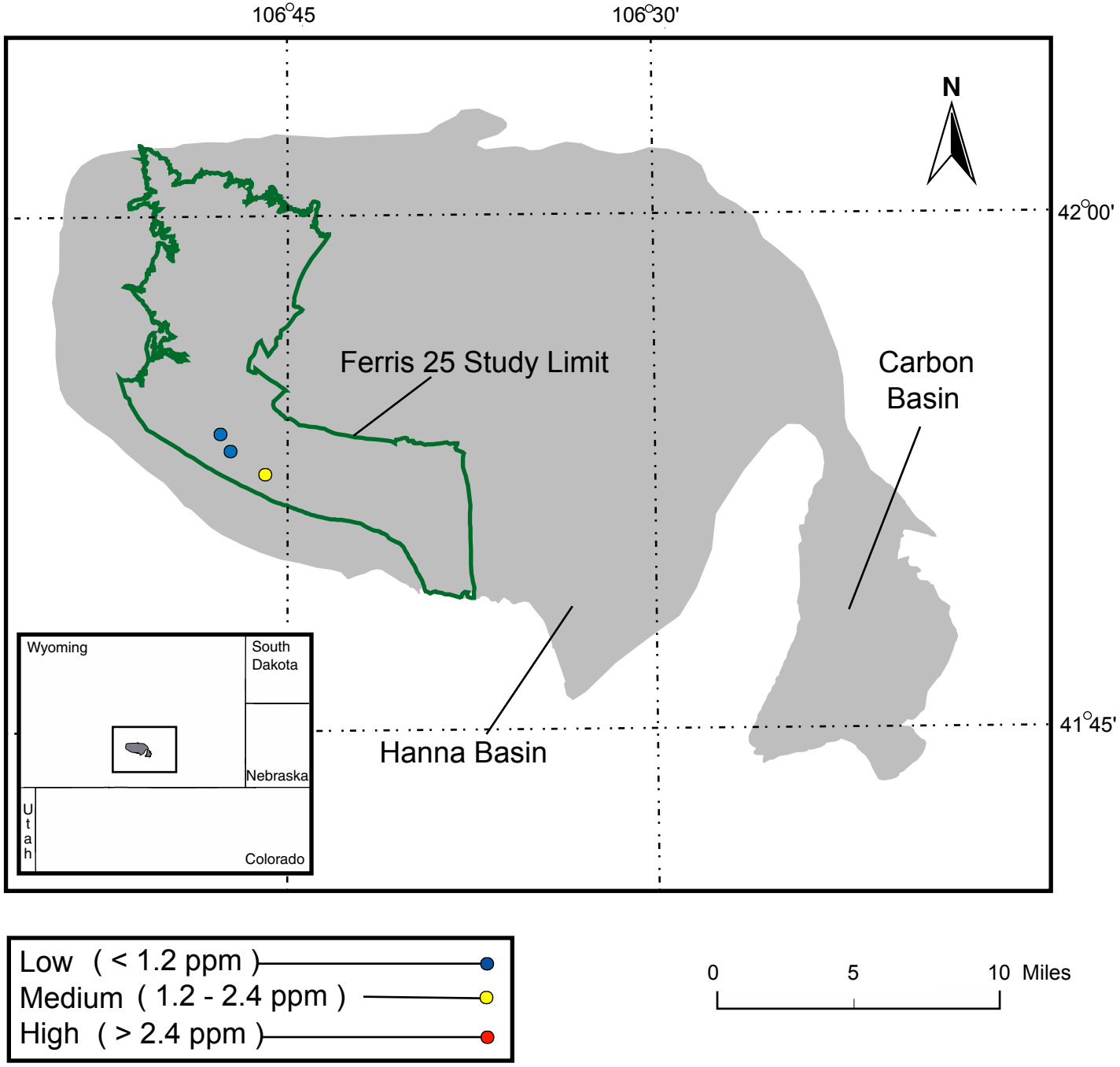

Figure HQ-21. Pounds of sulfur dioxide per million Btu in the Ferris 25 coal zone, Ferris coalfield, Hanna Basin, Wyoming.

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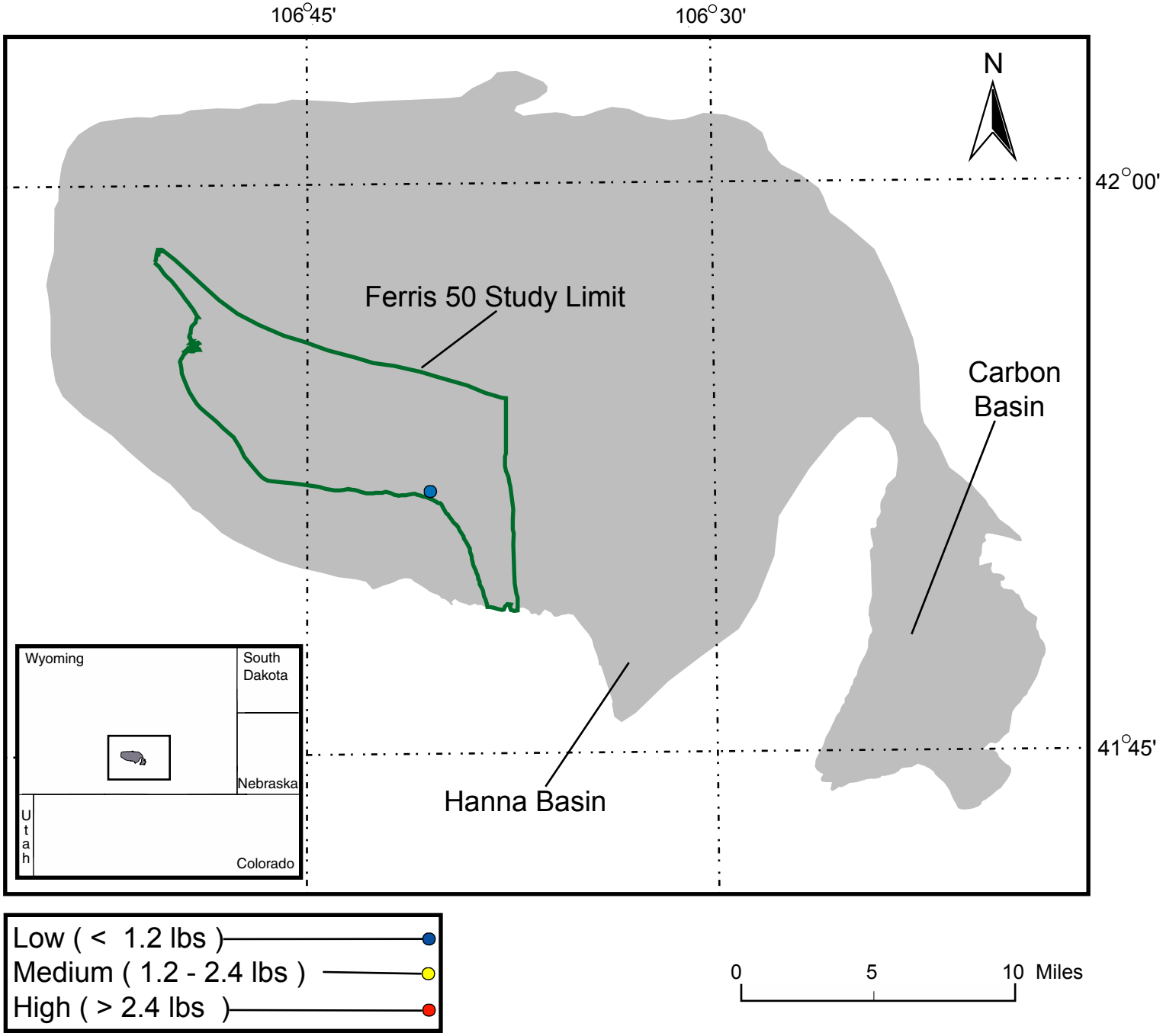

Figure HQ-22. Pounds of sulfur dioxide per million Btu in the Ferris 50 coal zone, Ferris coalfield, Hanna Basin, Wyoming.

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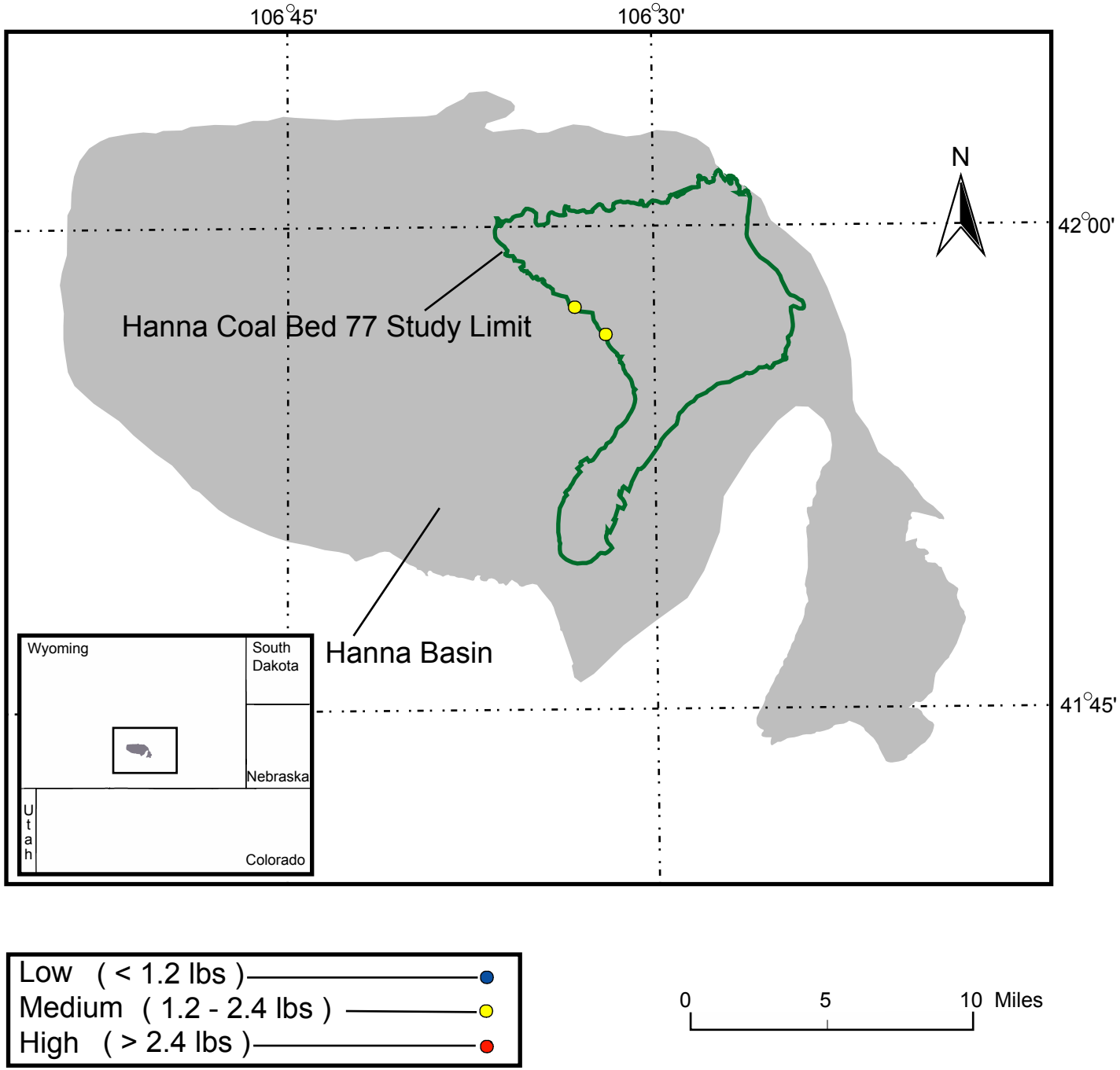

Figure HQ-23. Pounds of sulfur dioxide per million Btu in the Hanna 77 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

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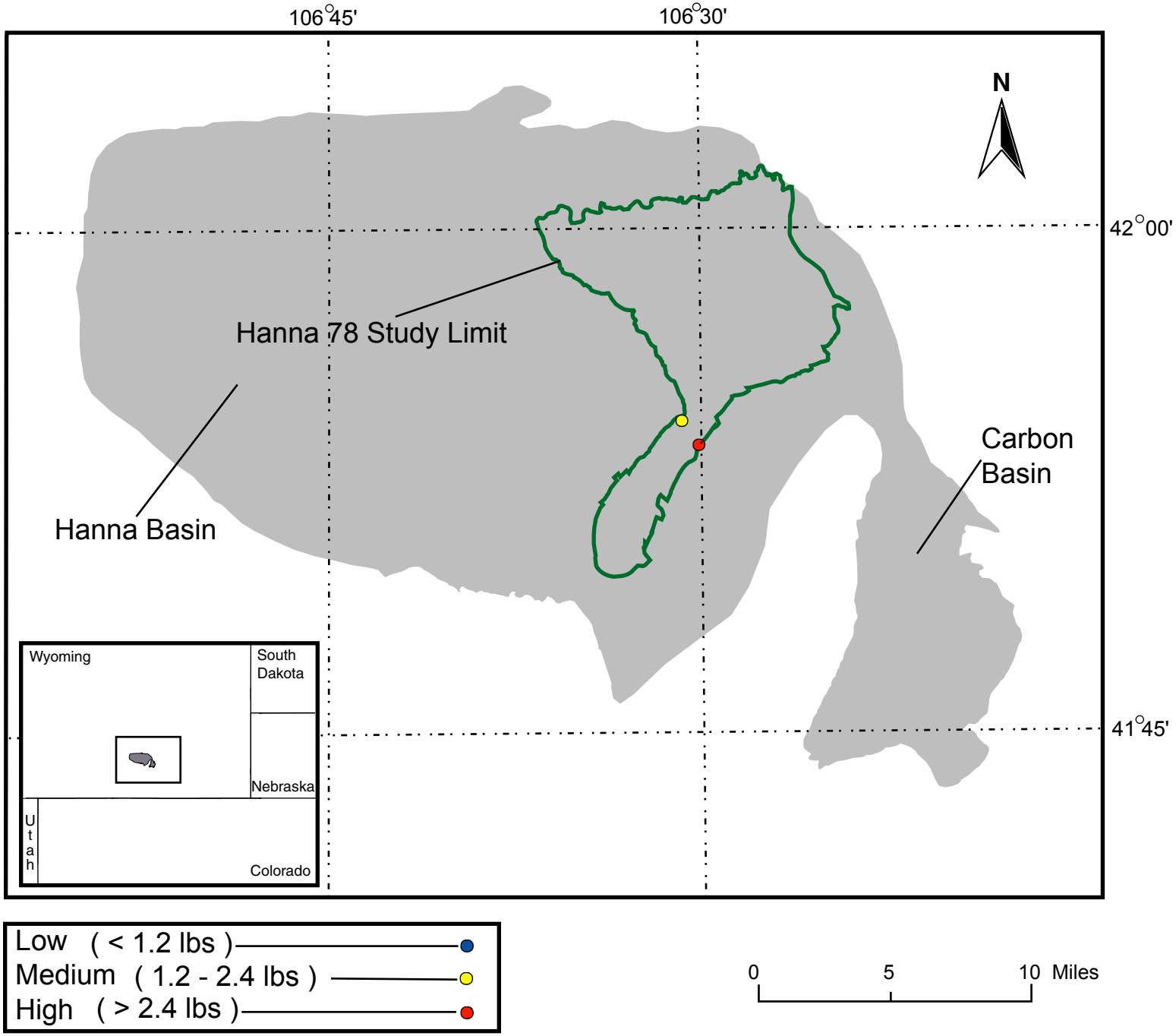

Figure HQ-24. Pounds of sulfur dioxide per million Btu in the Hanna 78 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

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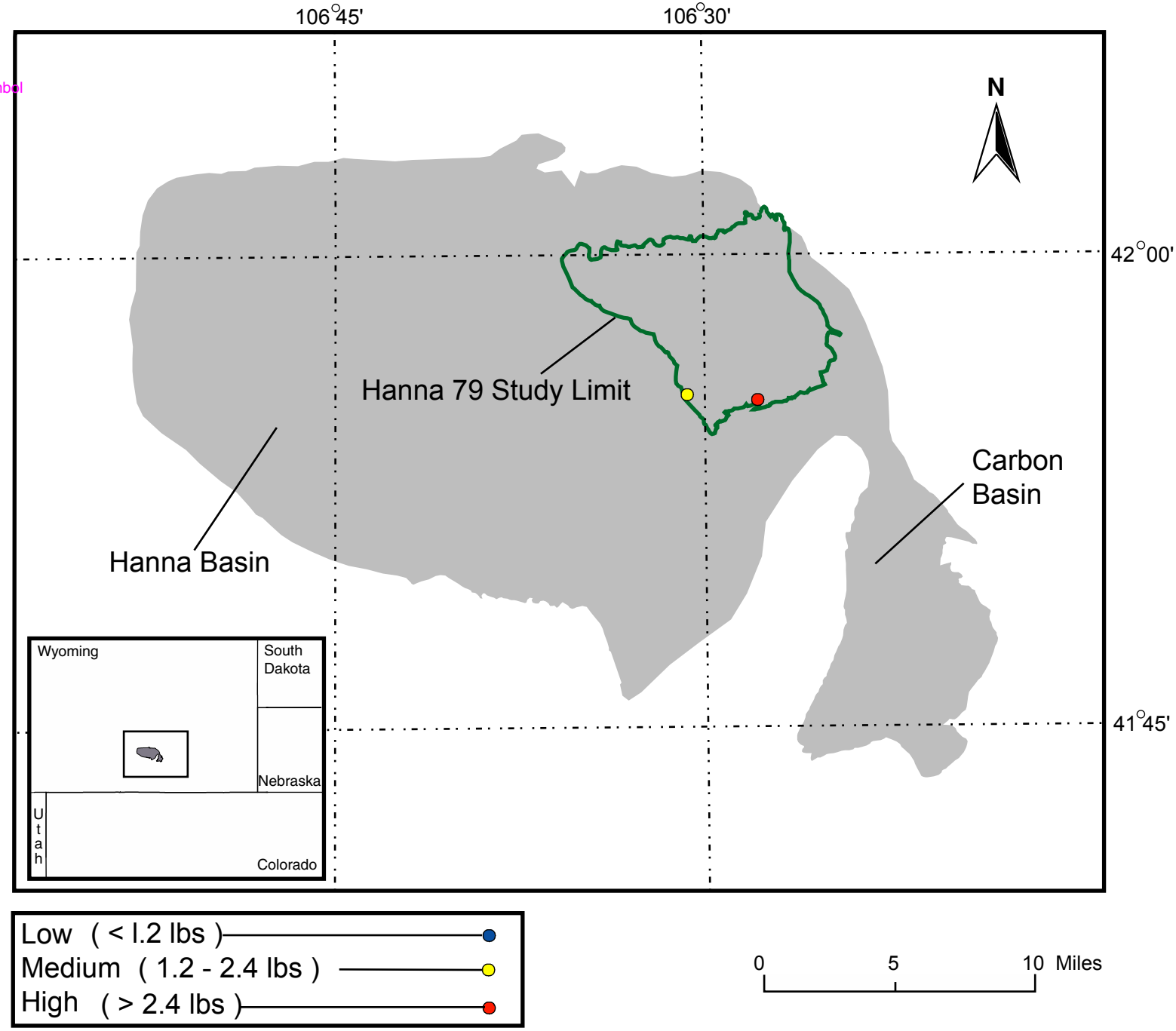

Figure HQ-25. Pounds of sulfur dioxide per million Btu in the Hanna 79 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

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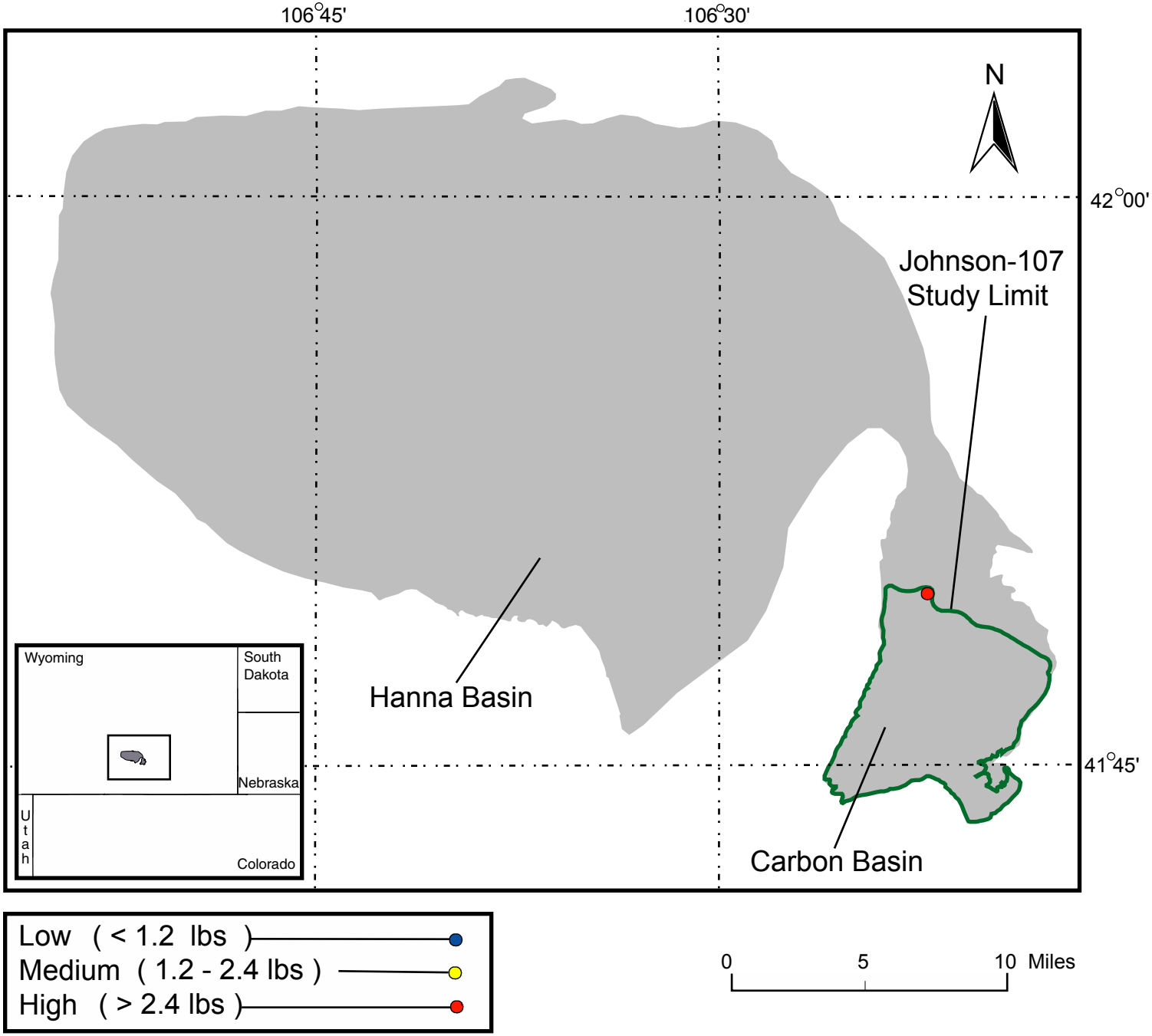

Figure HQ-26. Pounds of sulfur dioxide per million Btu in the Johnson-107 coal zone, South Carbon coalfiled, Carbon Basin, Wyoming.

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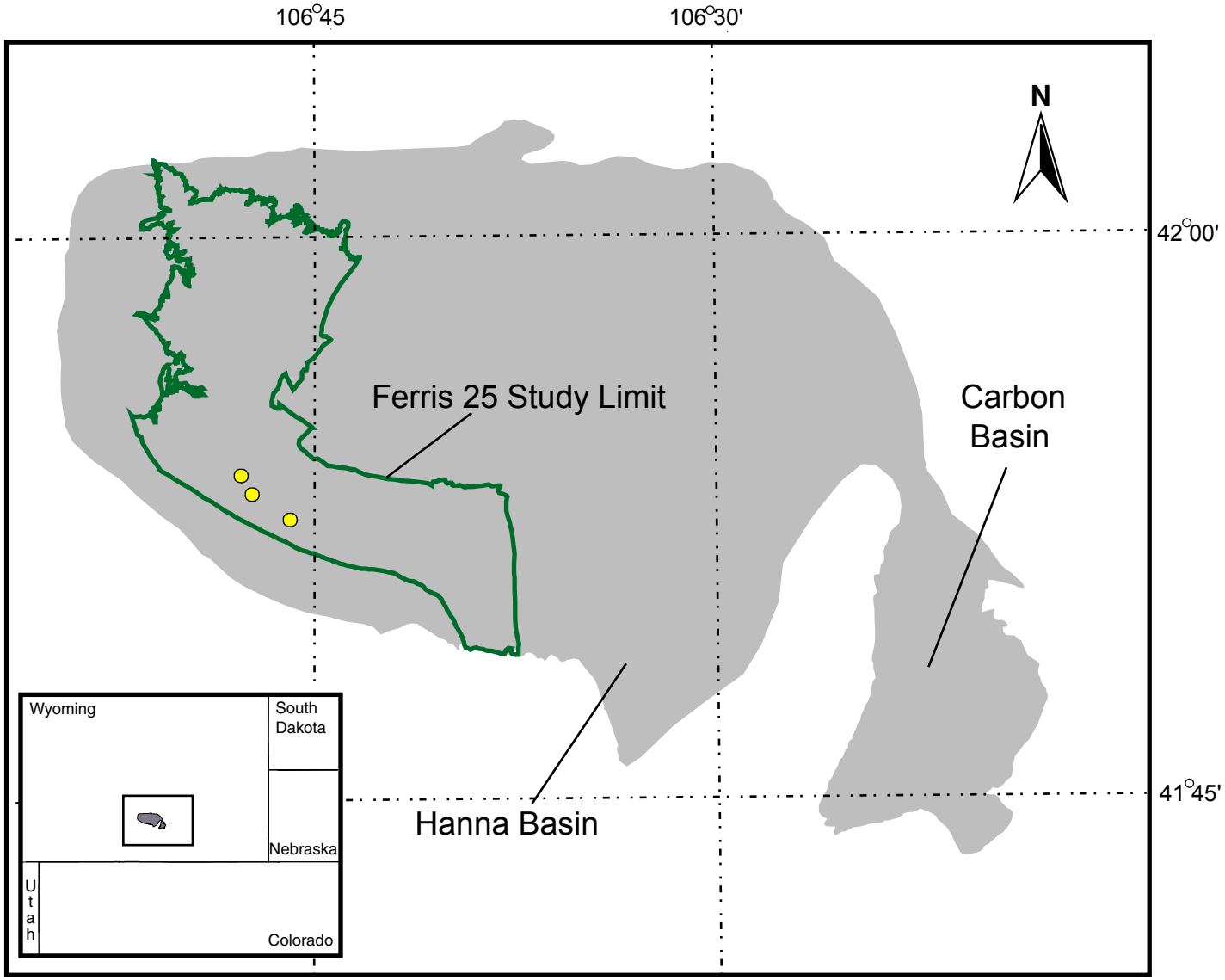

Figure HQ-27. Antimony concentration in the Ferris 25 coal zone, Ferris coalfield, Hanna Basin, Wyoming.

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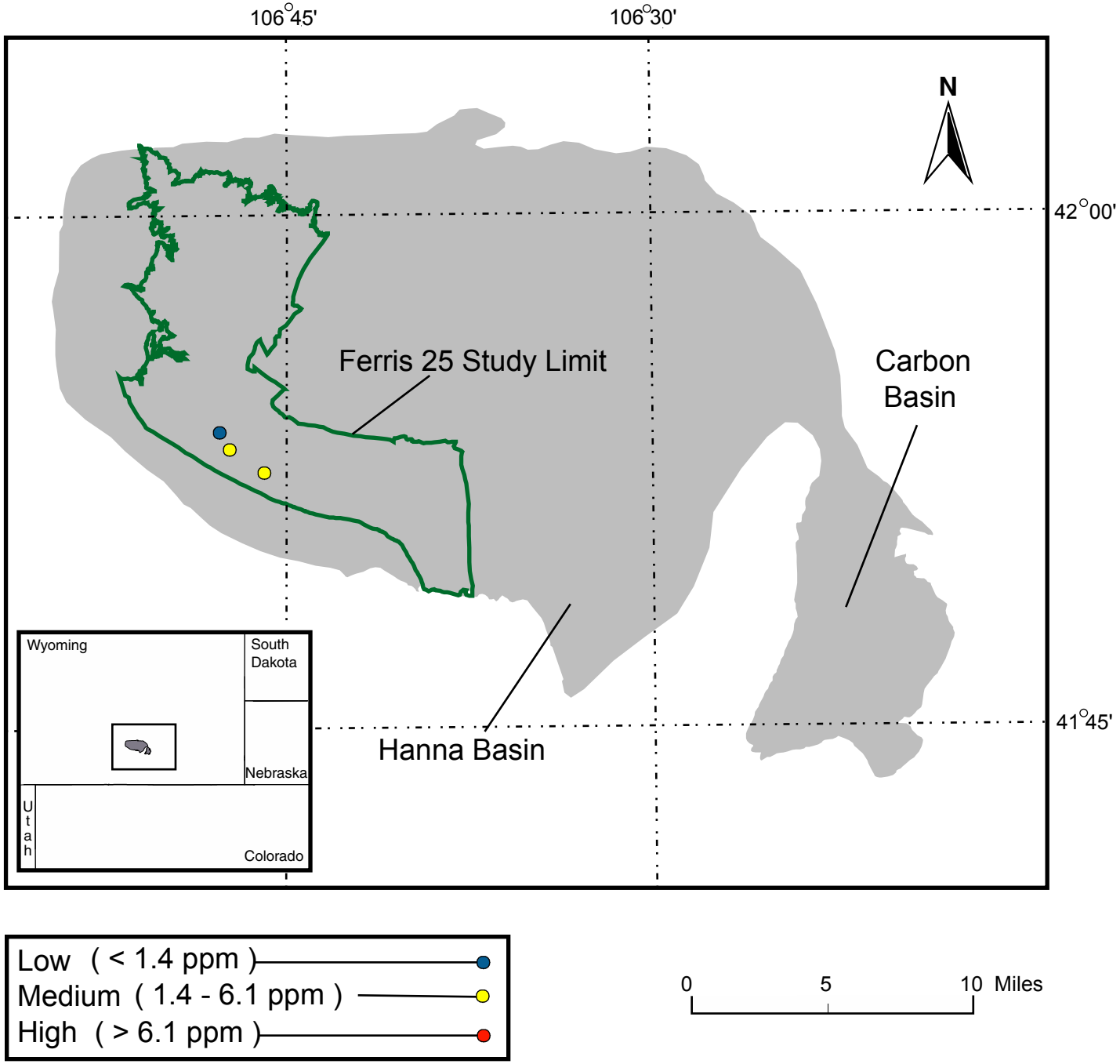

Figure HQ-28. Arsenic concentration in the Ferris 25 coal zone, Ferris coalfield, Hanna Basin, Wyoming.

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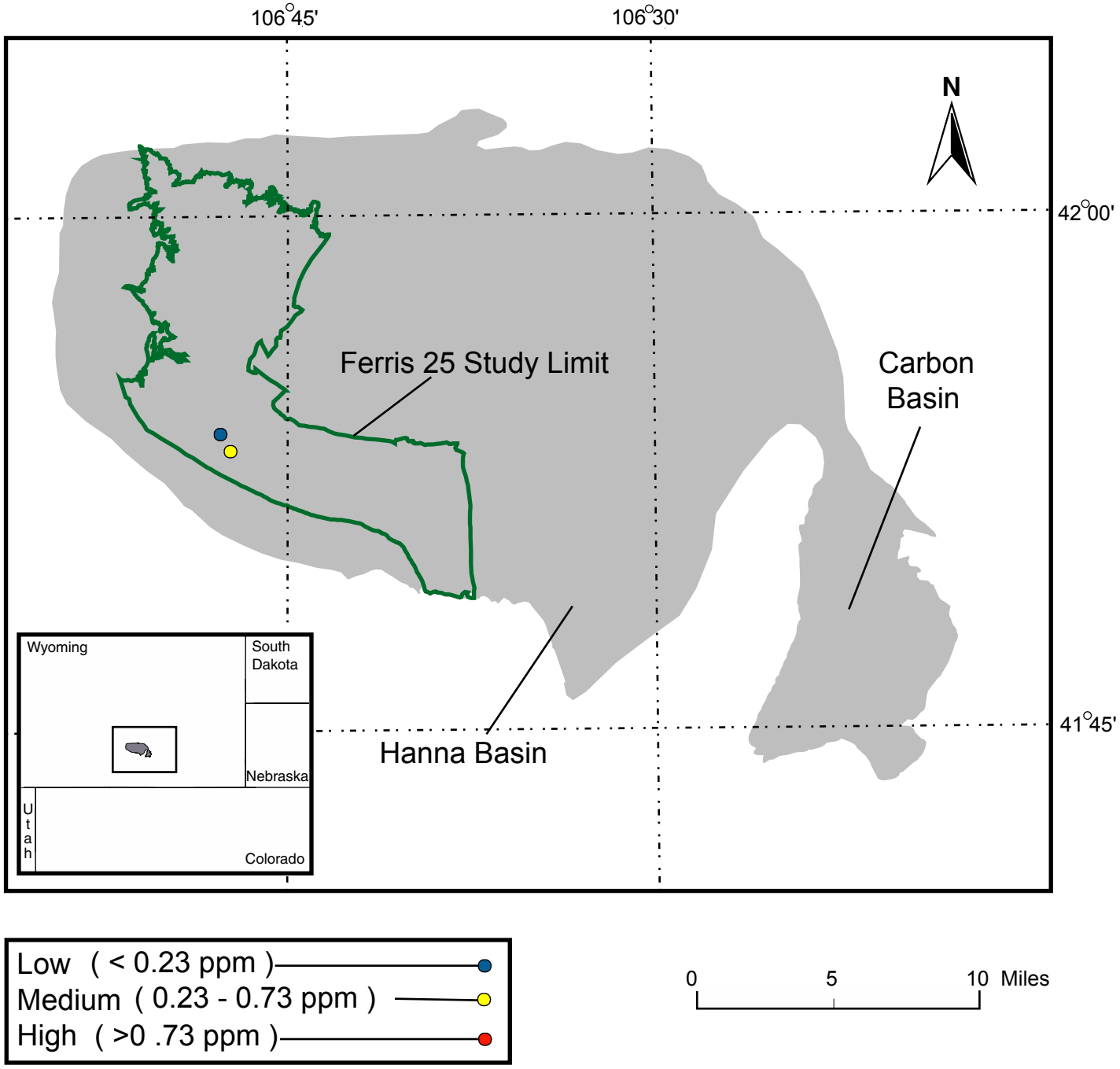

Figure HQ-29. Beryllium concentration in the Ferris 25 coal zone, Ferris coalfield, Hanna Basin, Wyoming.

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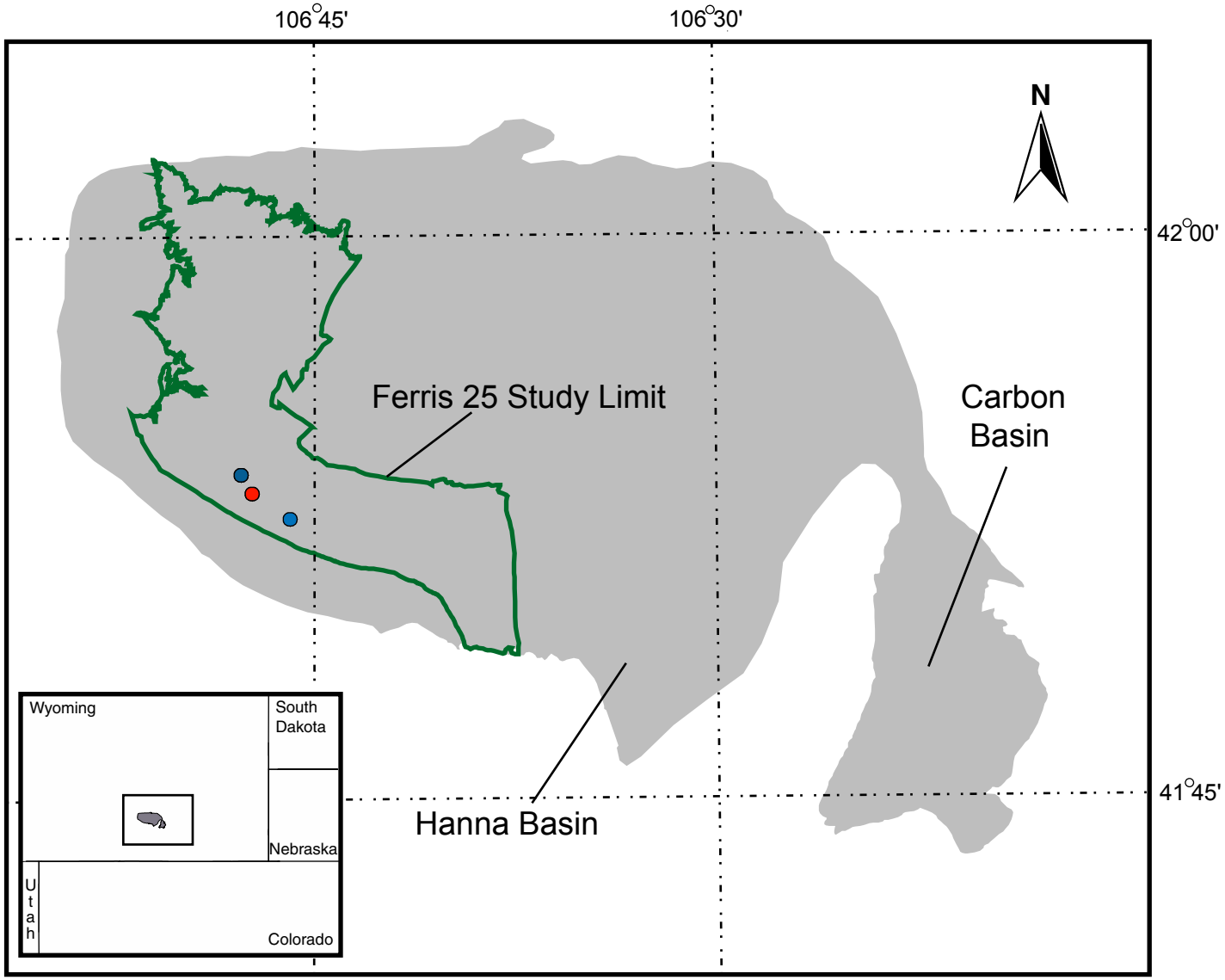

Figure HQ-30. Cadmium concentration in the Ferris 25 coal zone, Ferris coalfield, Hanna Basin, Wyoming.

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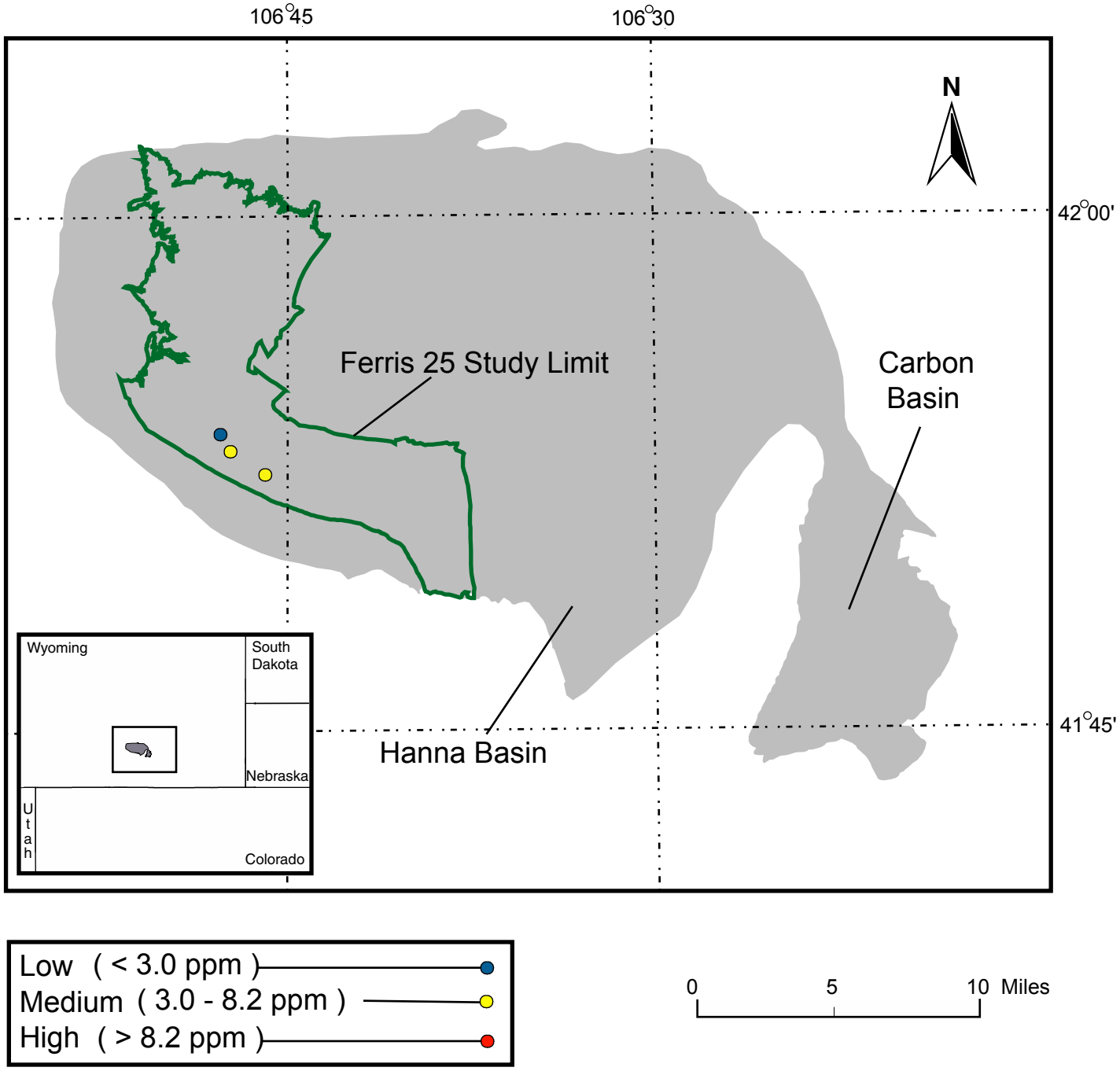

Figure HQ-31. Chromium concentration in the Ferris 25 coal zone, Ferris coalfield, Hanna Basin, Wyoming.

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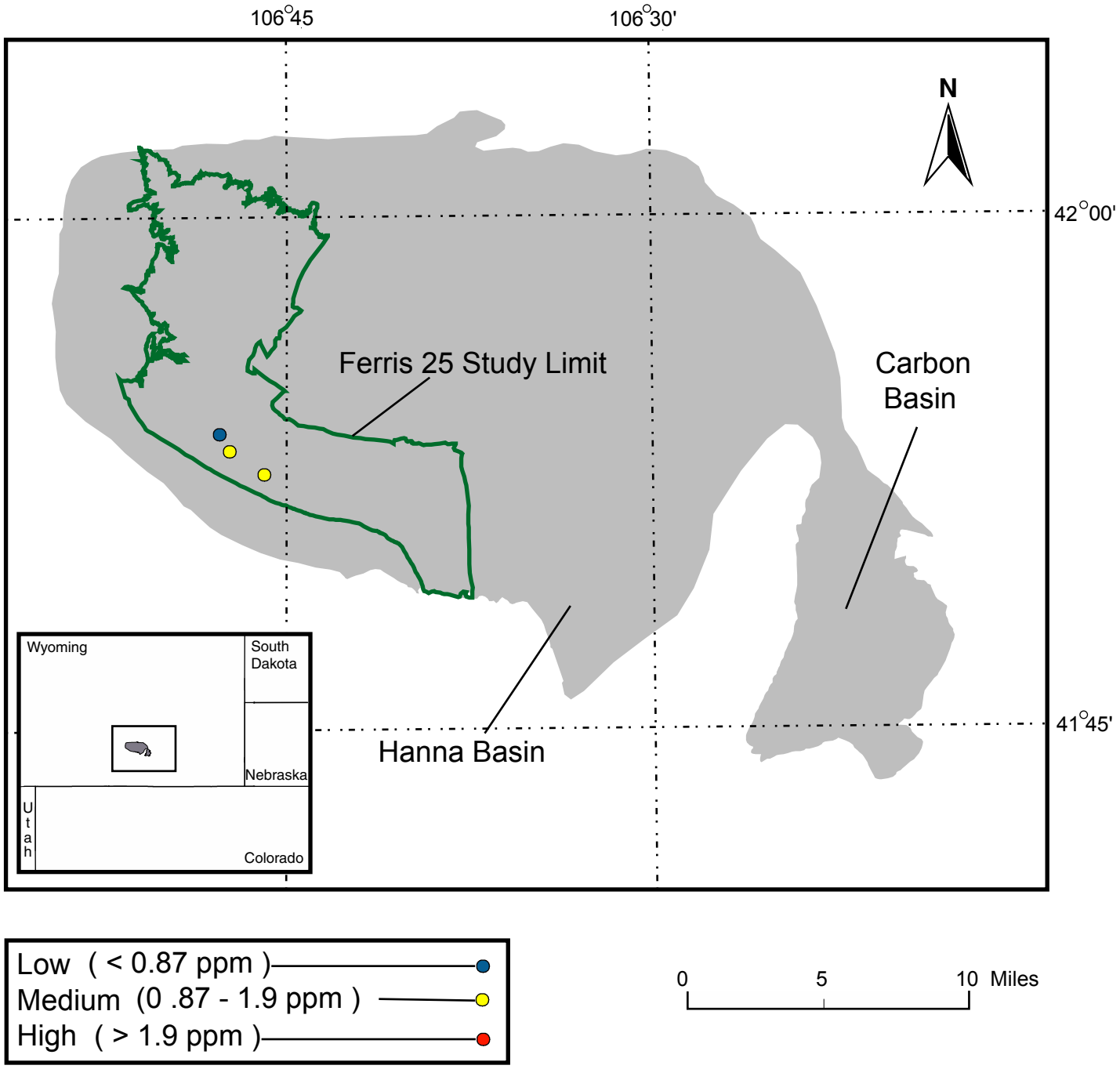

Figure HQ-32. Cobalt concentration in the Ferris 25 coal zone, Ferris coalfield, Hanna Basin, Wyoming.

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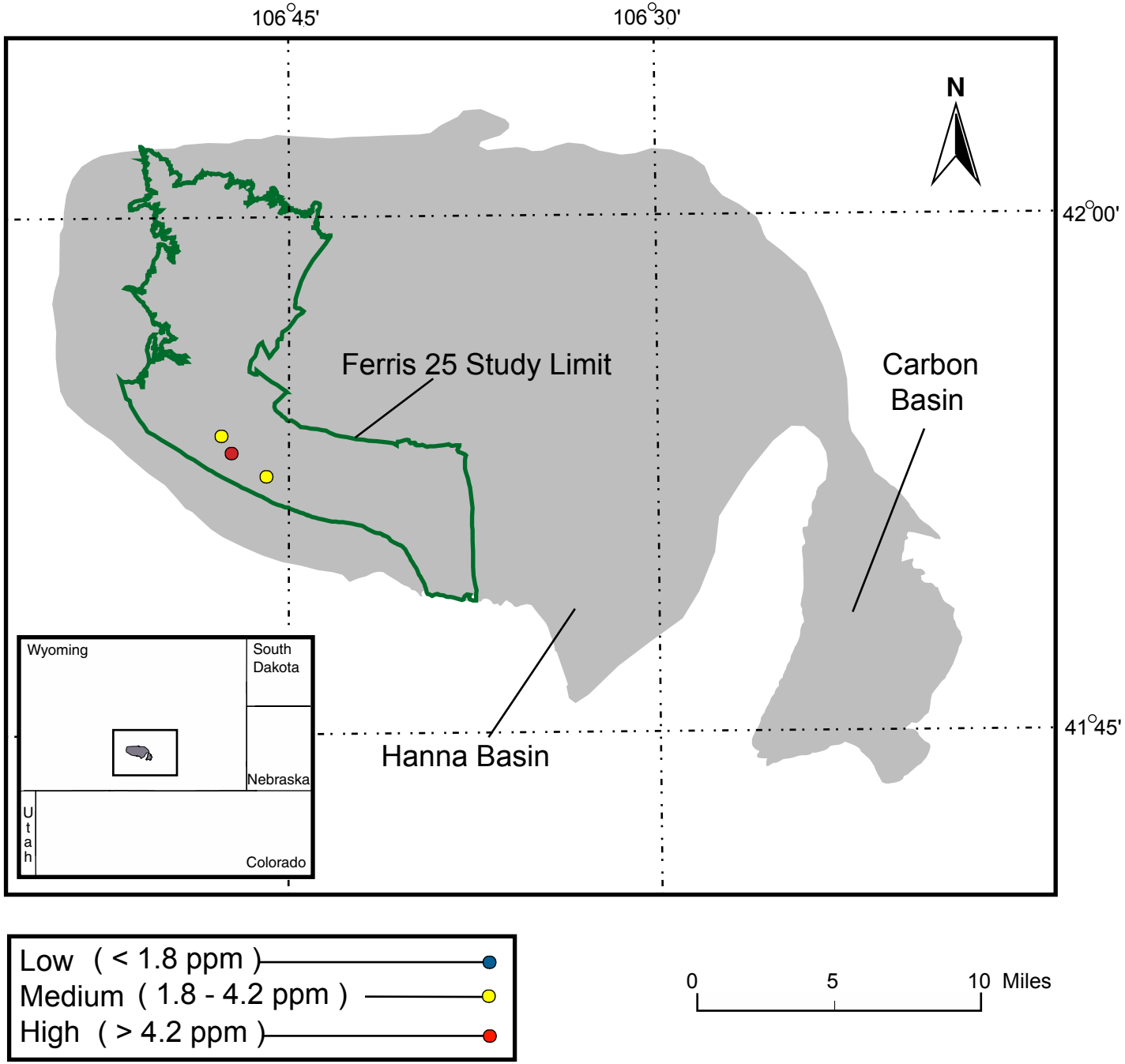

Figure HQ-33. Lead concentration in the Ferris 25 coal zone, Ferris coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

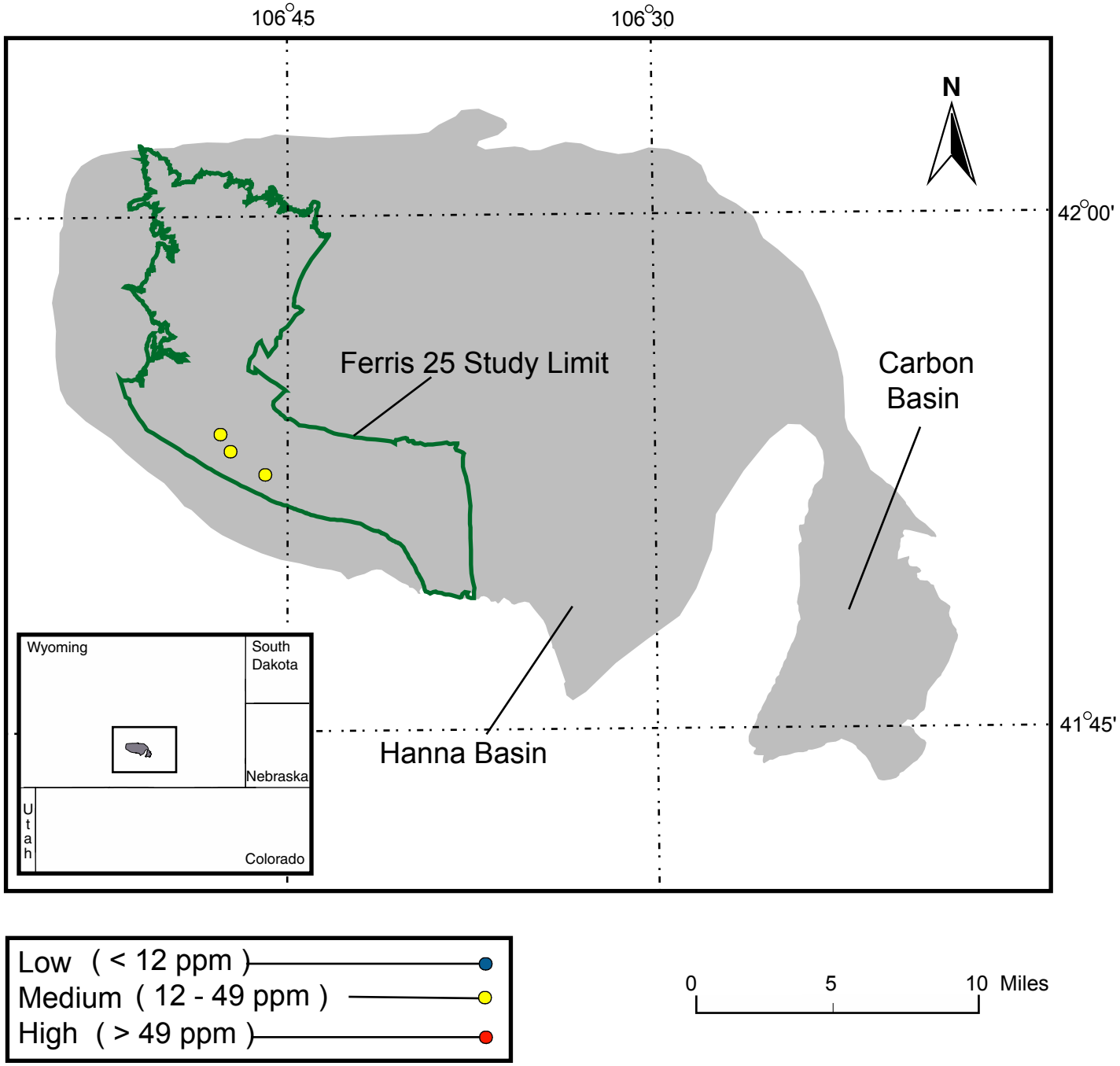

Figure HQ-34. Manganese concentration in the Ferris 25 coal zone, Ferris coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

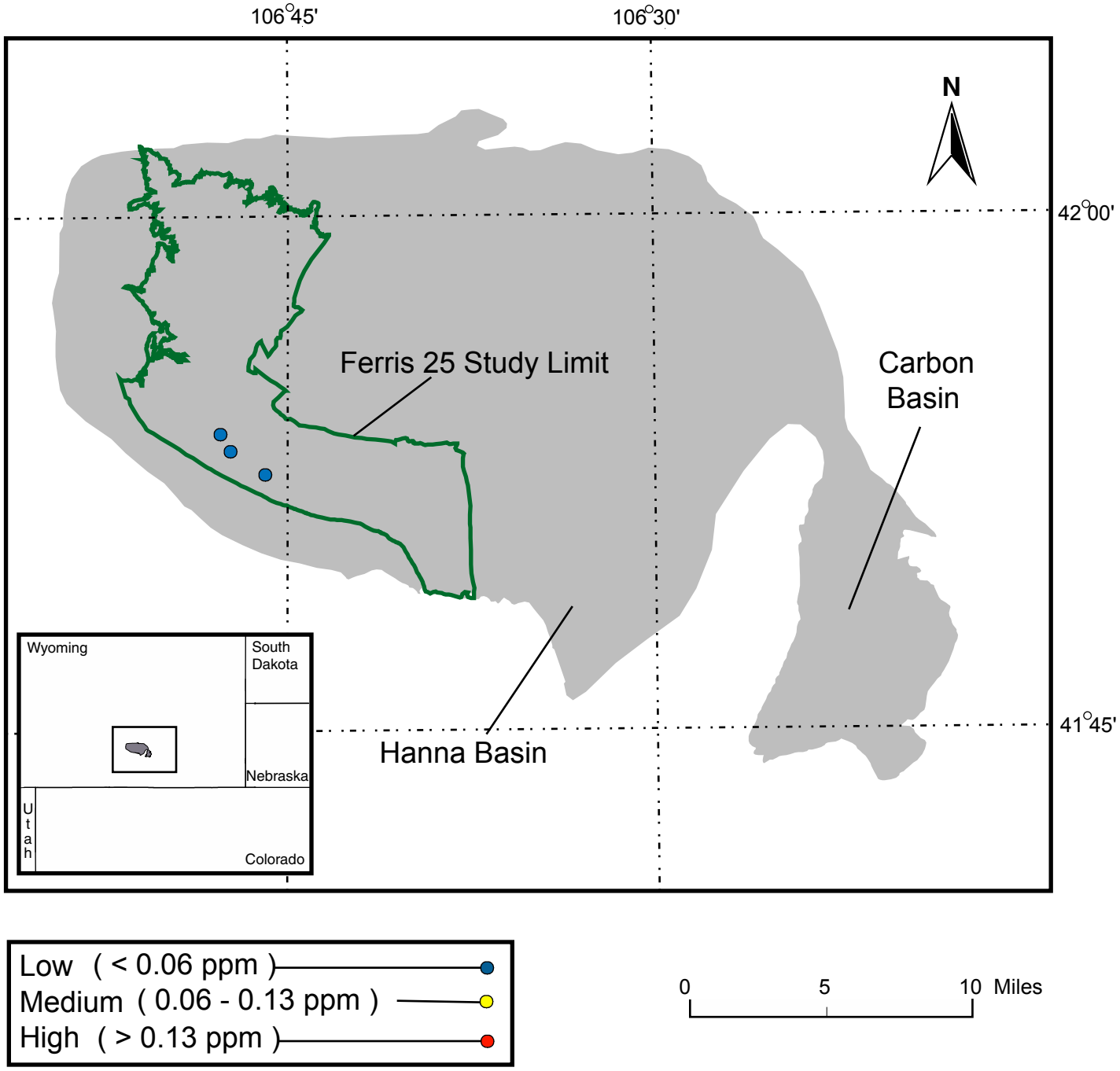

Figure HQ-35. Mercury concentration in the Ferris 25 coal zone, Ferris coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

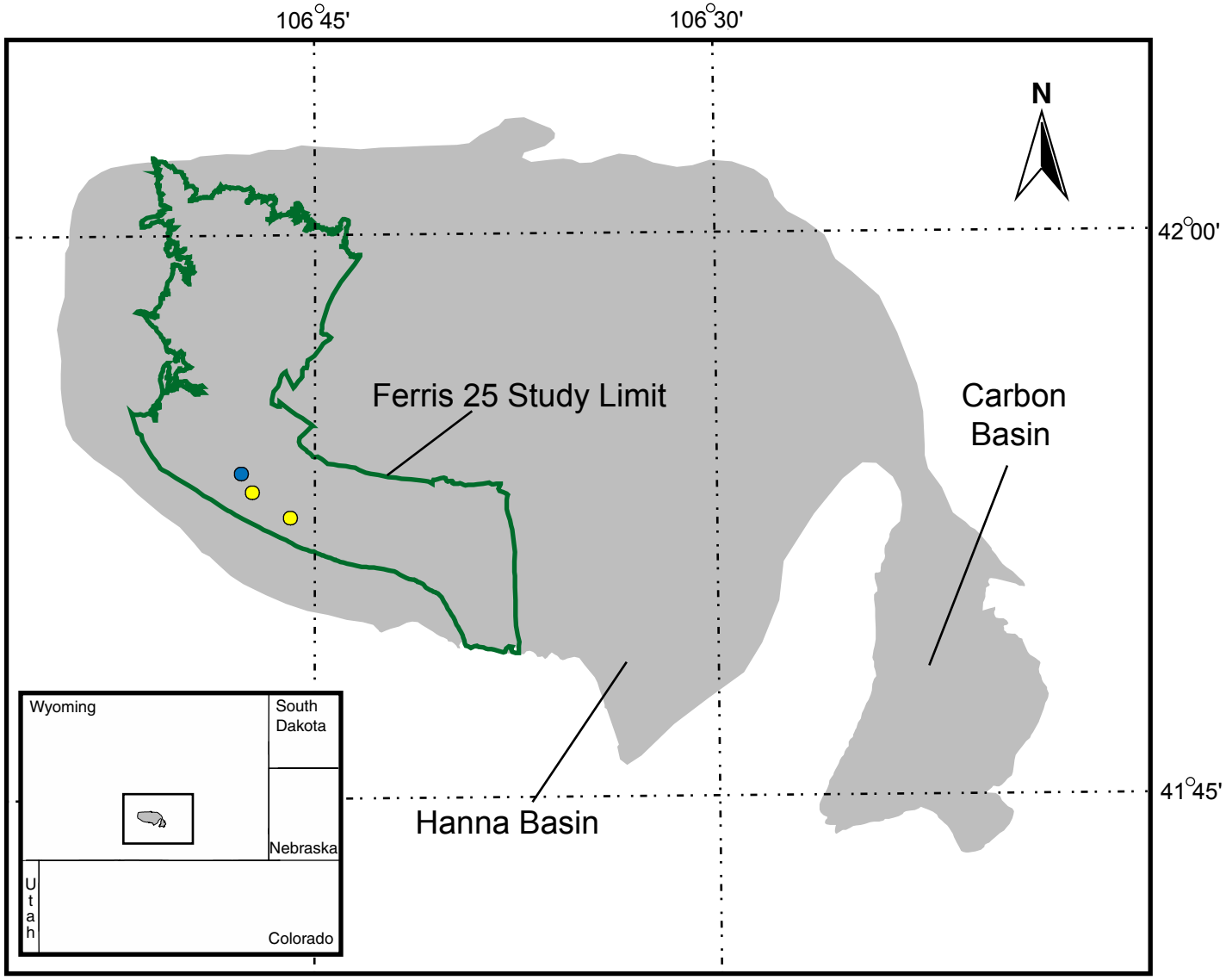

Figure HQ-36. Nickel concentration in the Ferris 25 coal zone, Ferris coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

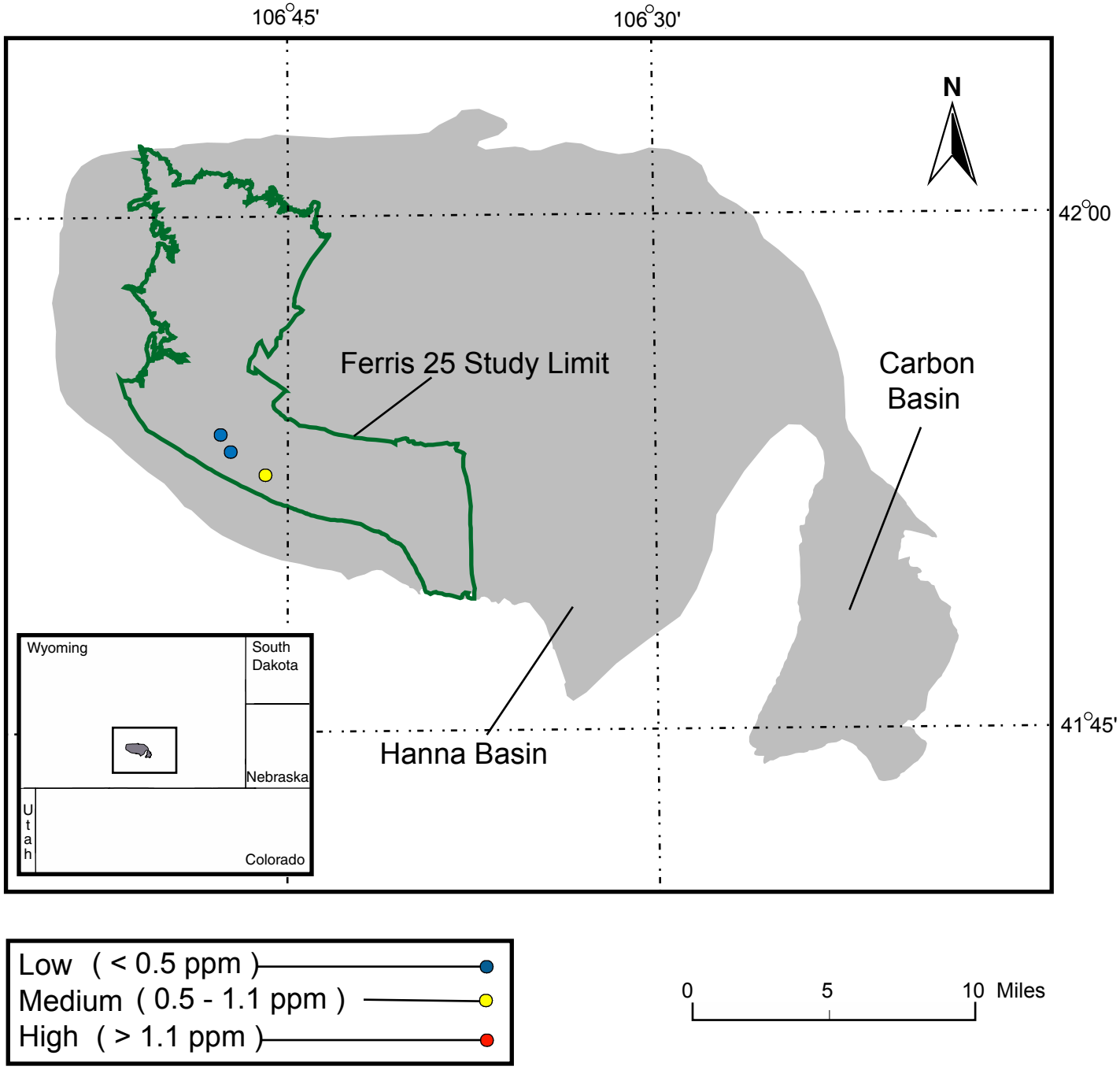

Figure HQ-37. Selenium concentration in the Ferris 25 coal zone, Ferris coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

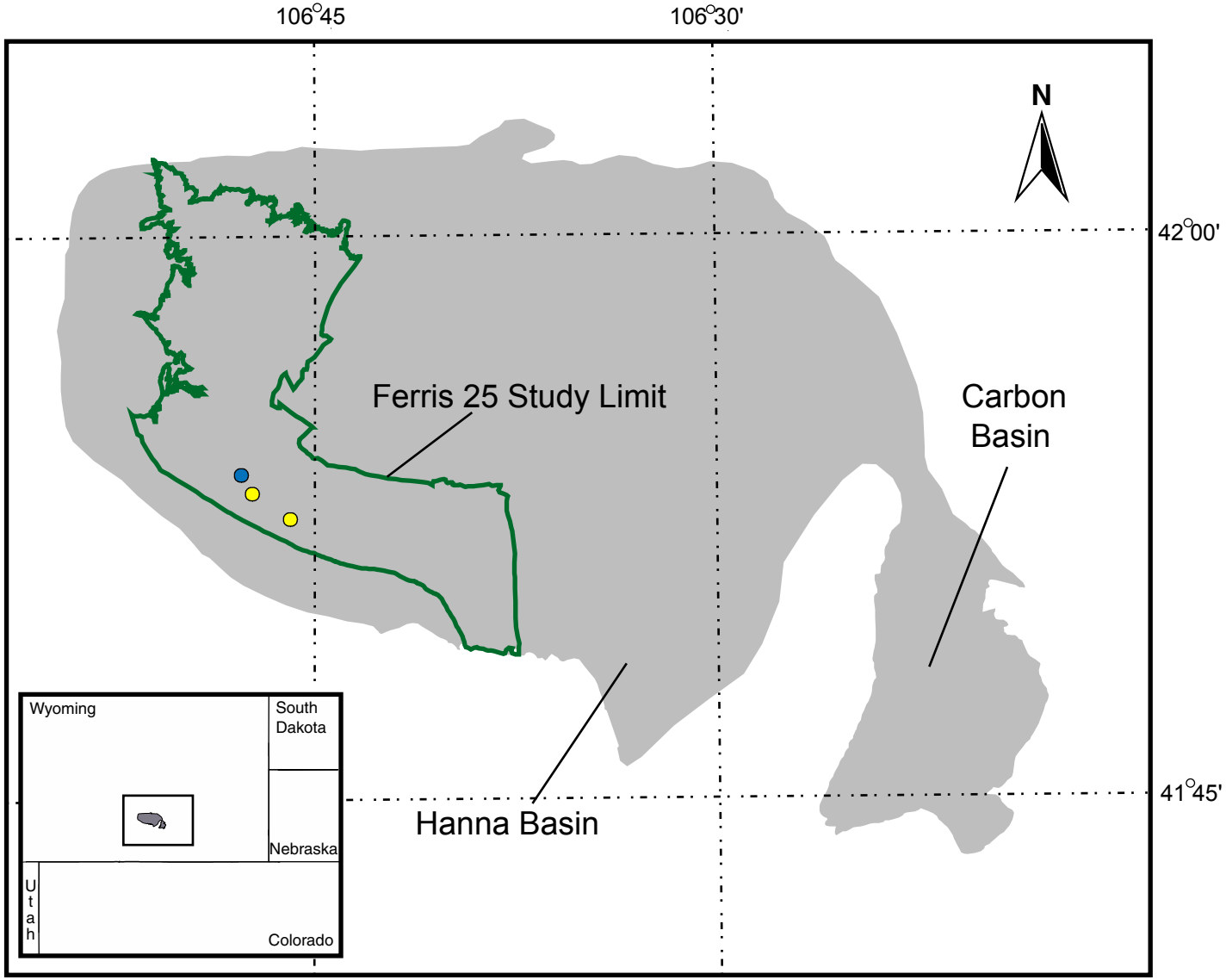

Figure HQ-38. Uranium concentration in the Ferris 25 coal zone, Ferris coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

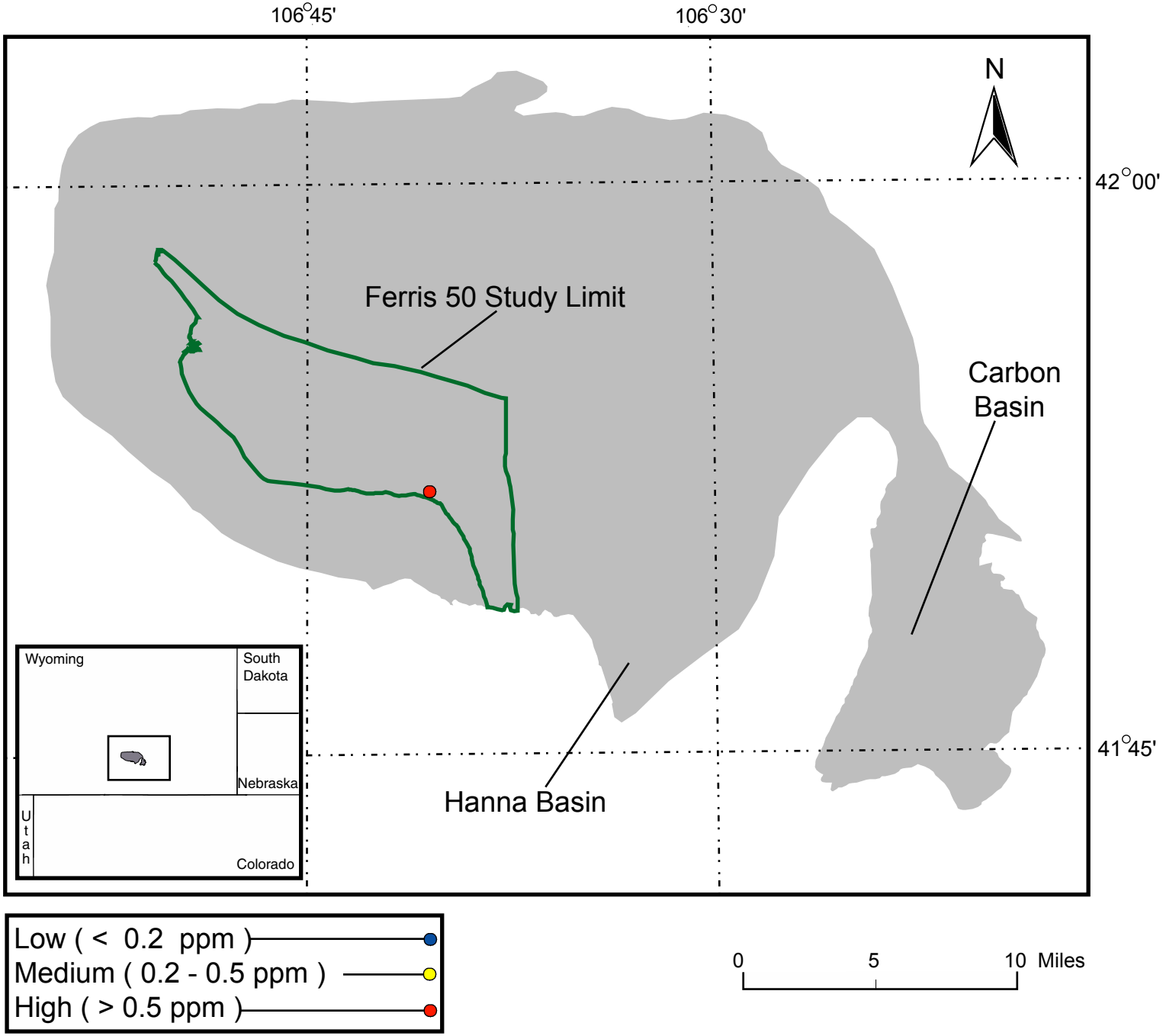

Figure HQ-39. Antimony concentration in the Ferris 50 coal zone, Ferris coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

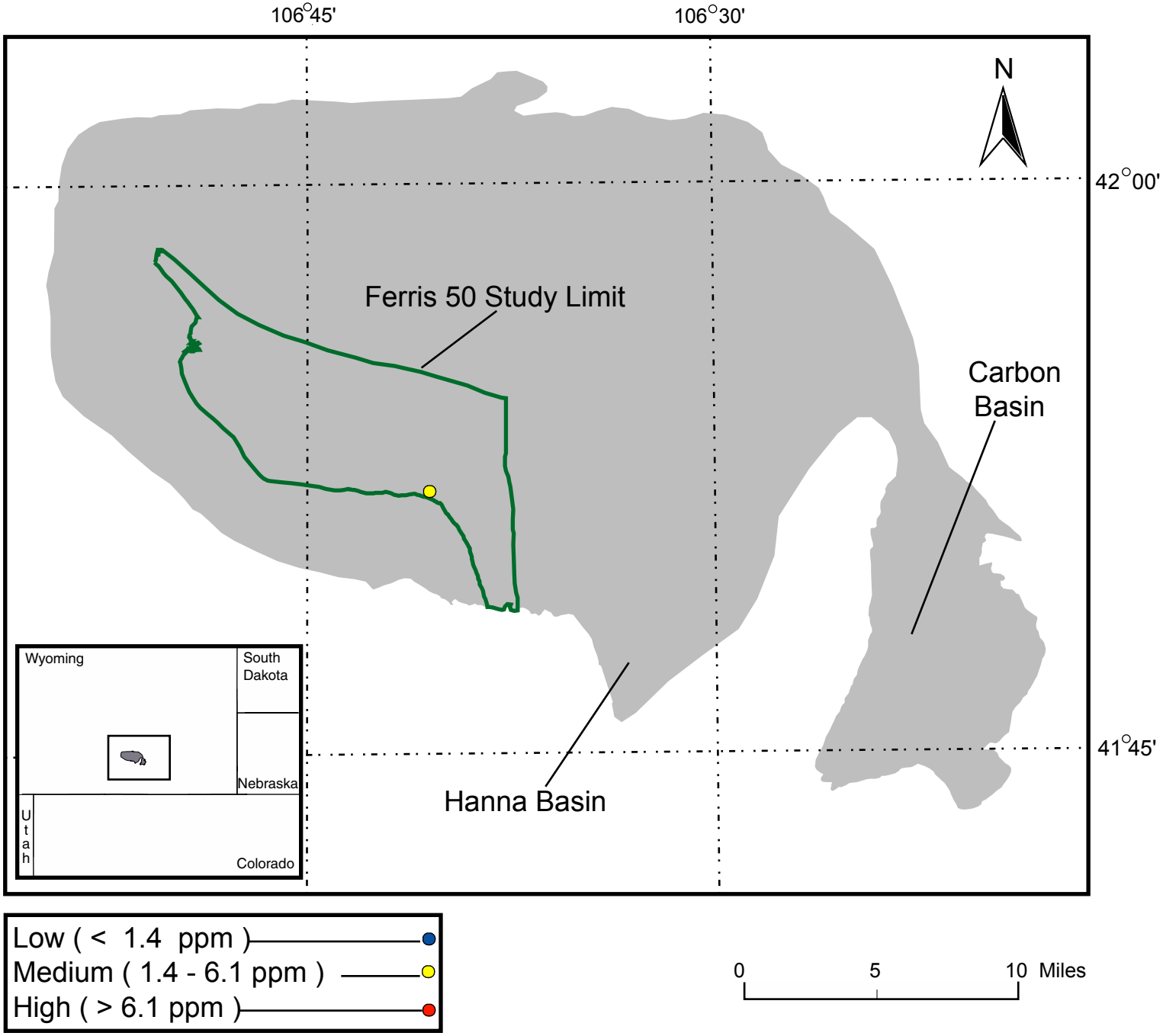

Figure HQ-40. Arsenic concentration in the Ferris 50 coal zone, Ferris coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

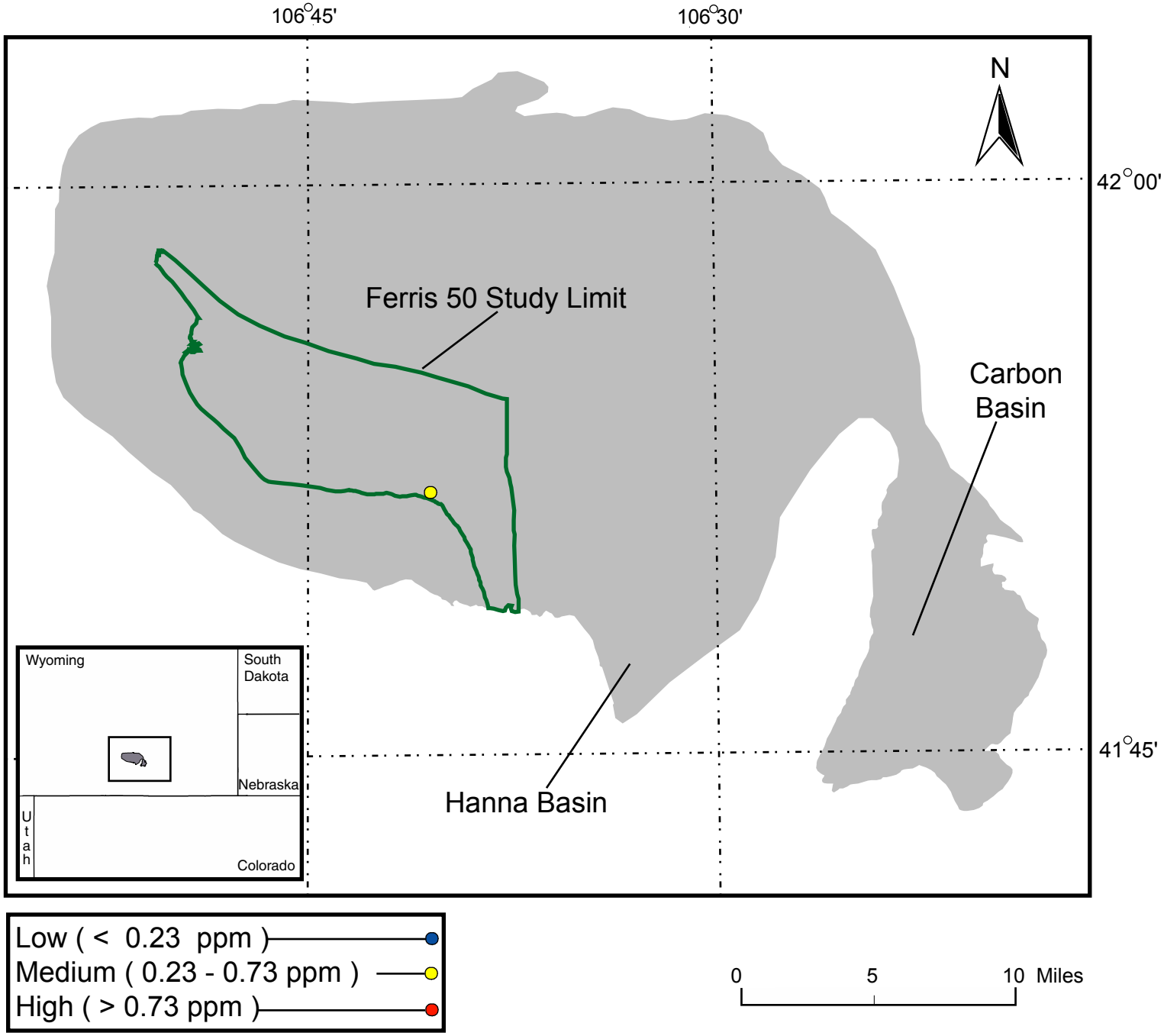

Figure HQ-41. Beryllium concentration in the Ferris 50 coal zone, Ferris coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

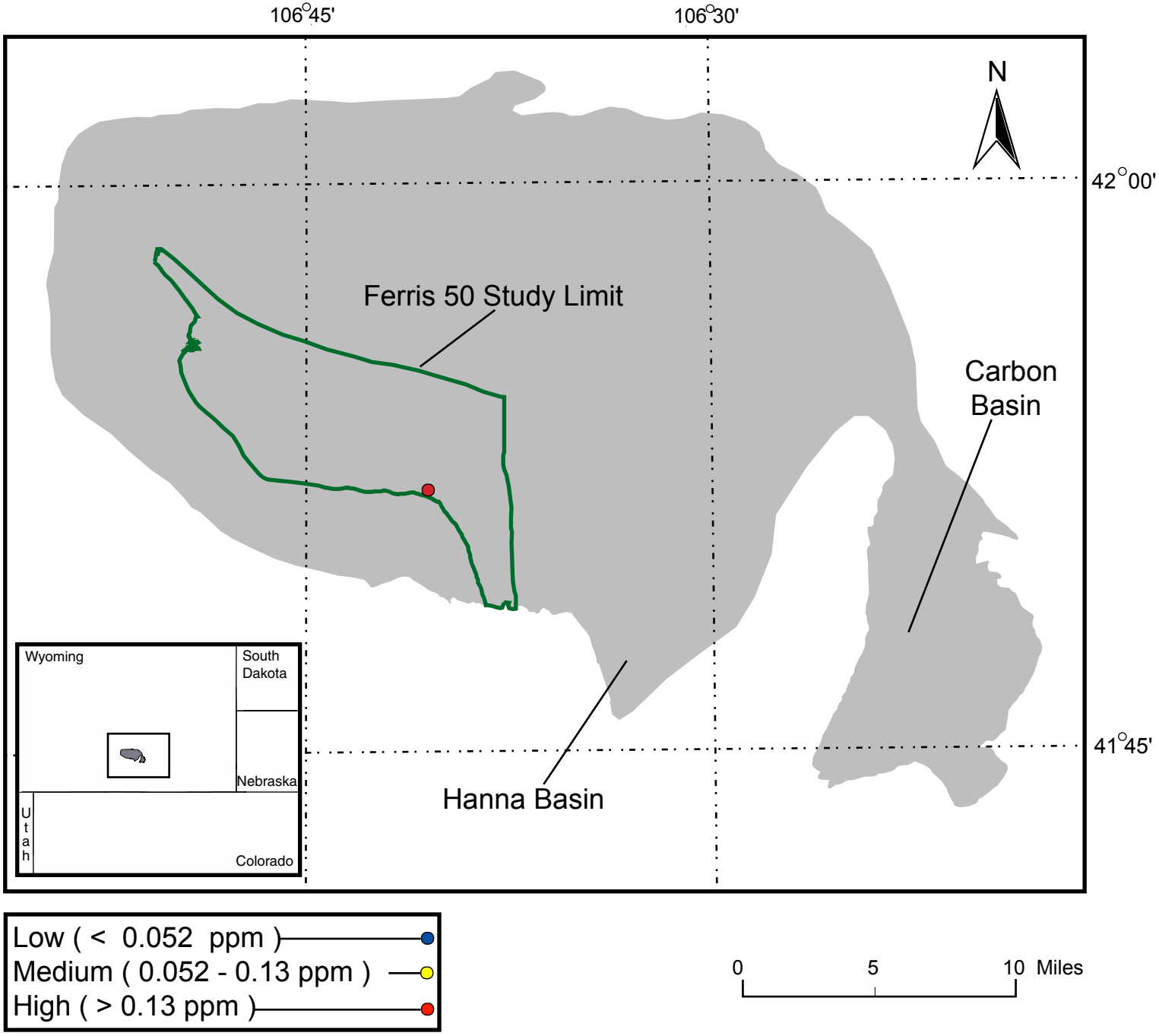

Figure 42. Cadmium concentration in the Ferris 50 coal zone, Ferris coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

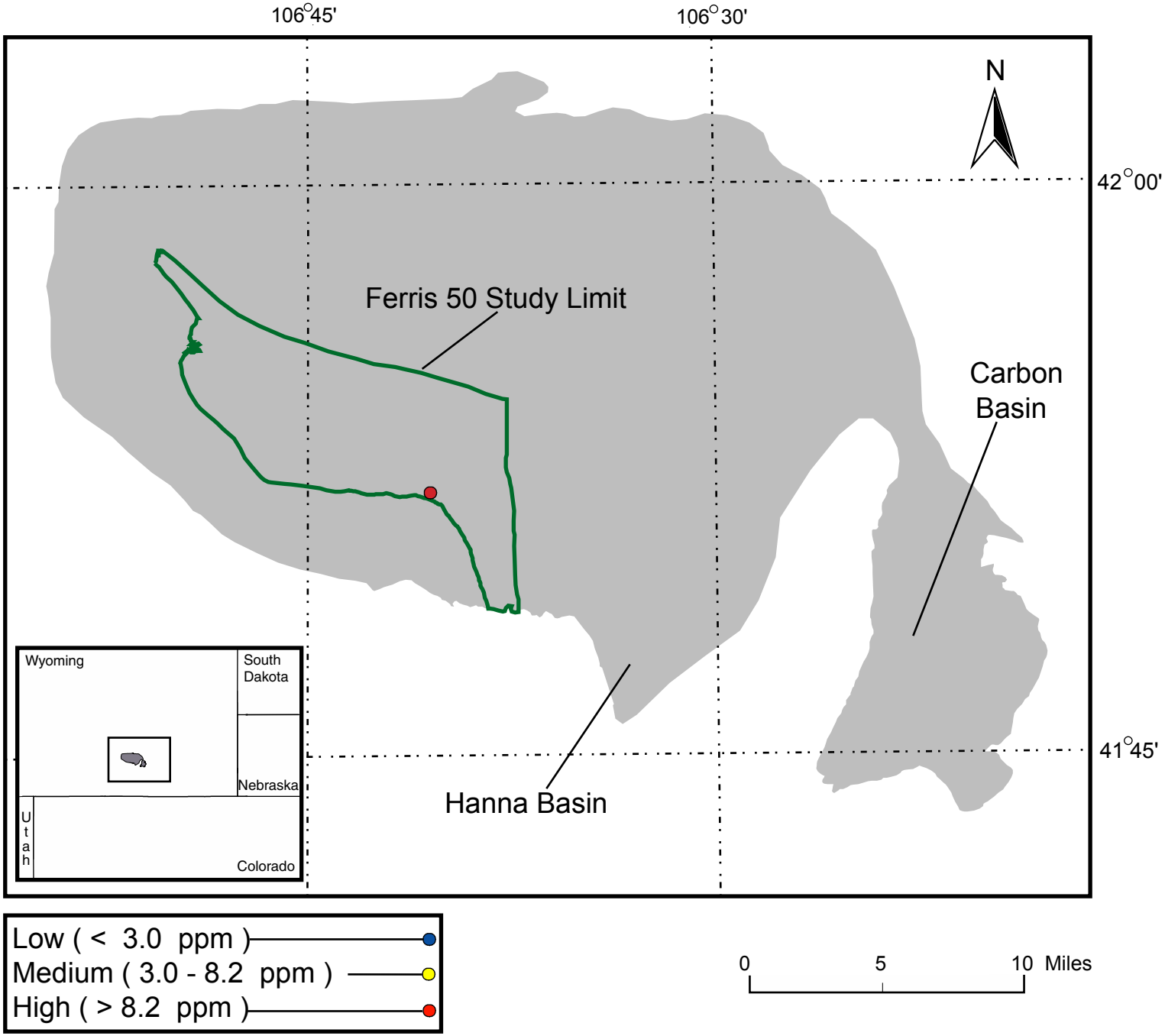

Figure HQ-43. Chromium concentration in the Ferris 50 coal zone, Ferris coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

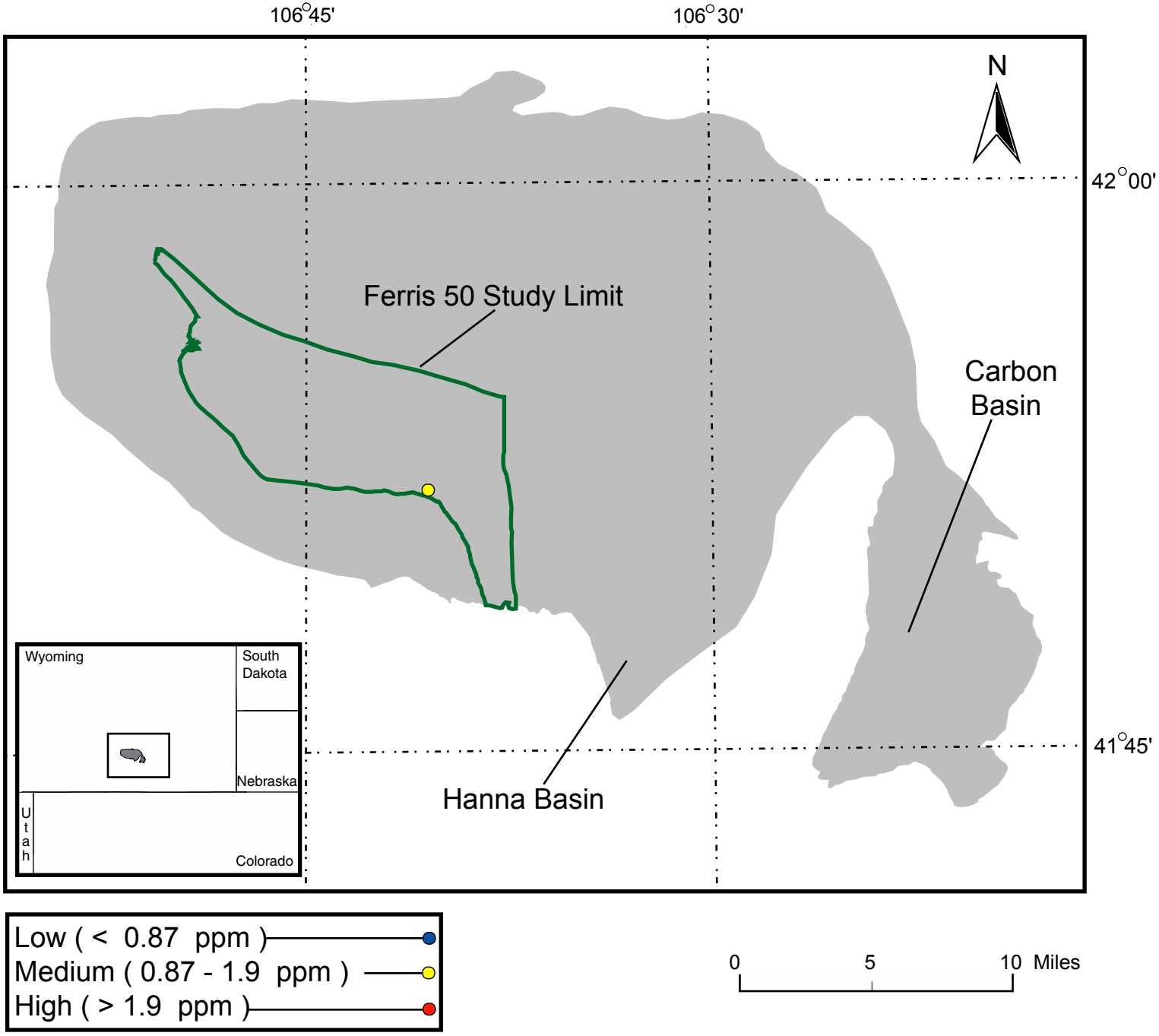

Figure HQ-44. Cobalt concentration in the Ferris 50 coal zone, Ferris coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

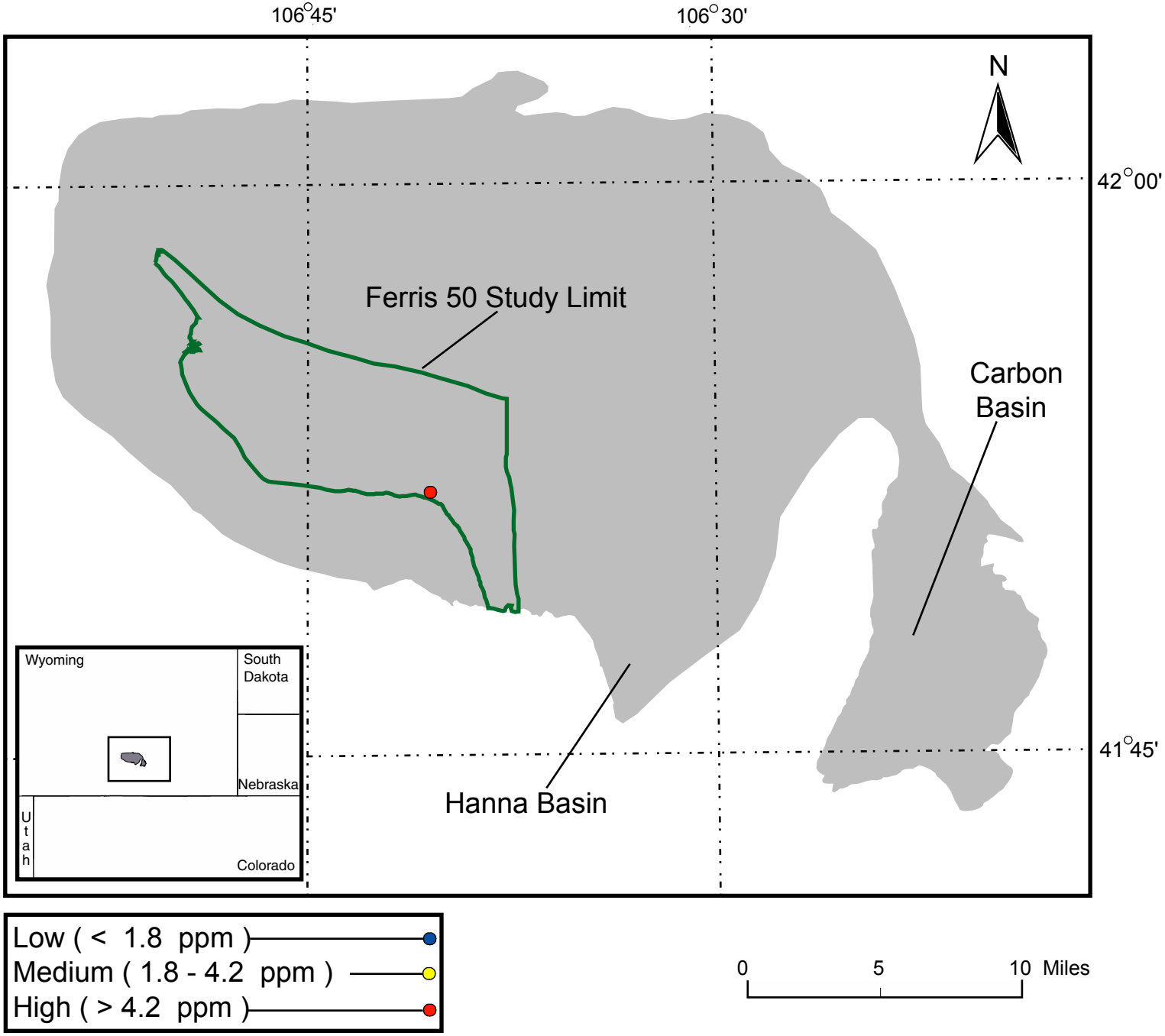

Figure HQ-45. Lead concentration in the Ferris 50 coal zone, Ferris coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

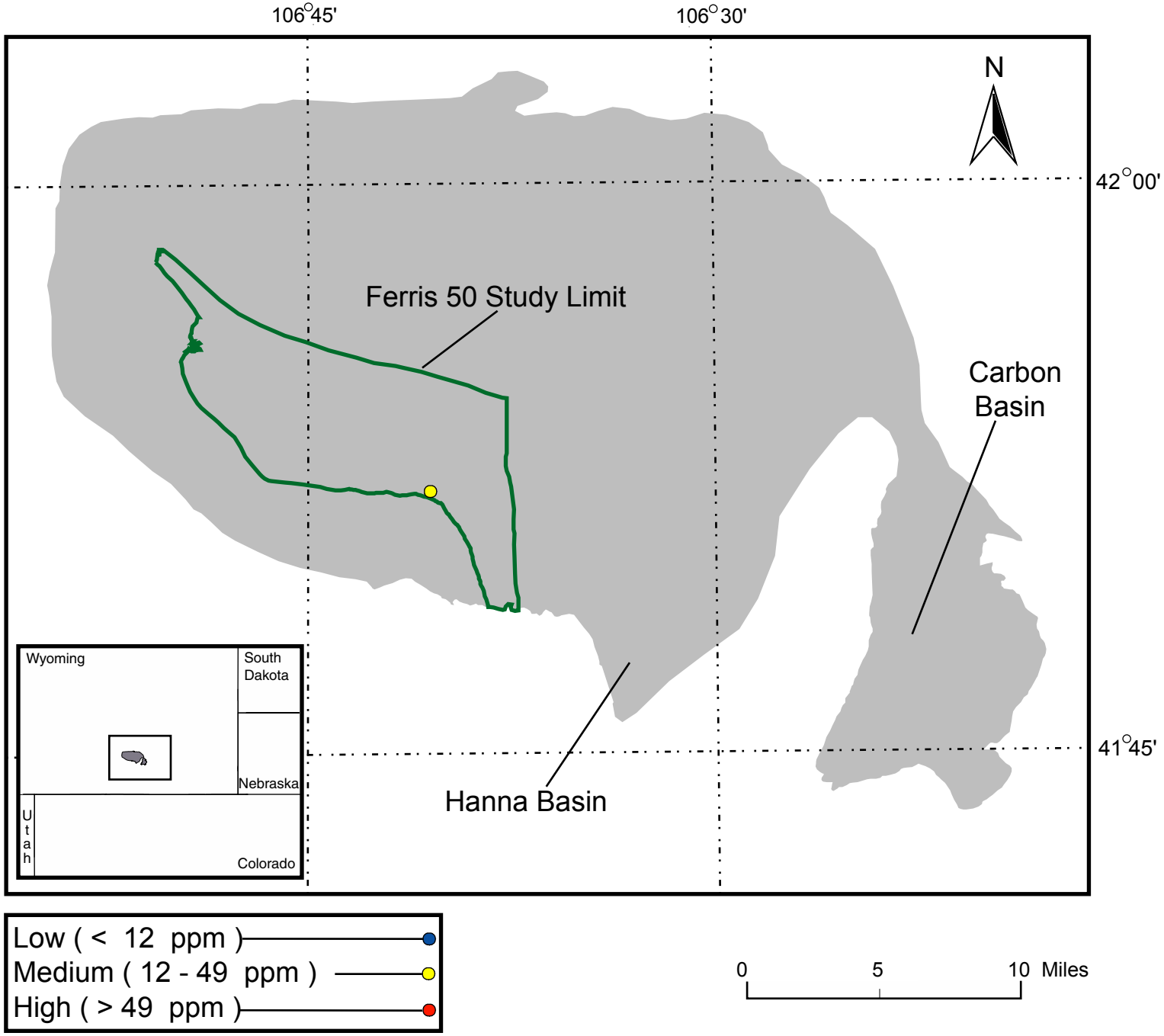

Figure HQ-46. Manganese concentration in the Ferris 50 coal zone, Ferris coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

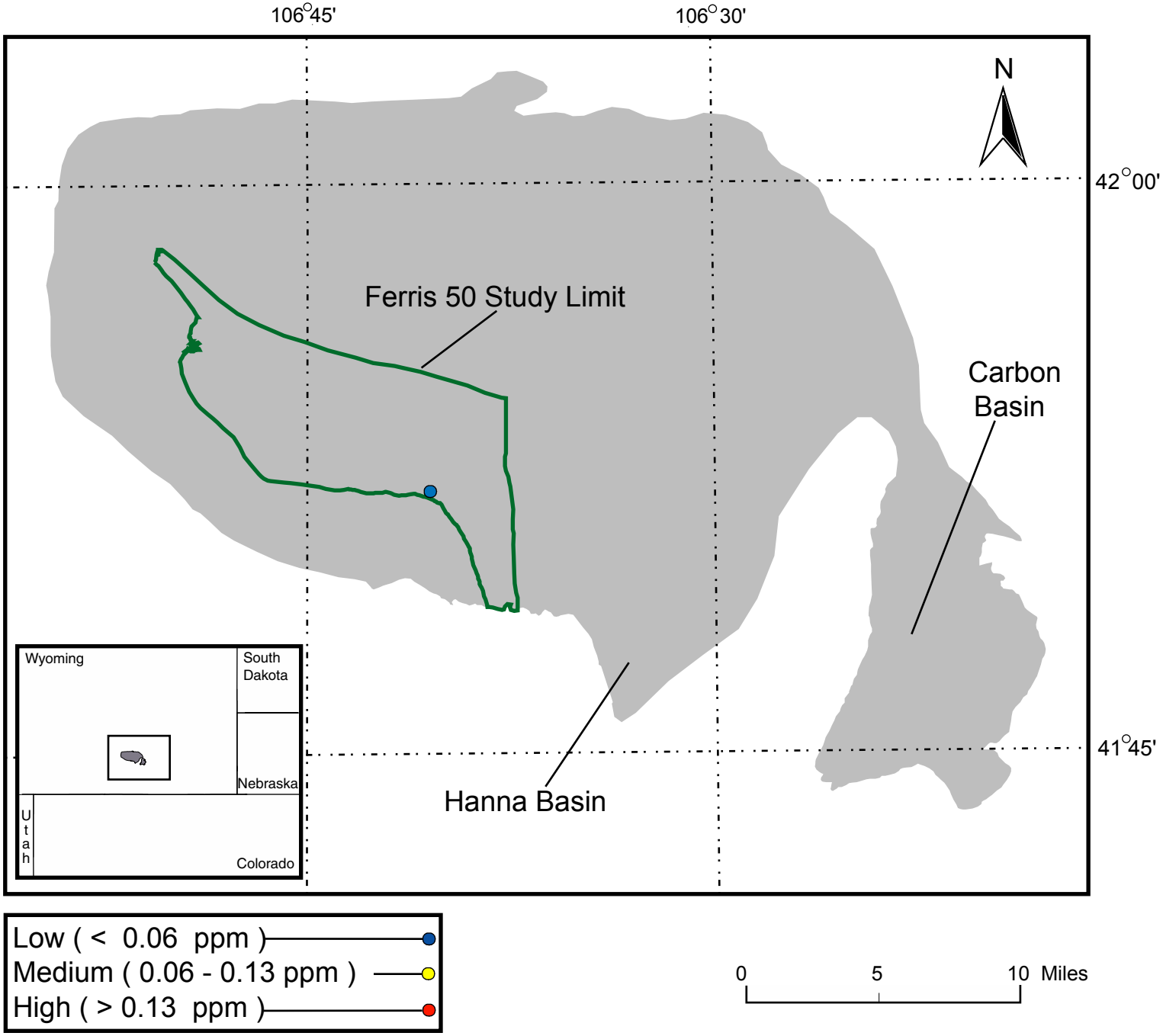

Figure HQ-47. Mercury concentration in the Ferris 50 coal zone, Ferris coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

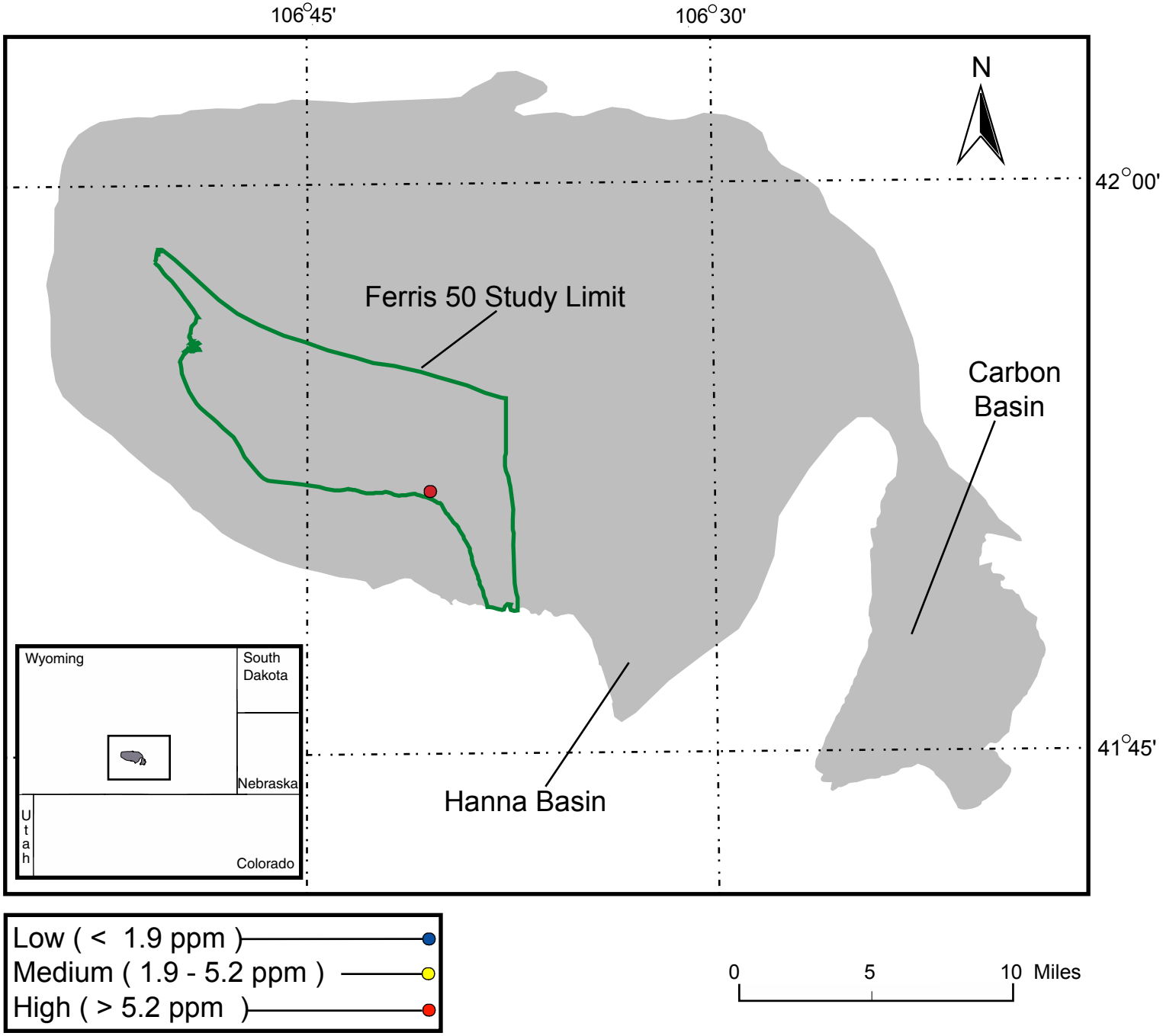

Figure HQ-48. Nickel concentration in the Ferris 50 coal zone, Ferris coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

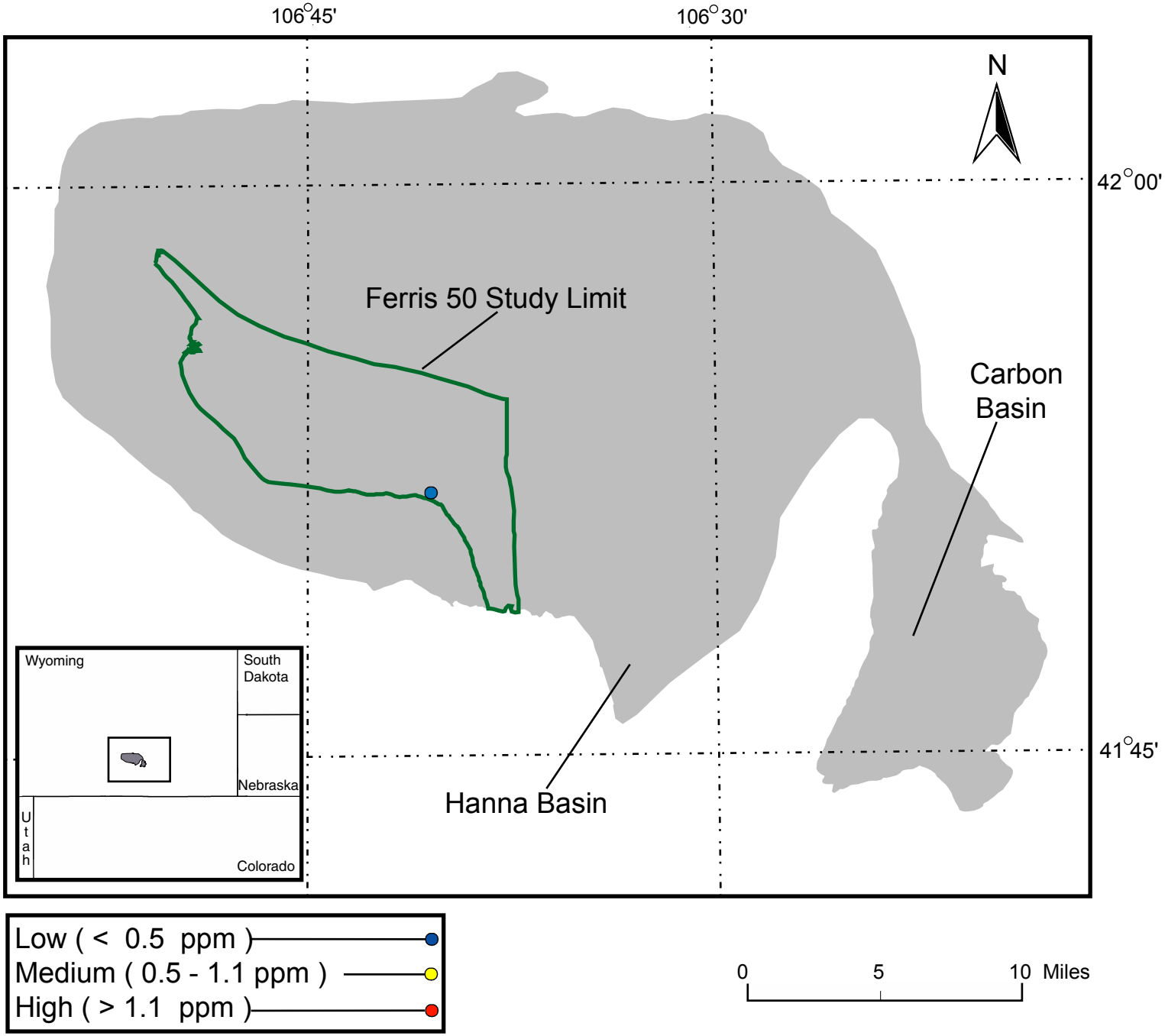

Figure HQ-49. Selenium concentration in the Ferris 50 coal zone, Ferris coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

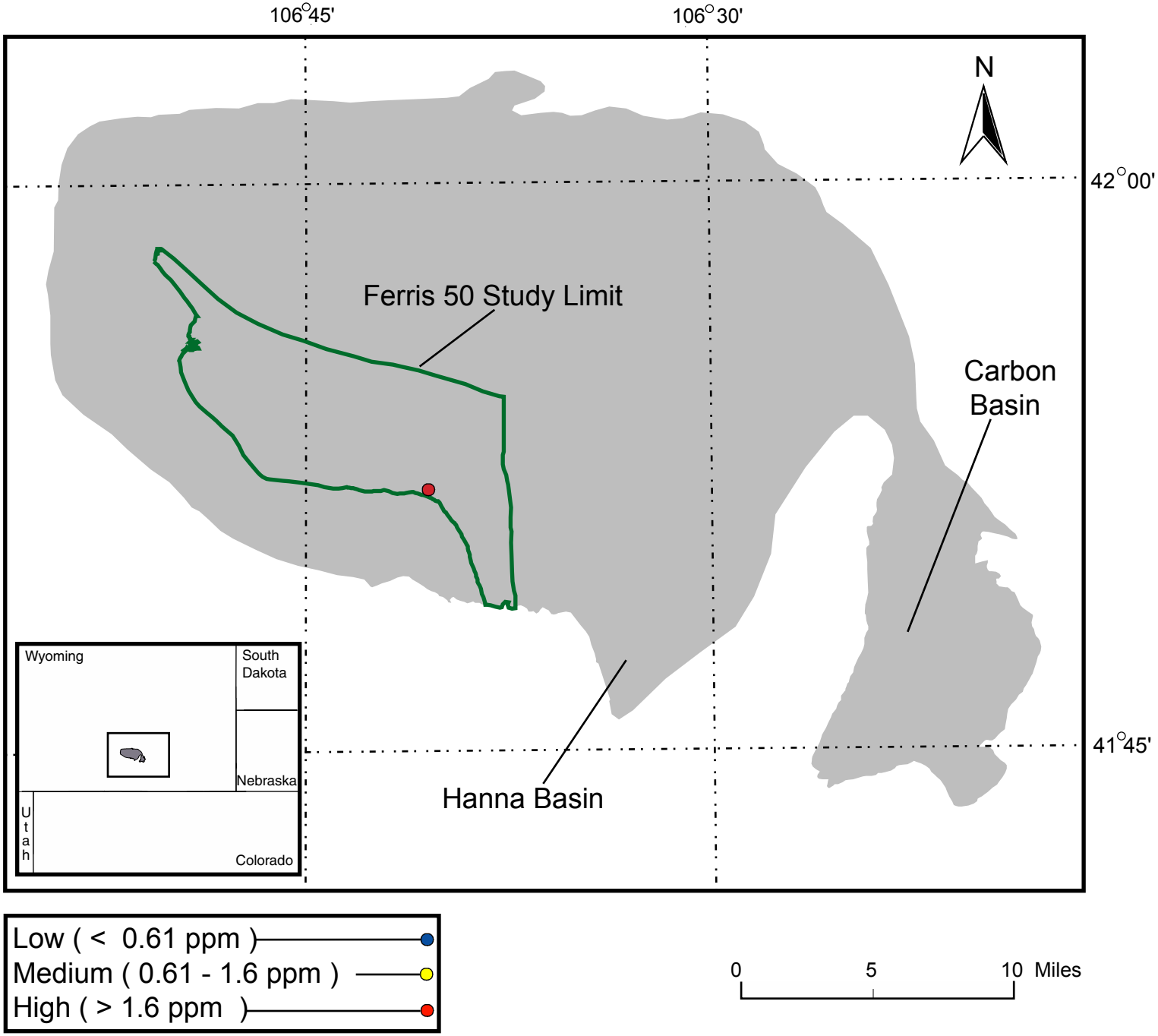

Figure HQ-50. Uranium concentration in the Ferris 50 coal zone, Ferris coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

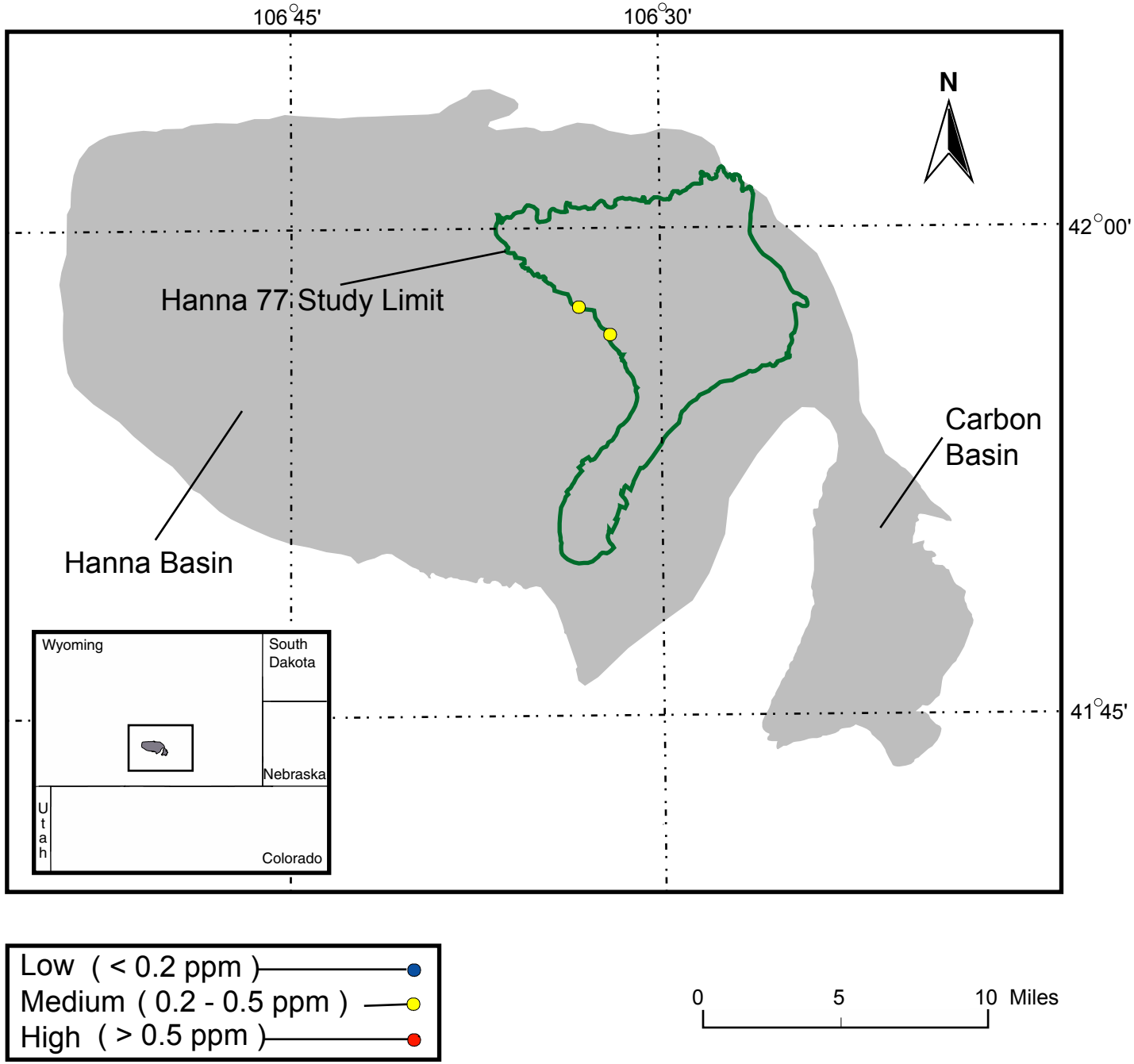

Figure HQ-51. Antimony concentration in the Hanna 77 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

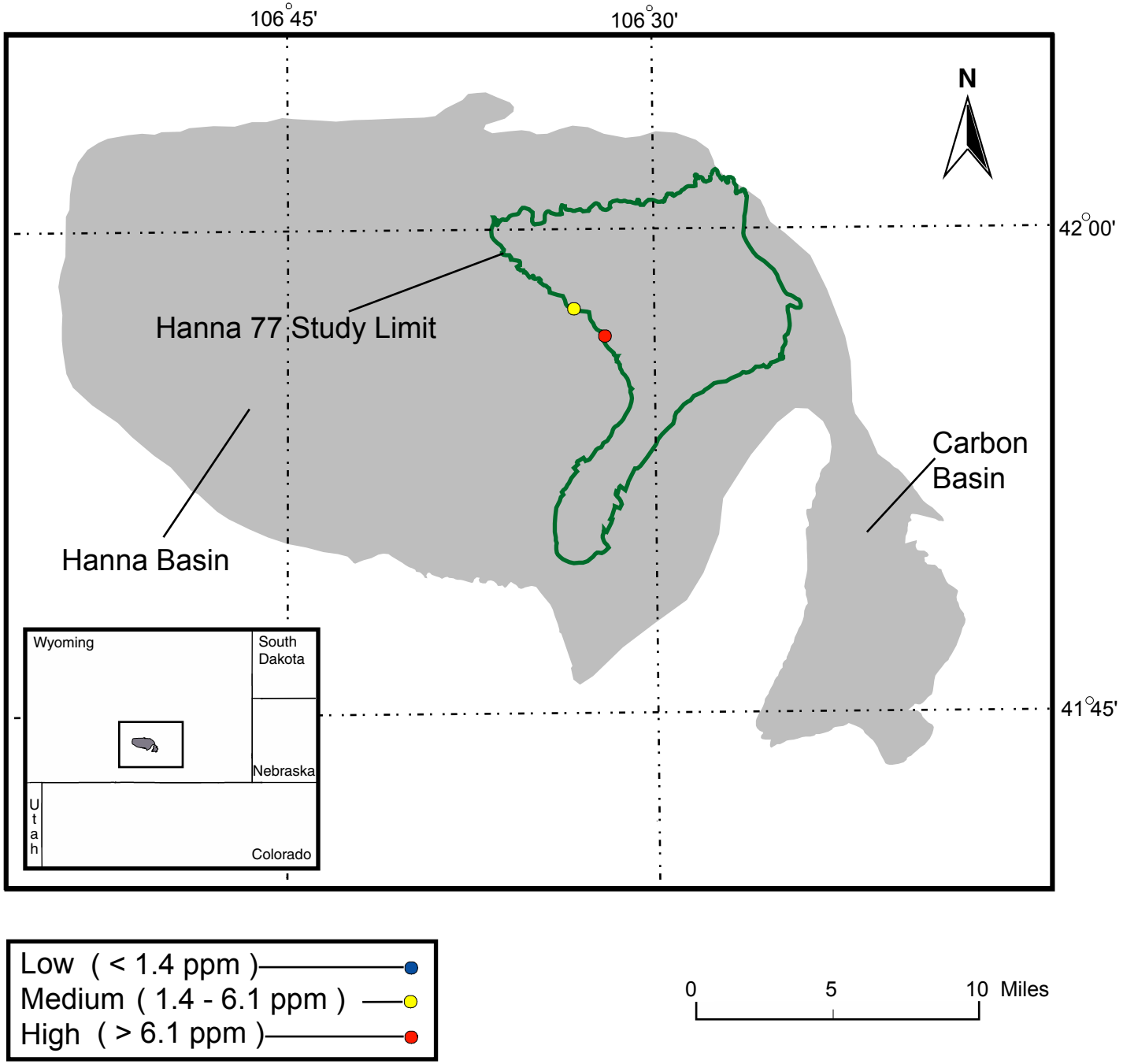

Figure HQ-52. Arsenic concentration in the Hanna 77 coal zone, Hanna coalfield Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

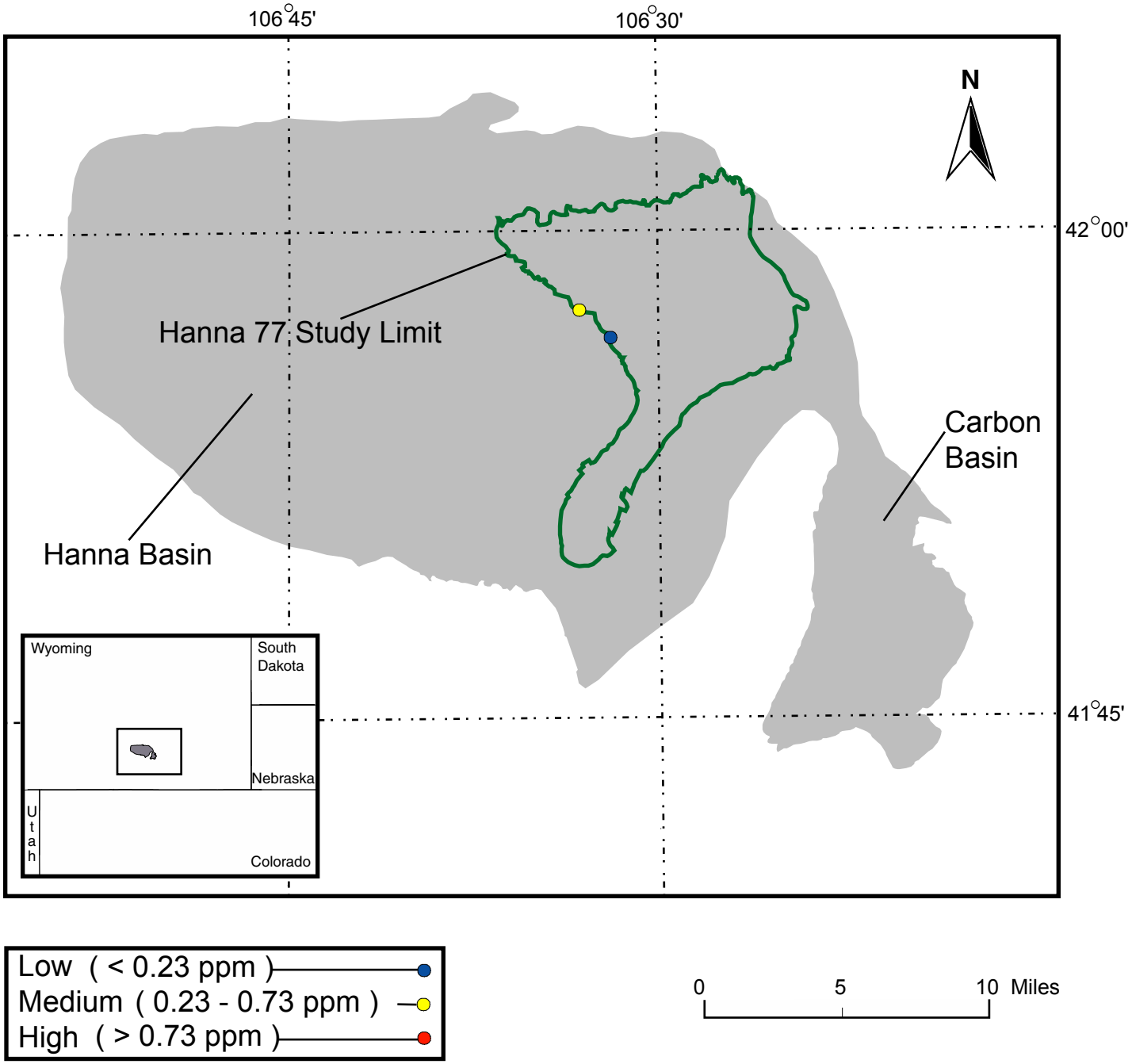

Figure HQ-53. Beryllium concentration in the Hanna 77 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

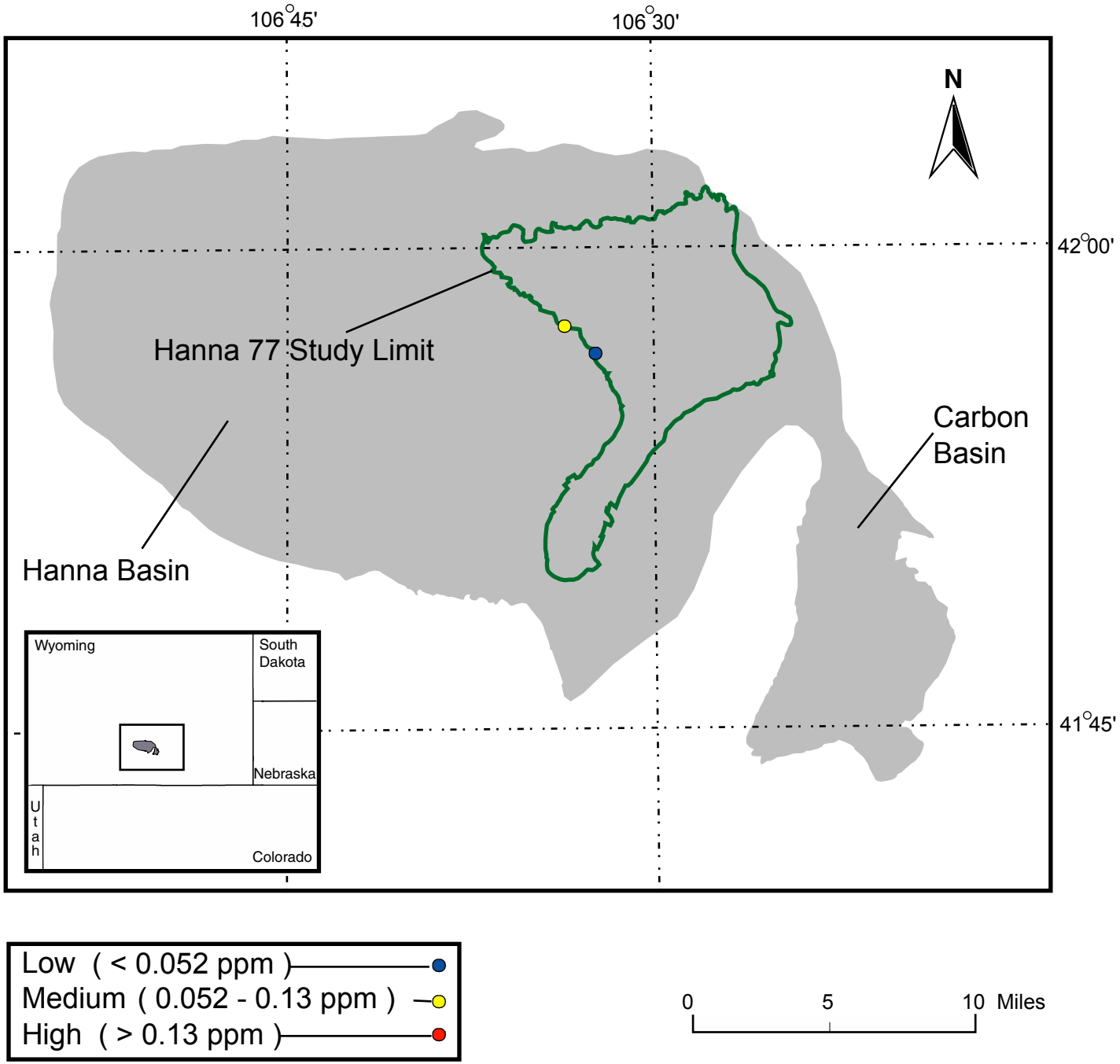

Figure HQ-54. Cadmium concentration in the Hanna 77 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

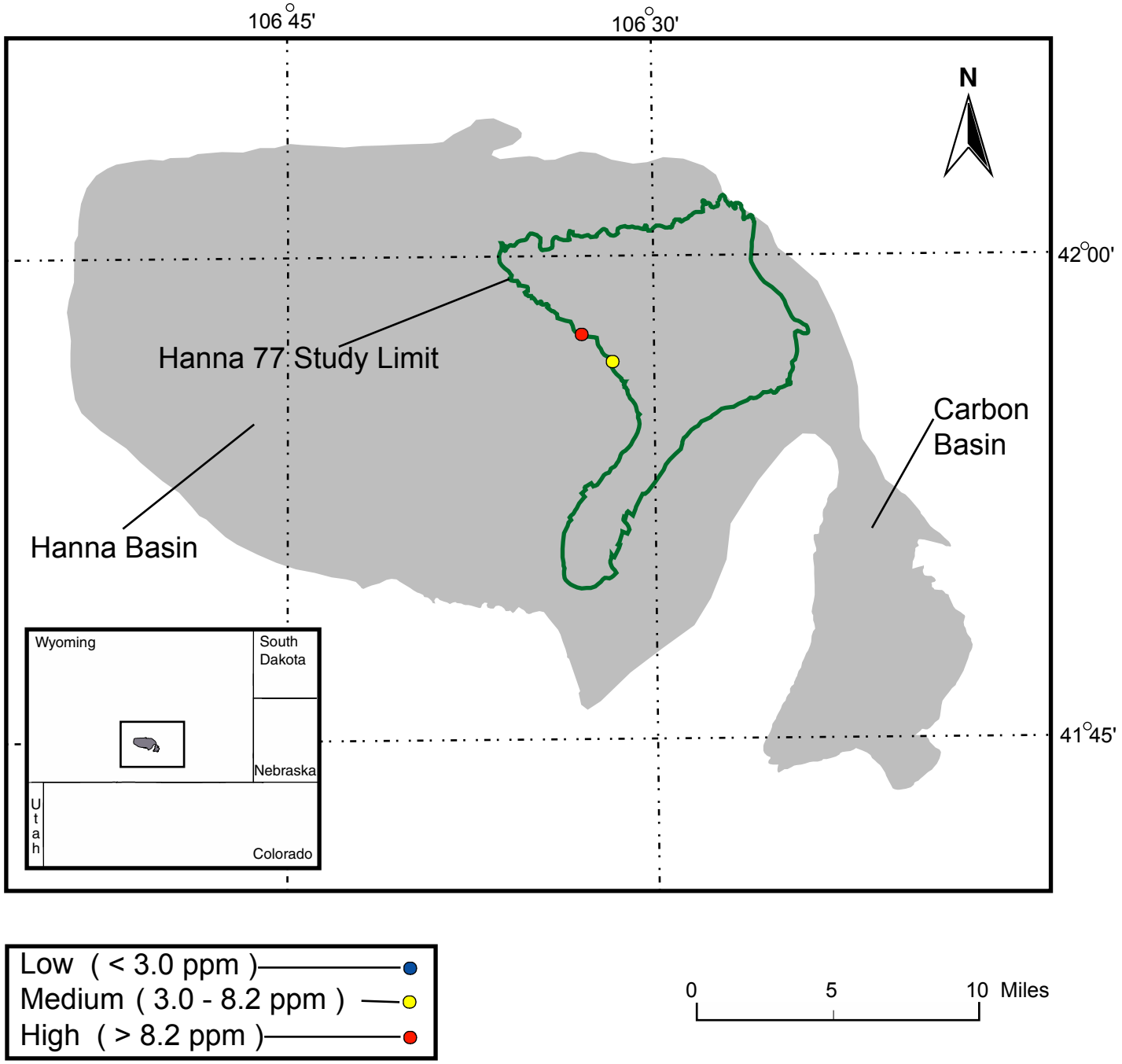

Figure HQ-55. Chromium concentration in the Hanna 77 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

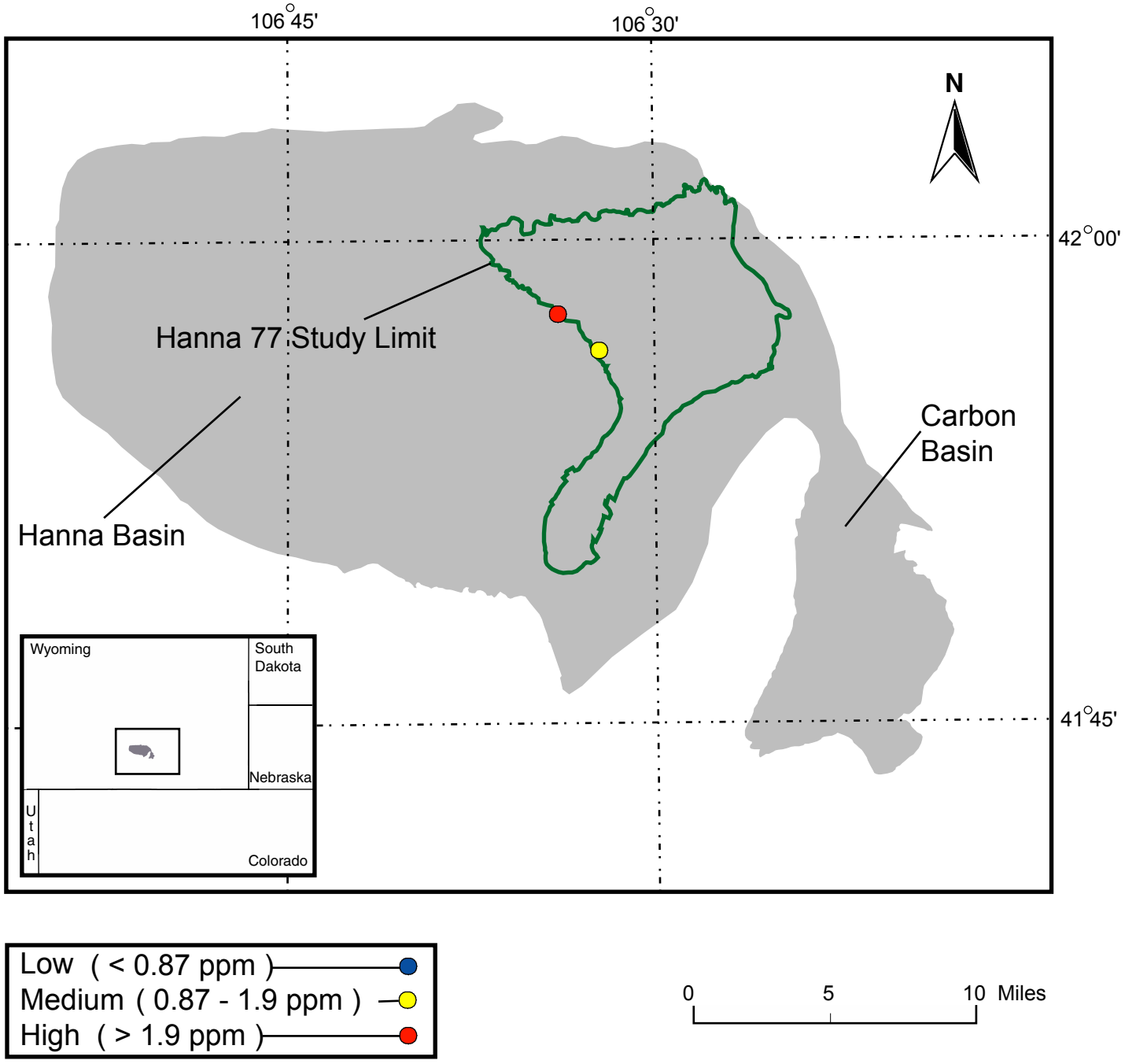

Figure HQ-56. Cobalt concentration in the Hanna 77 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

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Click here or on this symbol in the toolbar to return.

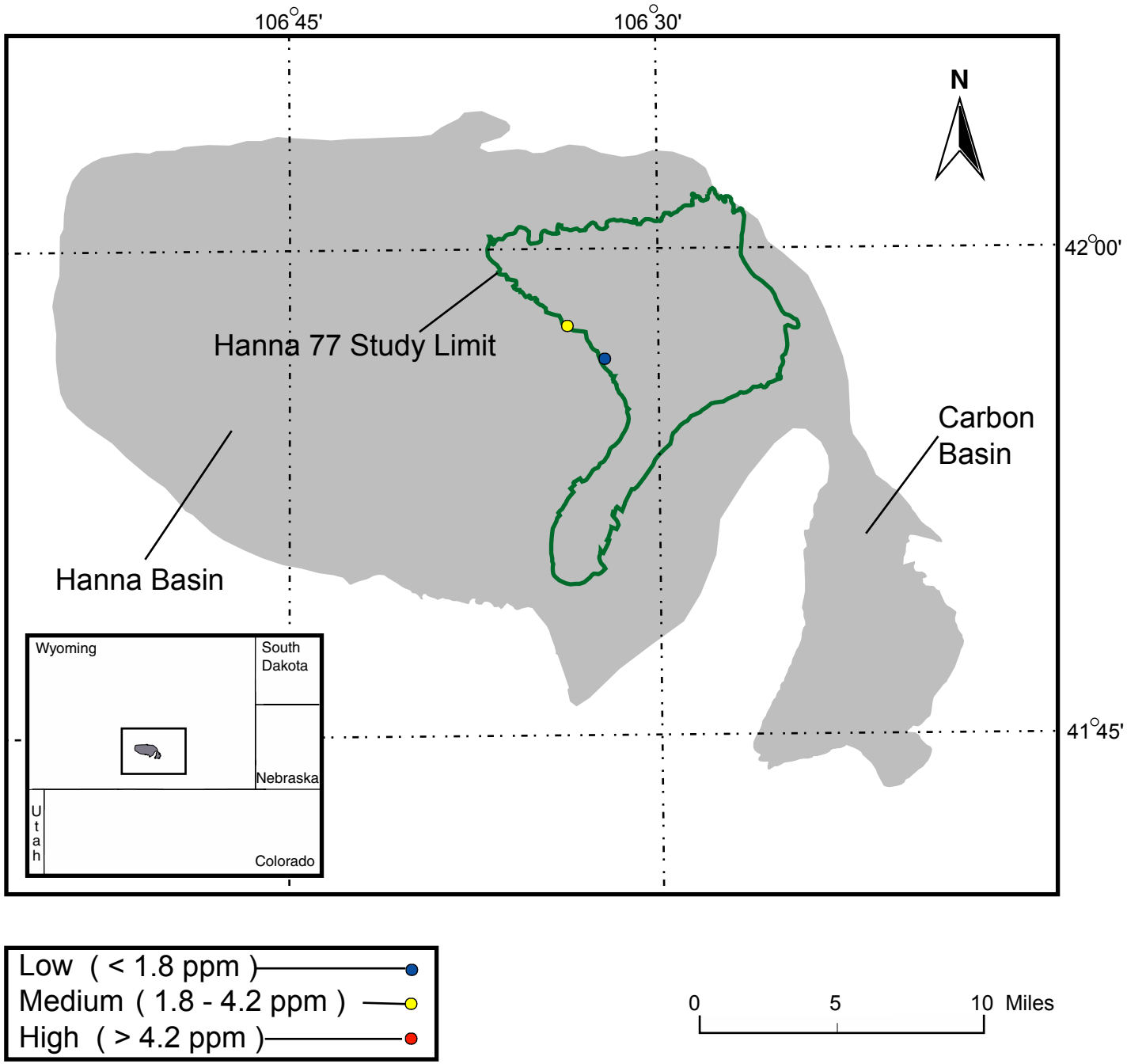

Figure HQ-57. Lead concentration in the Hanna 77 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

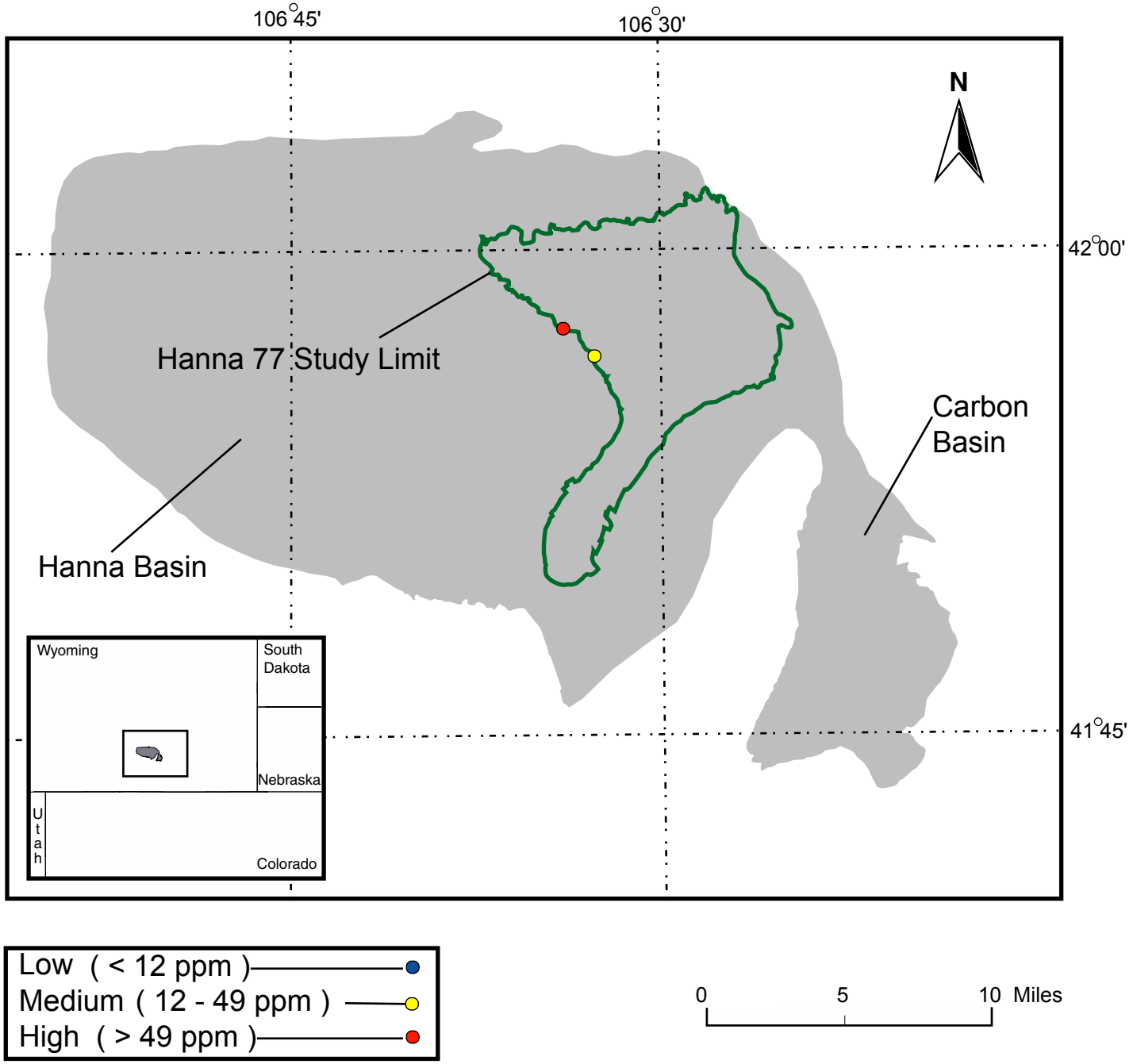

Figure HQ-58. Manganese concentration in the Hanna 77 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

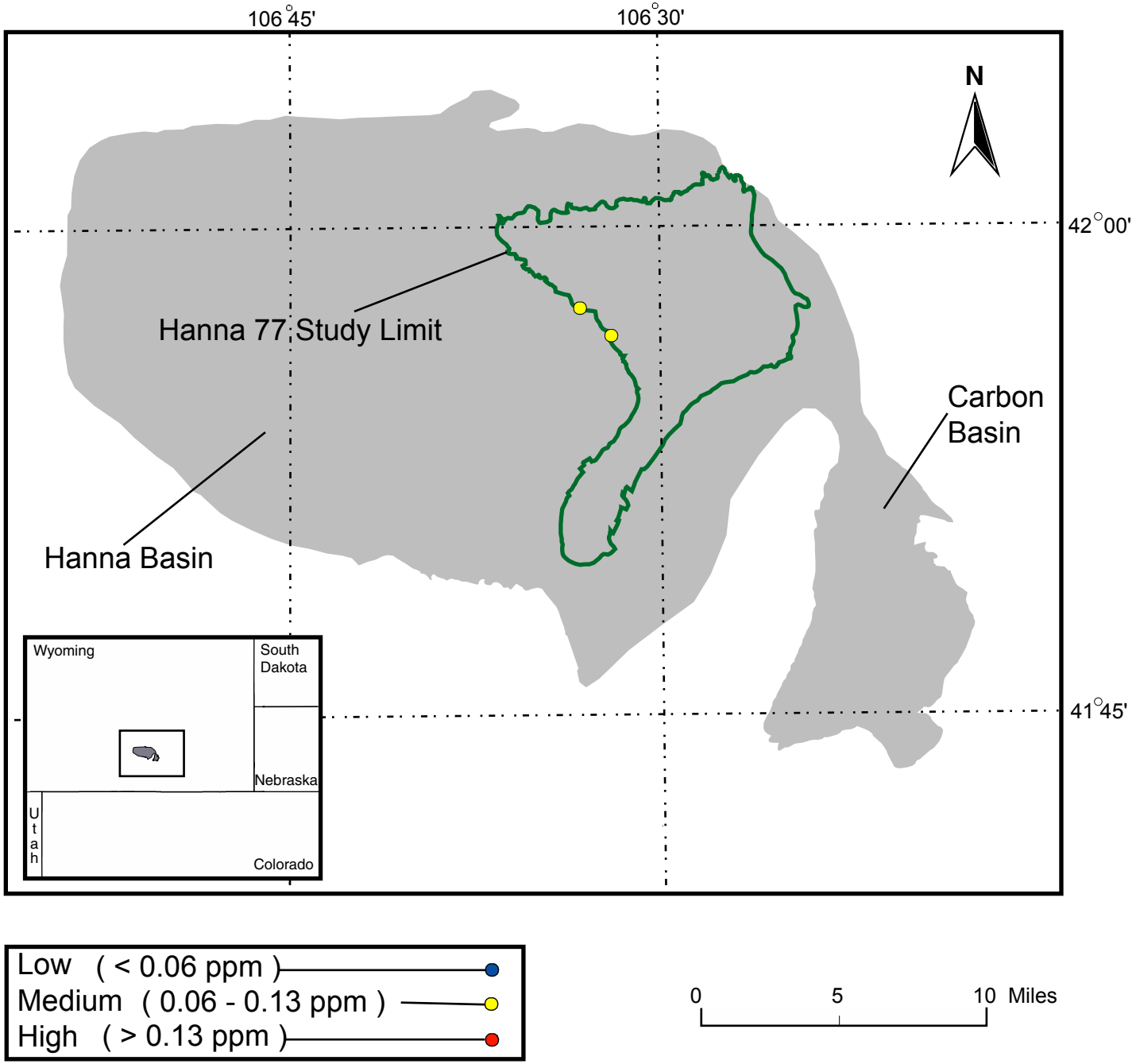

Figure HQ-59. Mercury concentration in the Hanna 77 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

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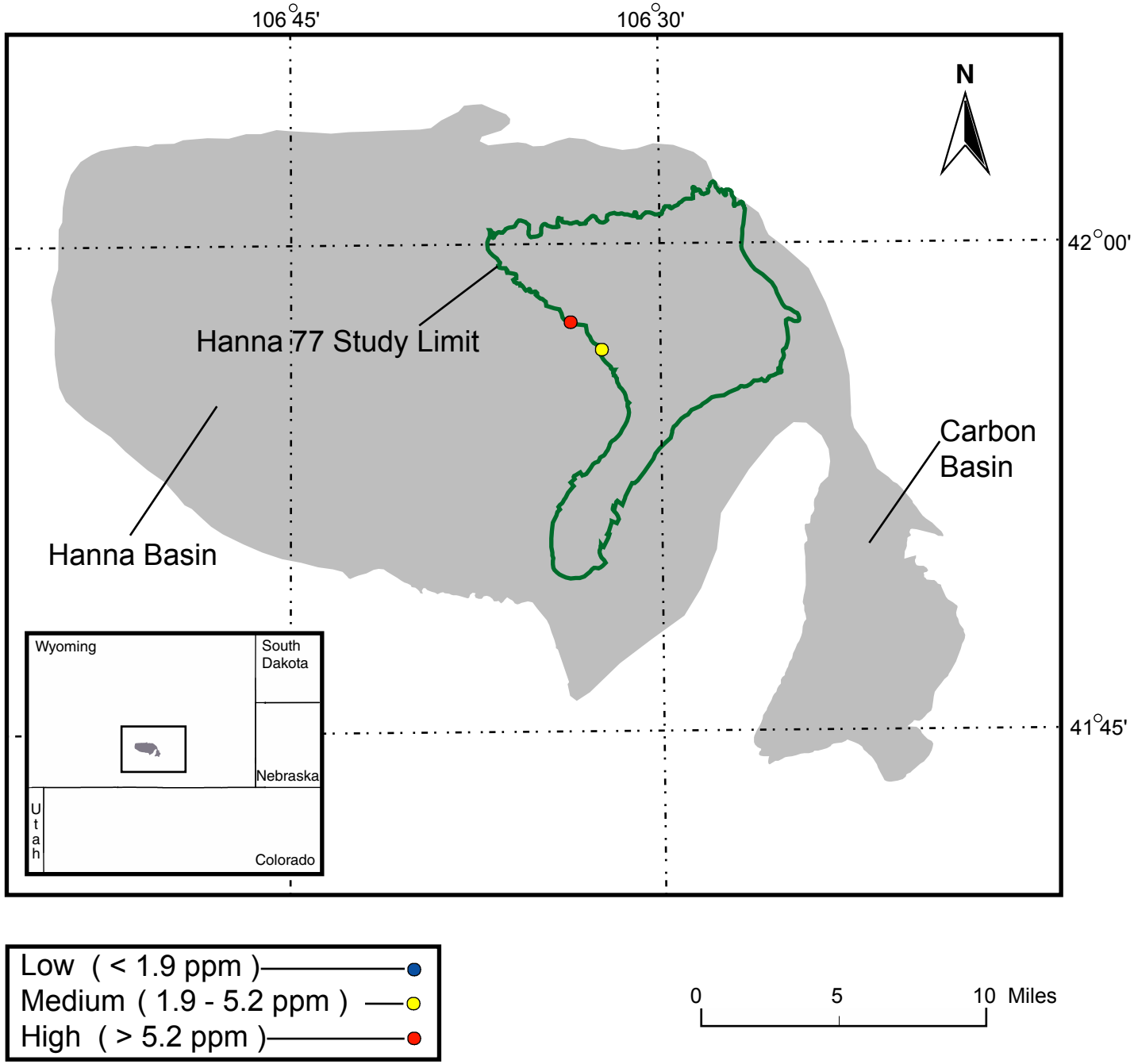

Figure HQ-60. Nickel concentration in the Hanna 77 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

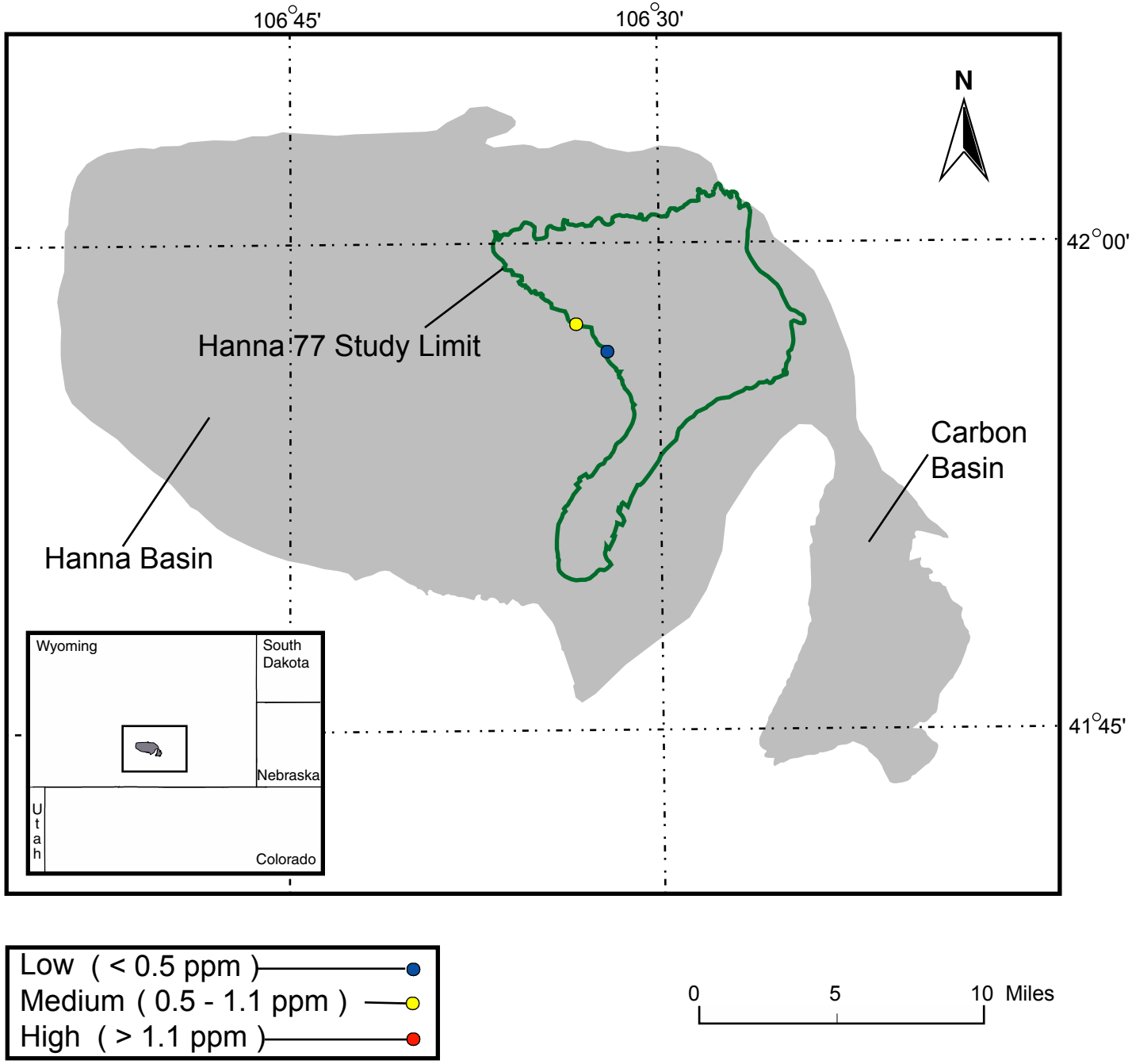

Figure HQ-61. Selenium concentration in the Hanna 77 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

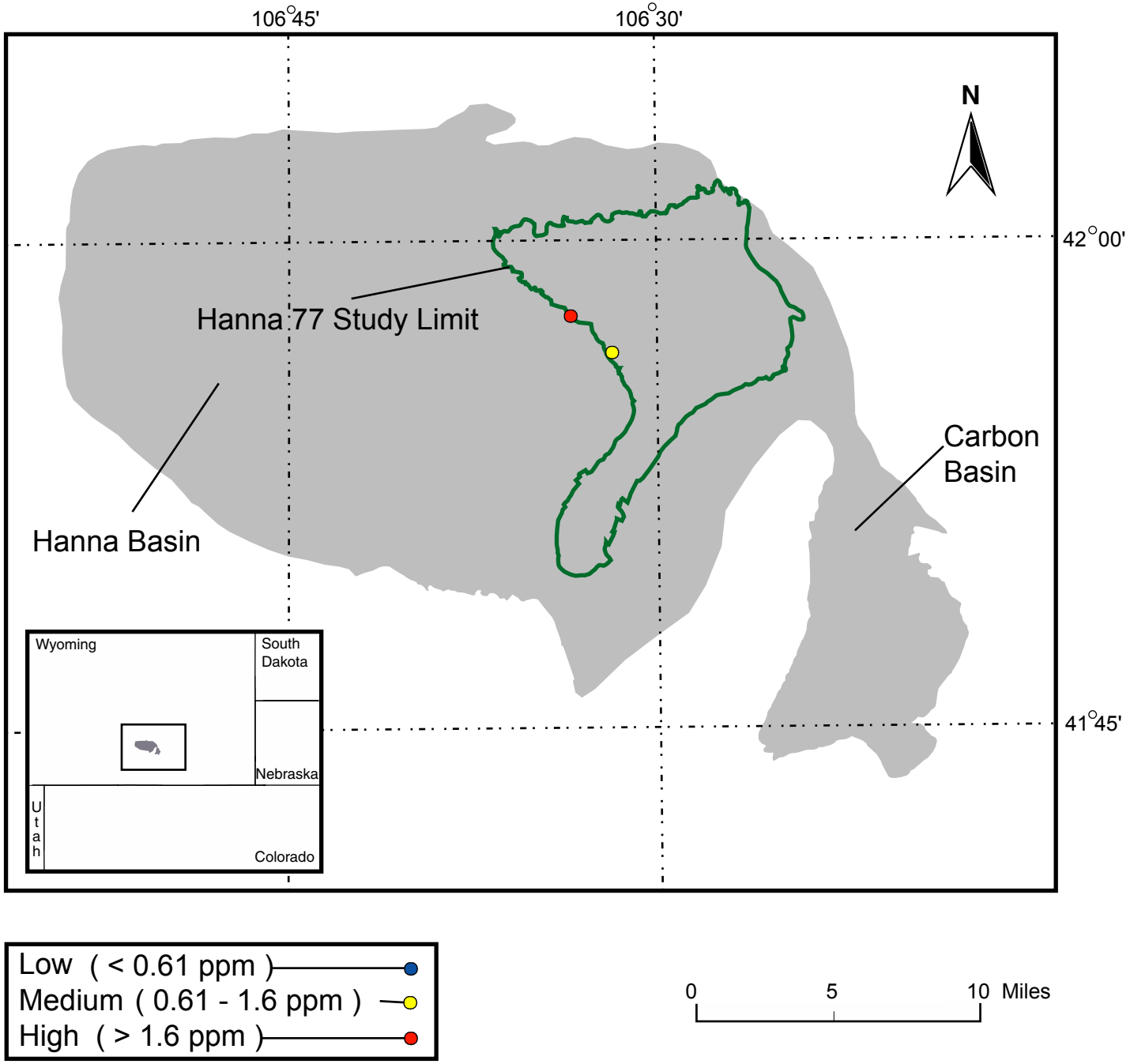

Figure HQ-62. Uranium concentration in the Hanna 77 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

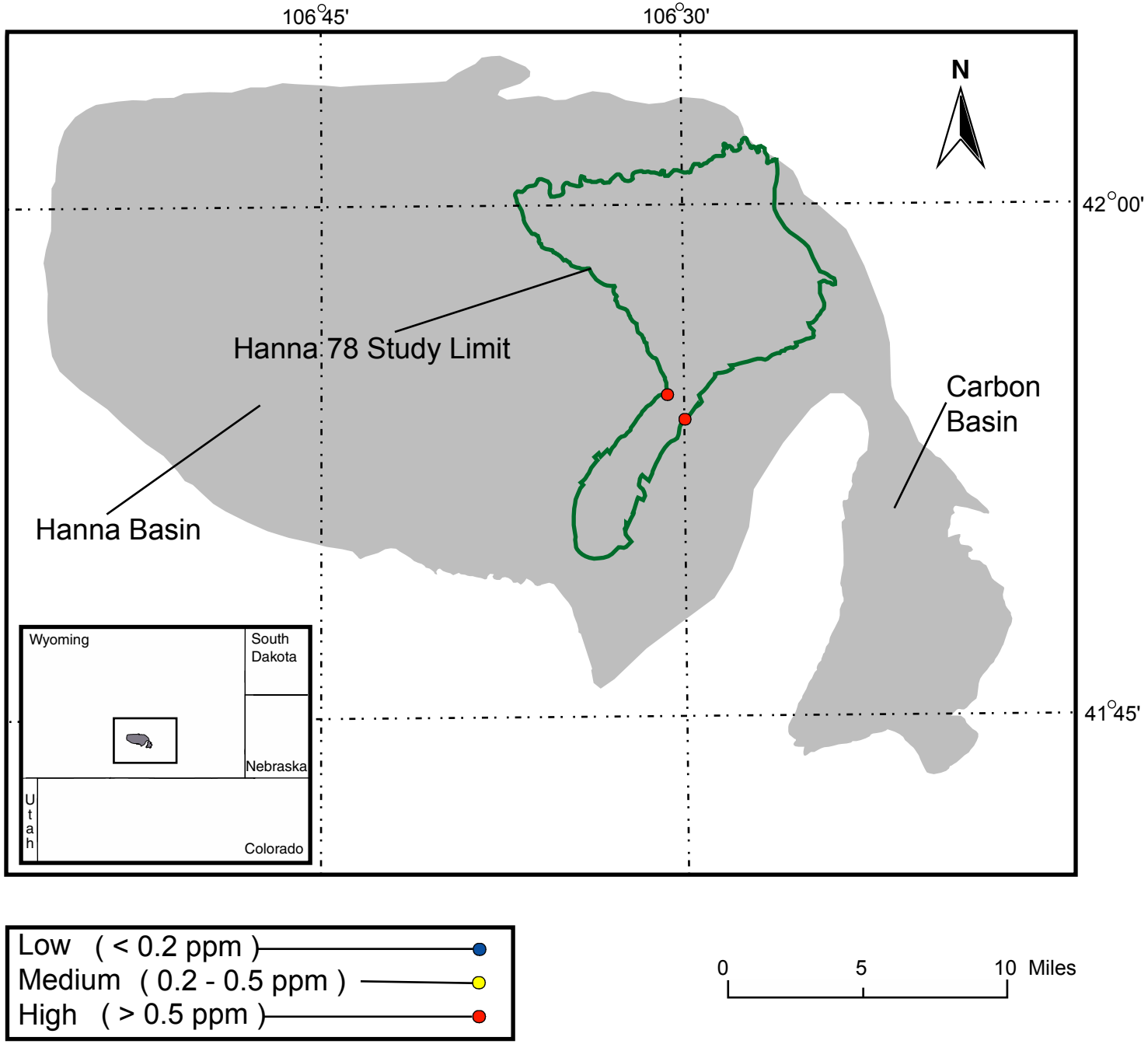

Figure HQ-63. Antimony concentration in the Hanna 78 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

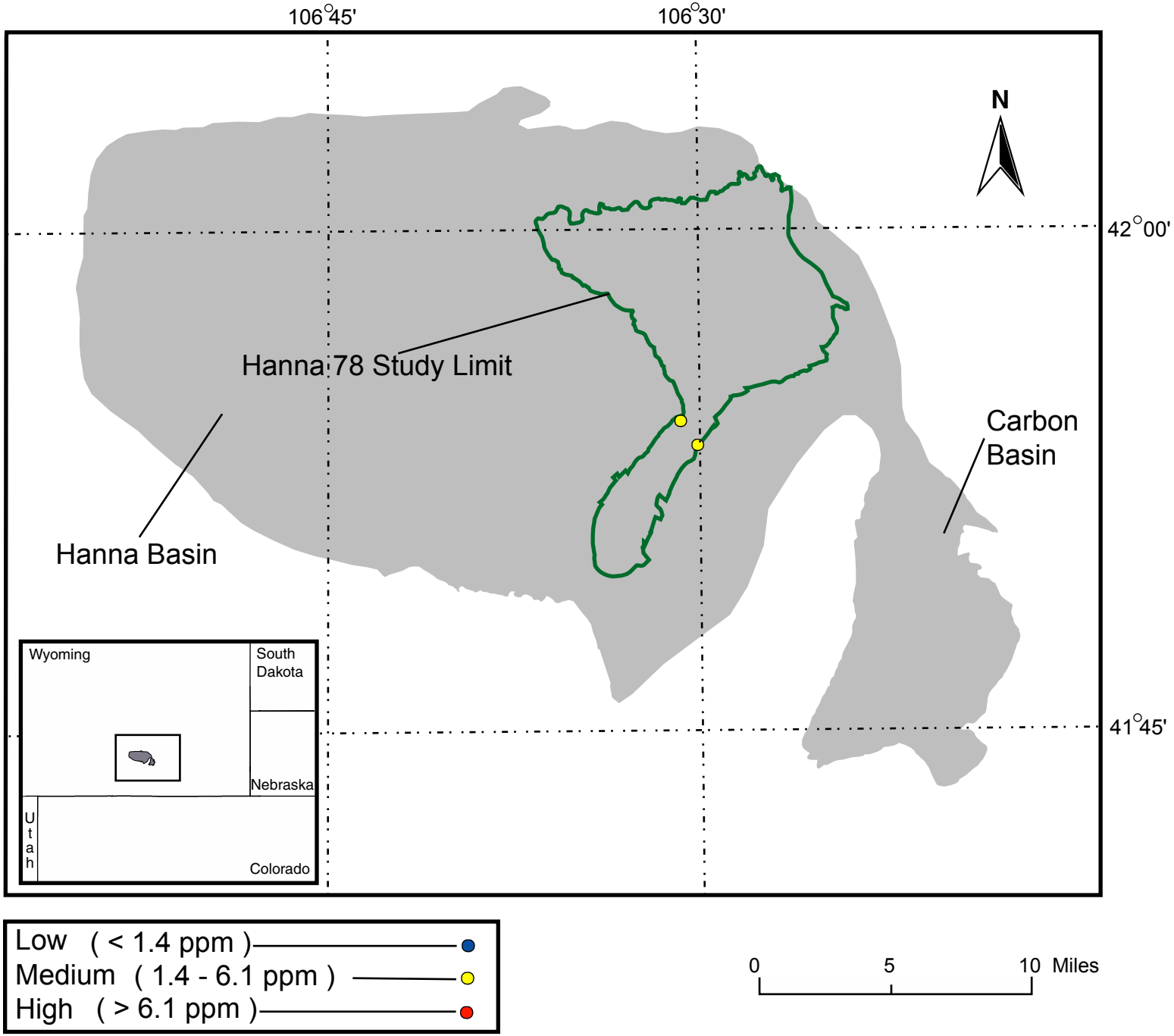

Figure HQ-64. Arsenic concentration in the Hanna 78 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

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Click here or on this symbol in the toolbar to return.

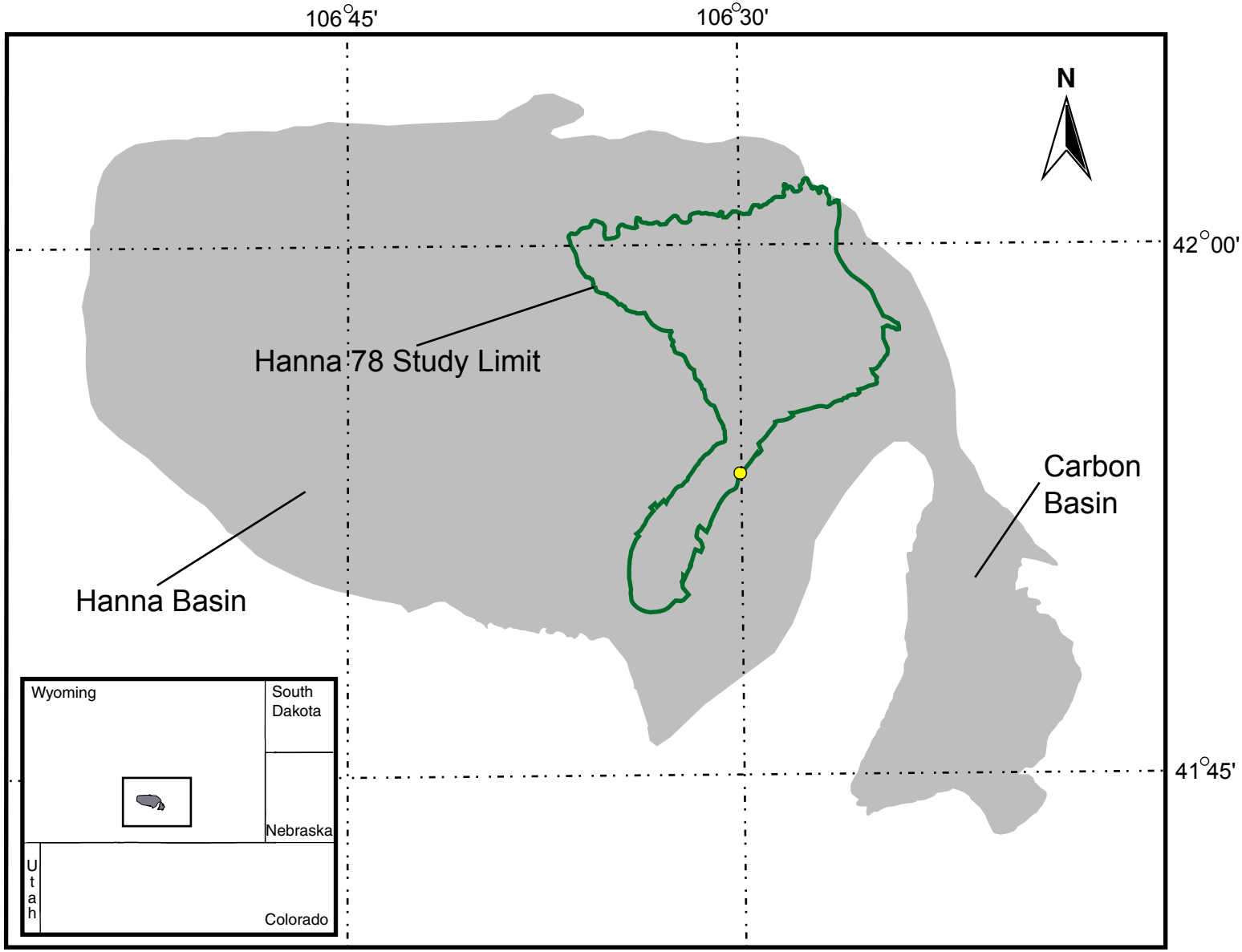

Figure HQ-65. Beryllium concentration in the Hanna 78 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

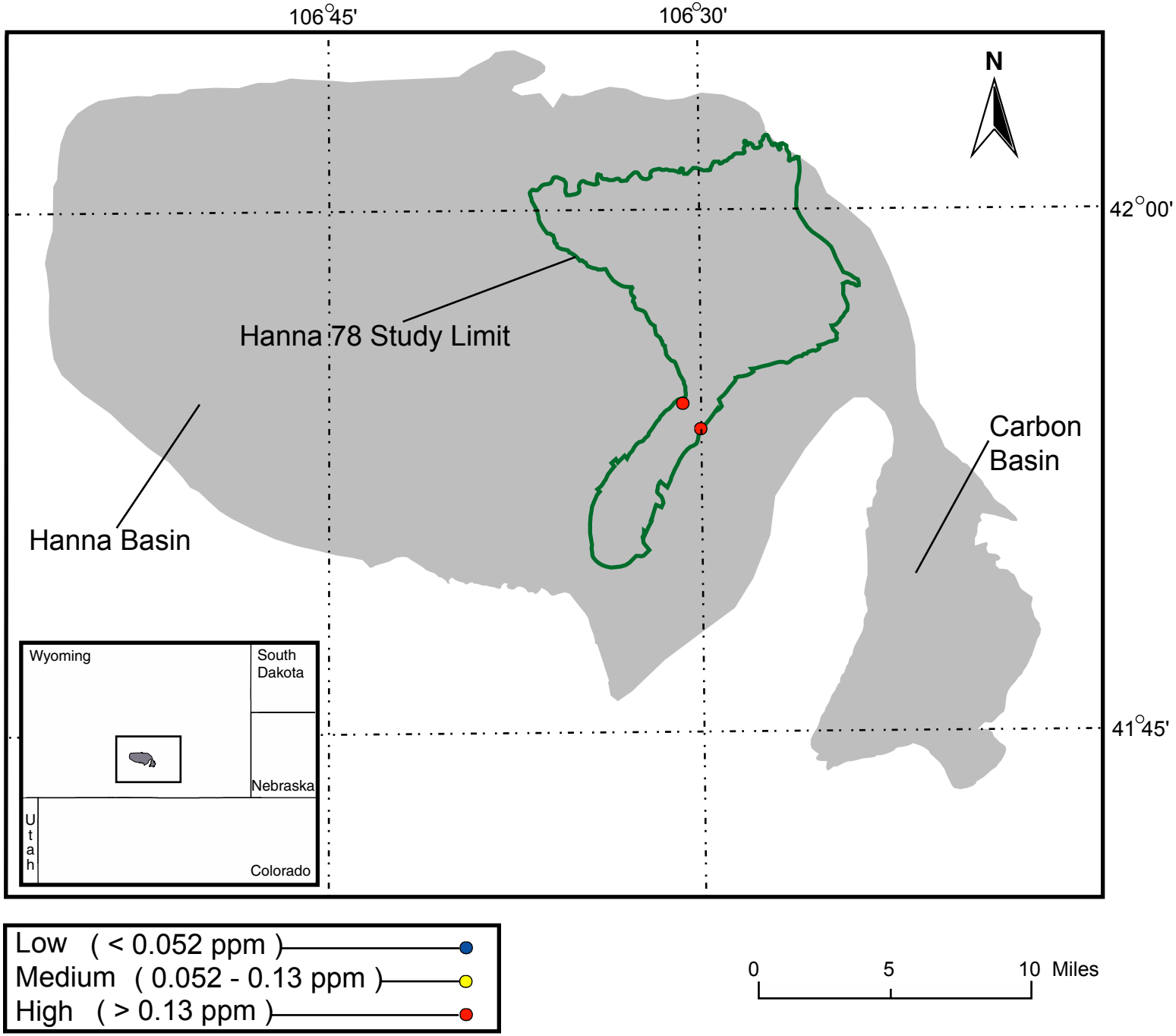

Figure HQ-66. Cadmium concentration in the Hanna 78 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

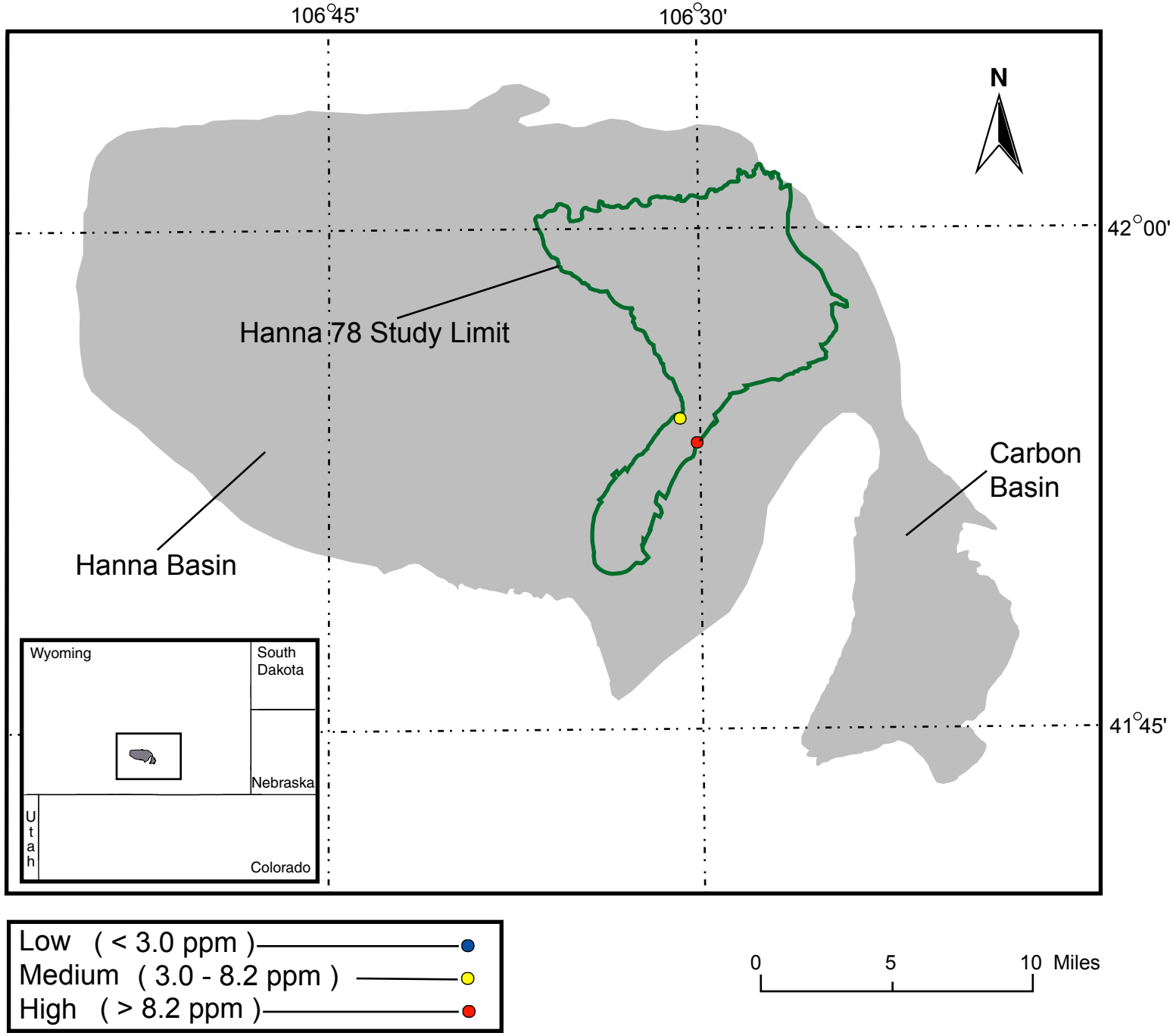

Figure HQ-67. Chromium concentration in the Hanna 78 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

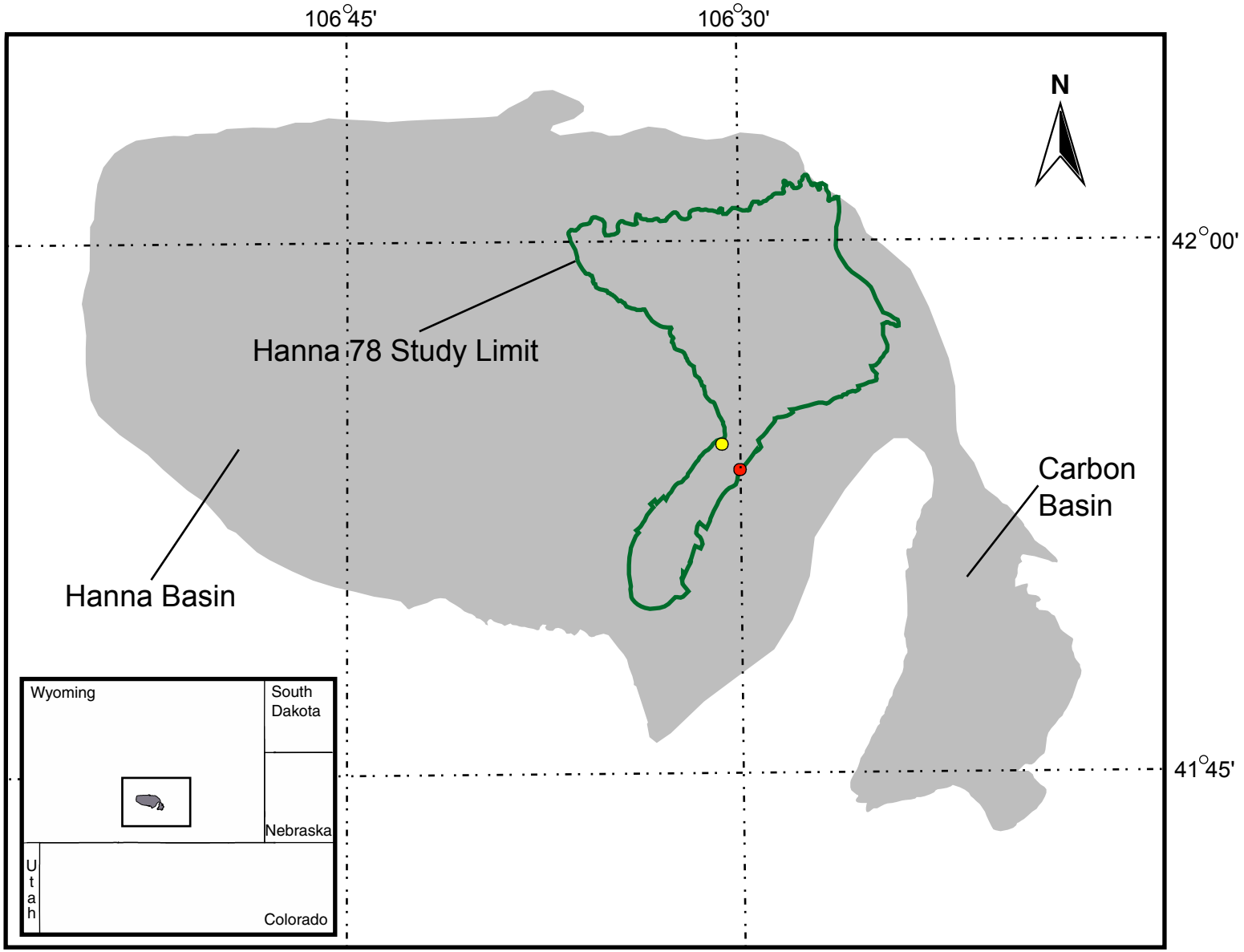

Figure HQ-68. Cobalt concentration in the Hanna 78 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

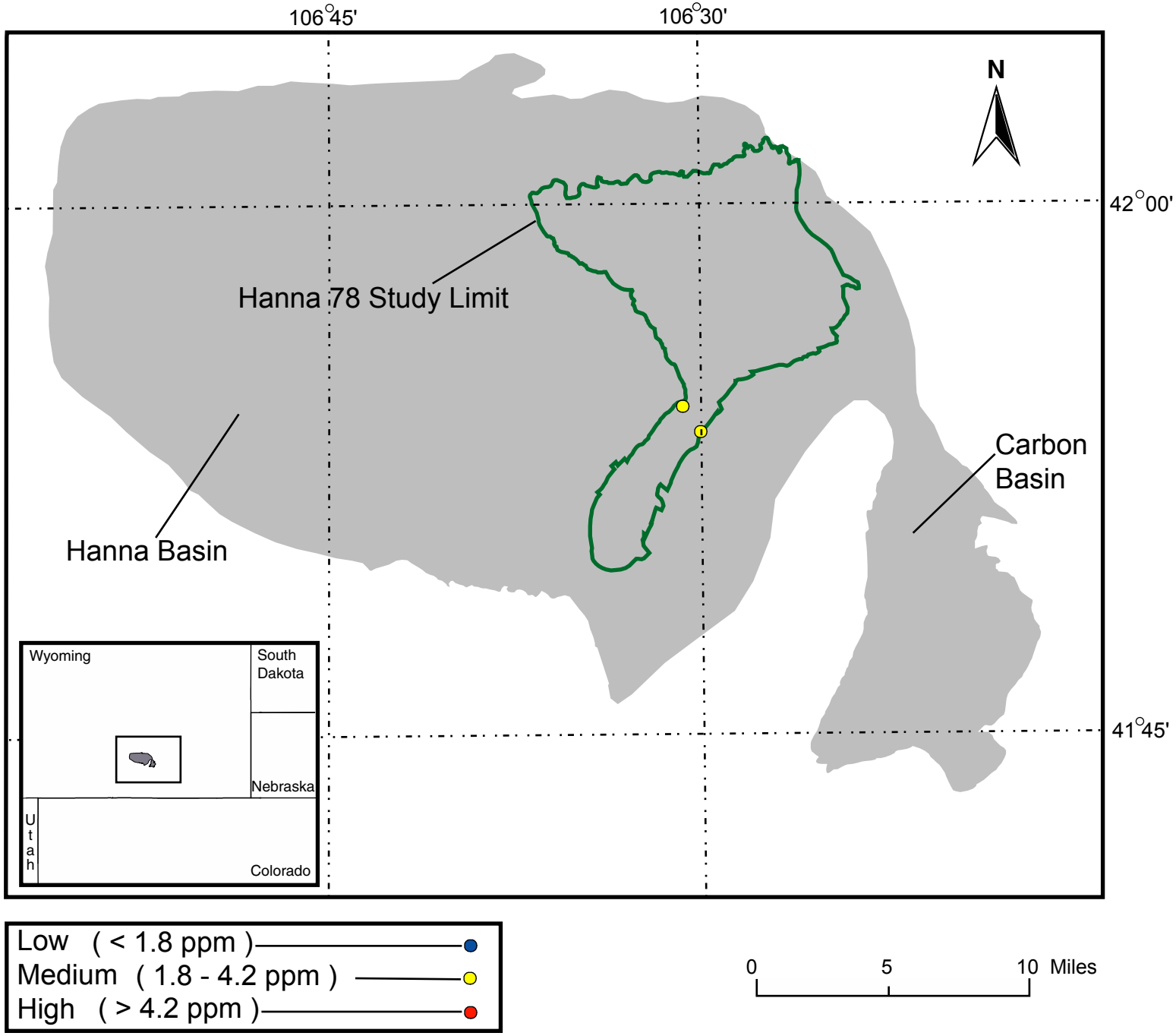

Figure HQ-69. Lead concentration in the Hanna 78 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

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Click here or on this symbol in the toolbar to return.

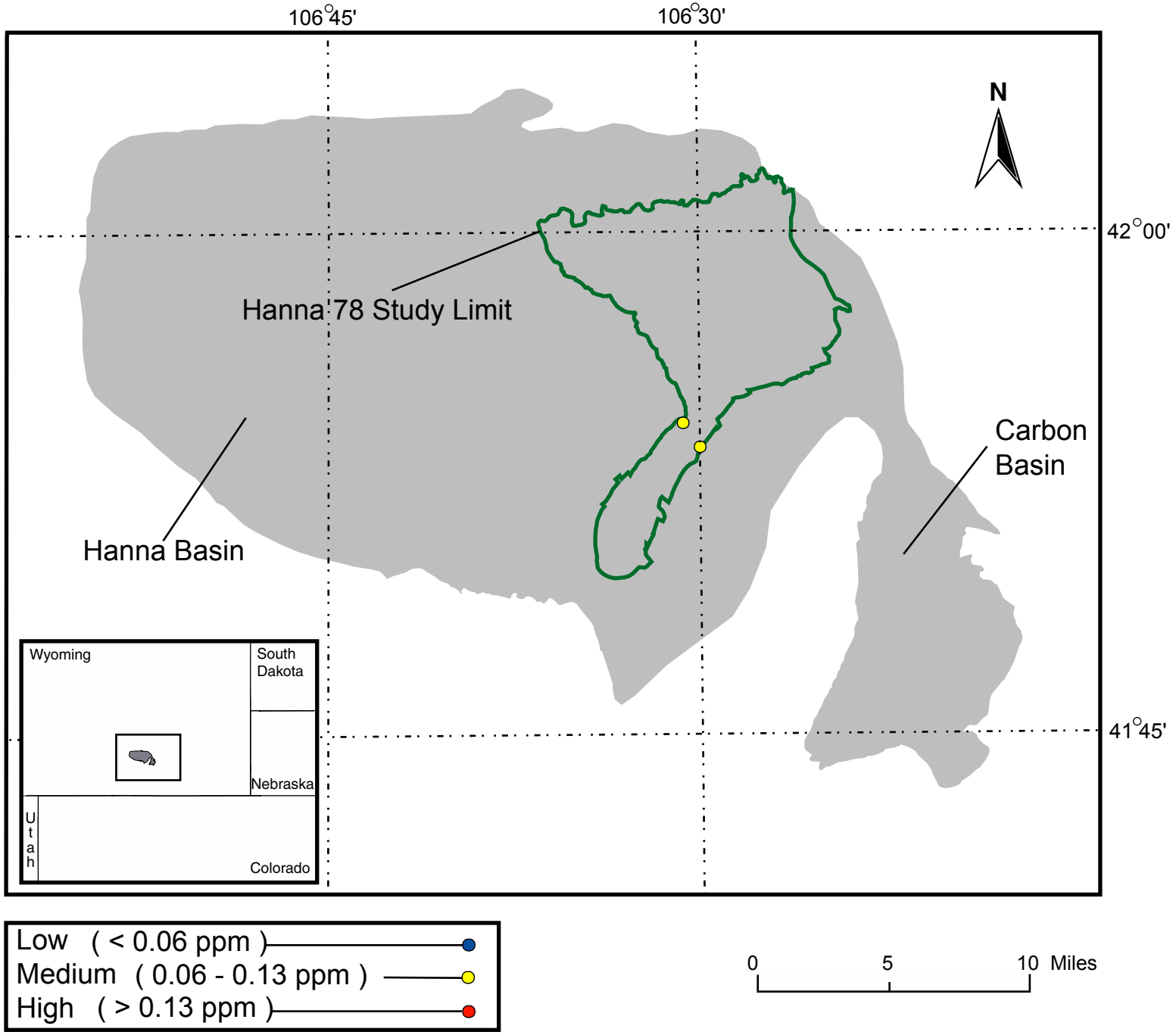

Figure HQ-70. Mercury concentration in the Hanna 78 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

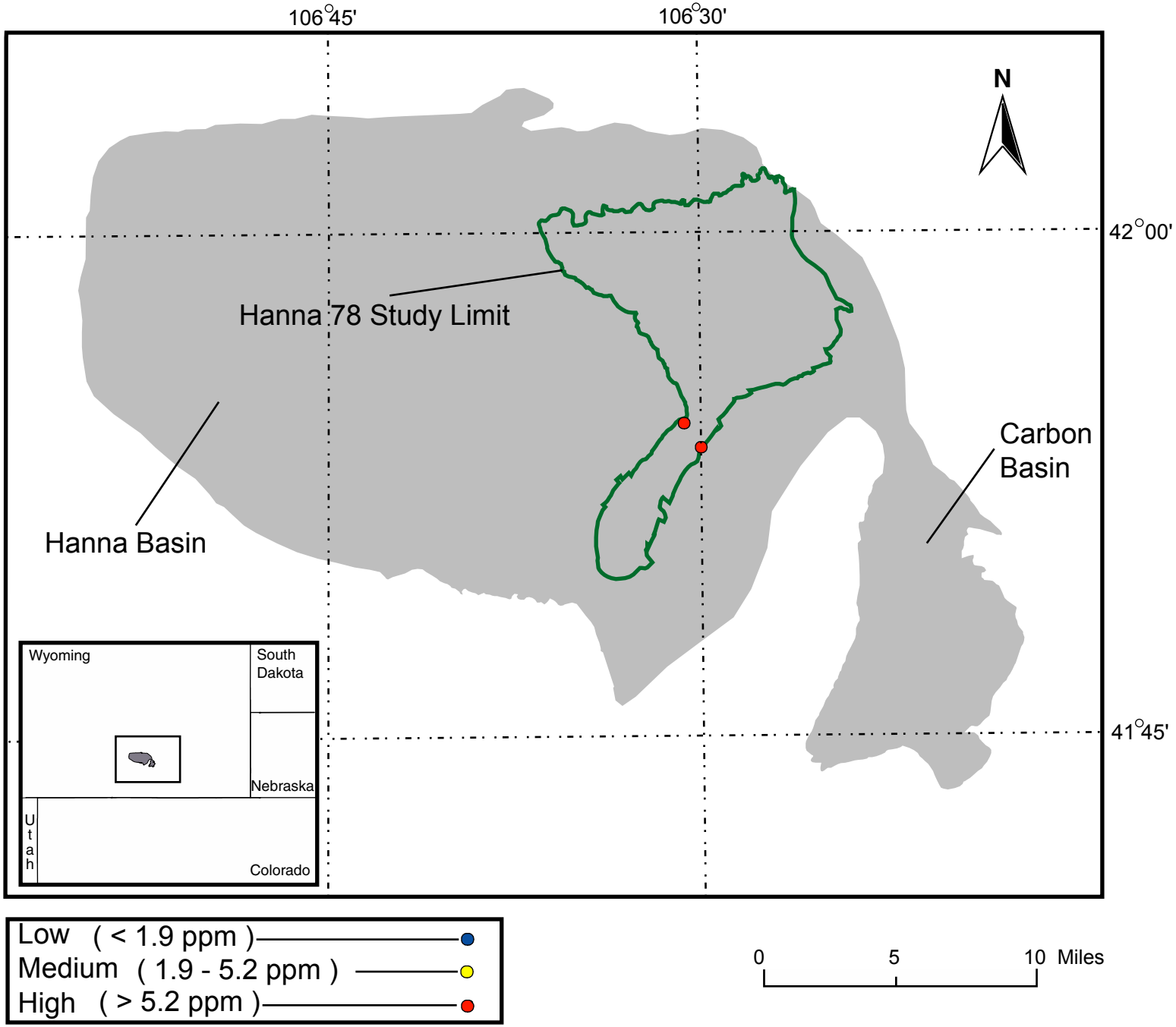

Figure HQ-71. Nickel concentration in the Hanna 78 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

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Click here or on this symbol in the toolbar to return.

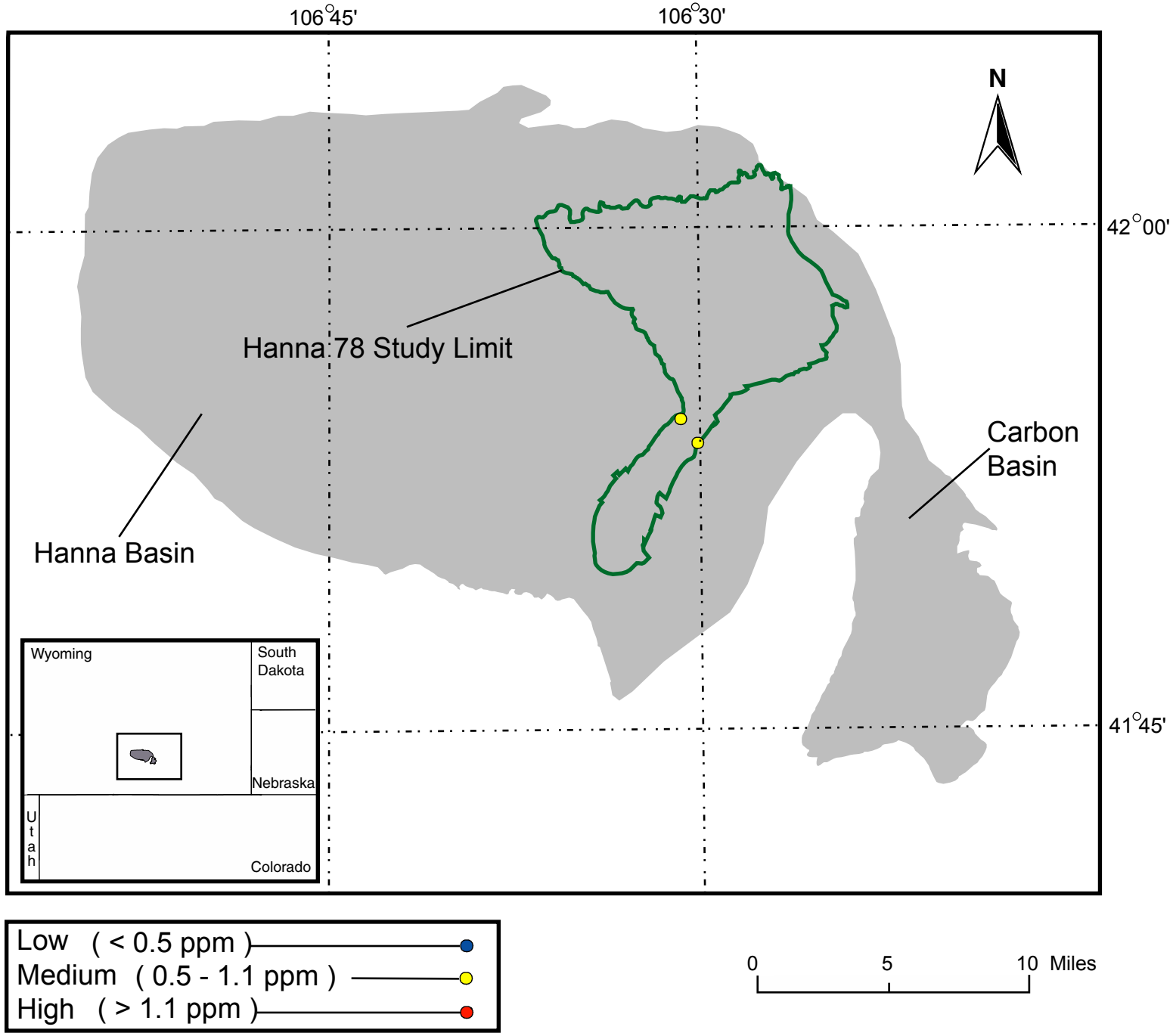

Figure HQ-72. Selenium concentration in the Hanna 78 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

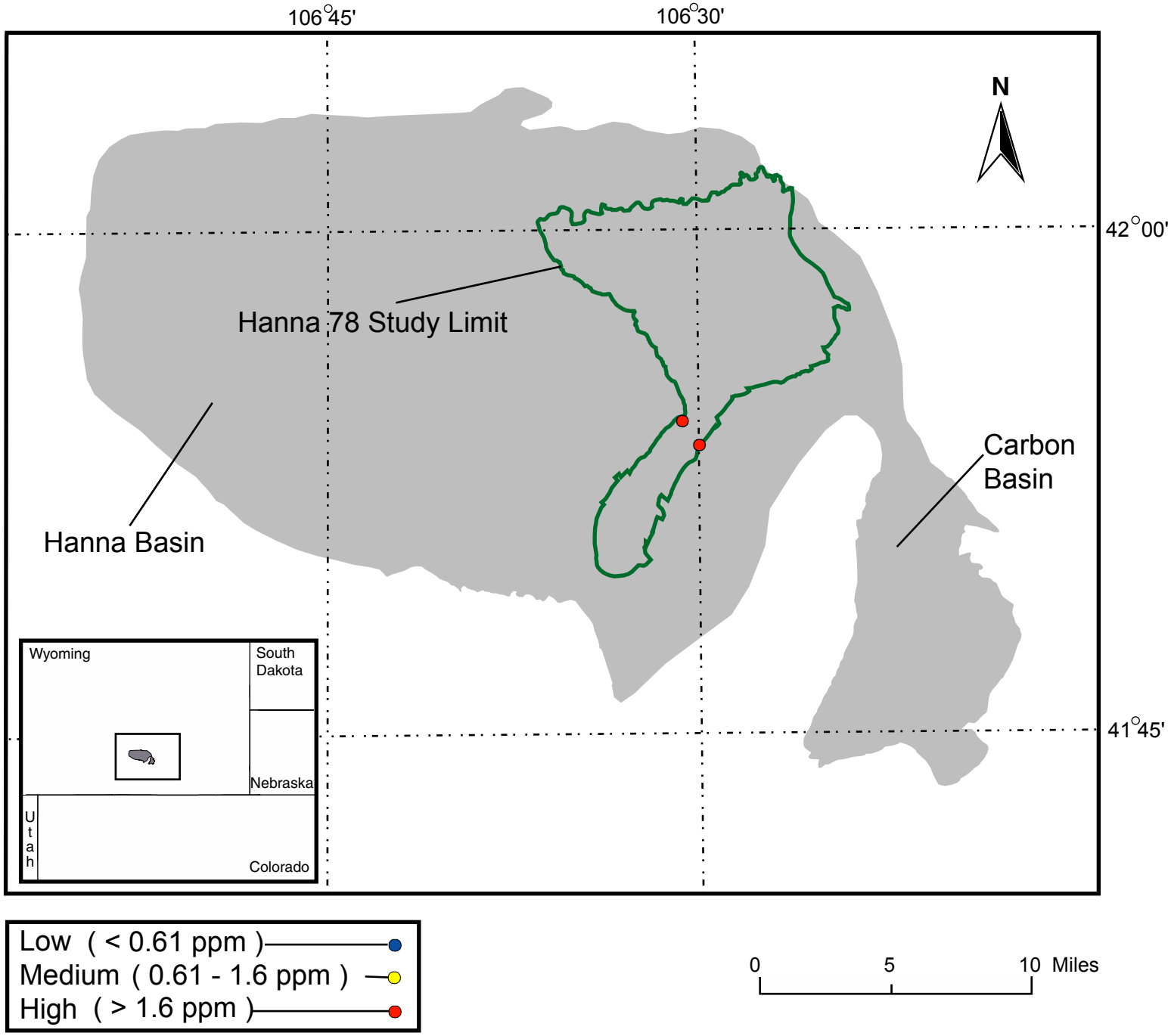

Figure HQ-73. Uranium concentration in the Hanna 78 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

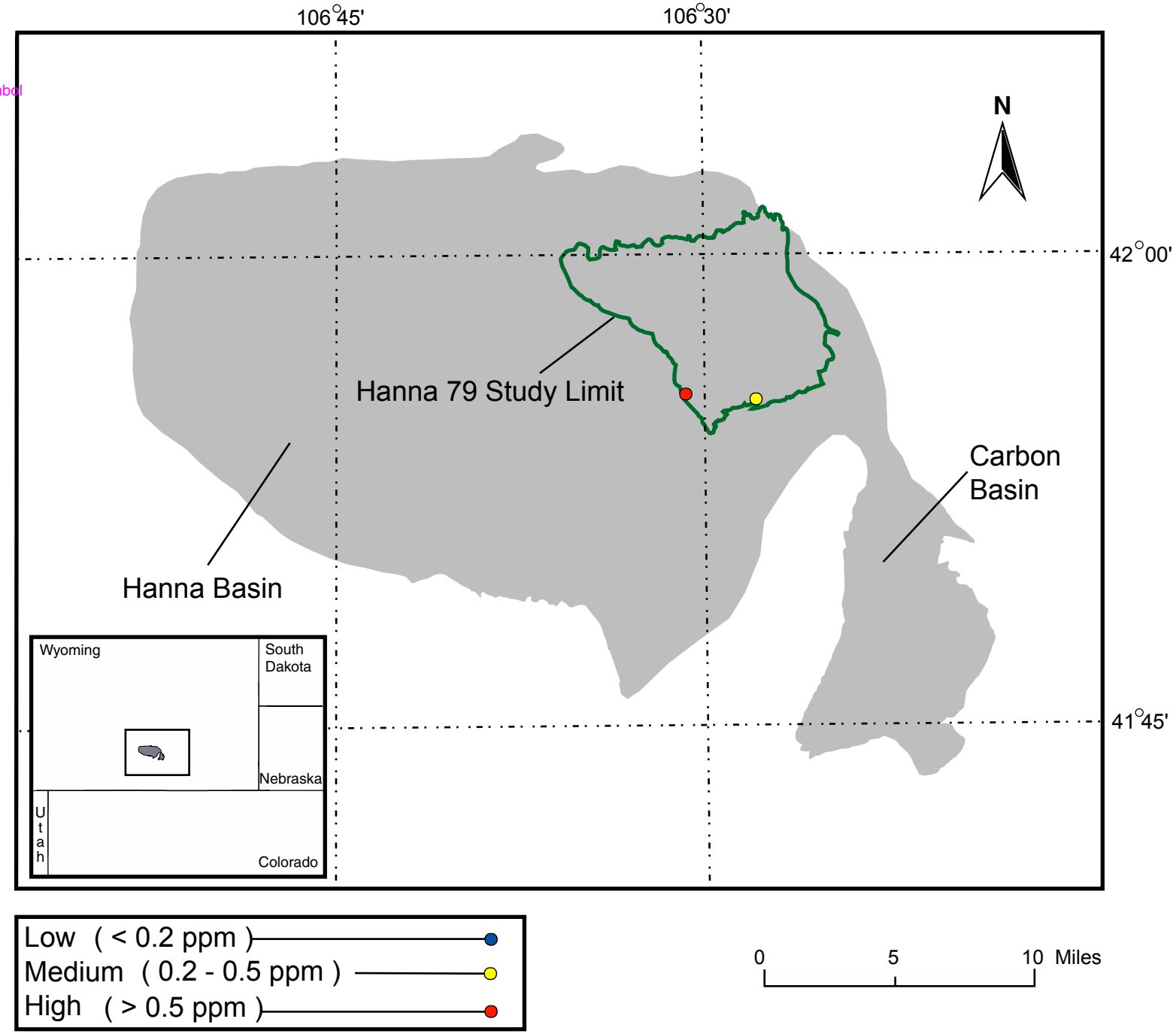

Figure HQ-74. Antimony concentration in the Hanna 79 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

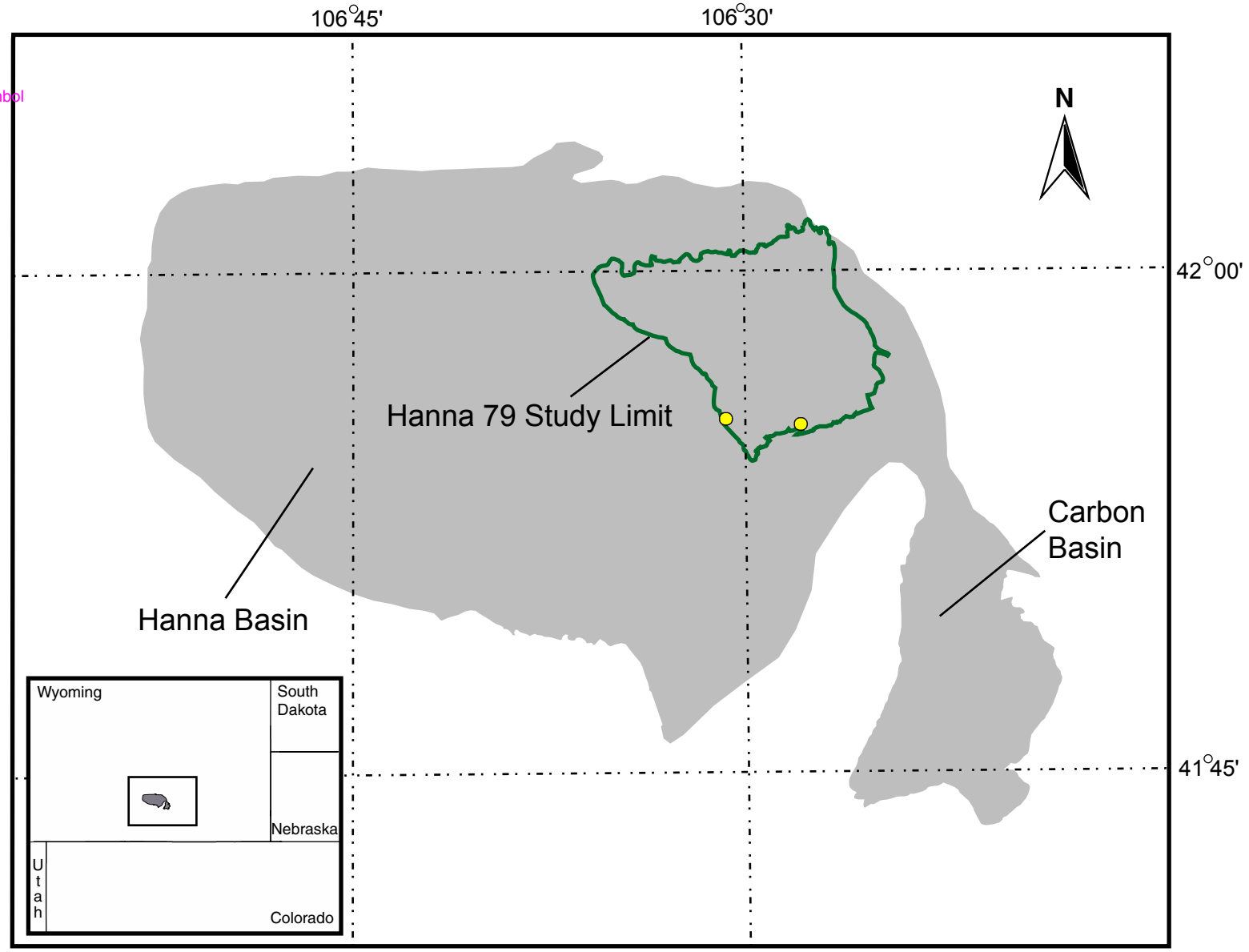

Figure HQ-75. Arsenic concentration in the Hanna 79 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

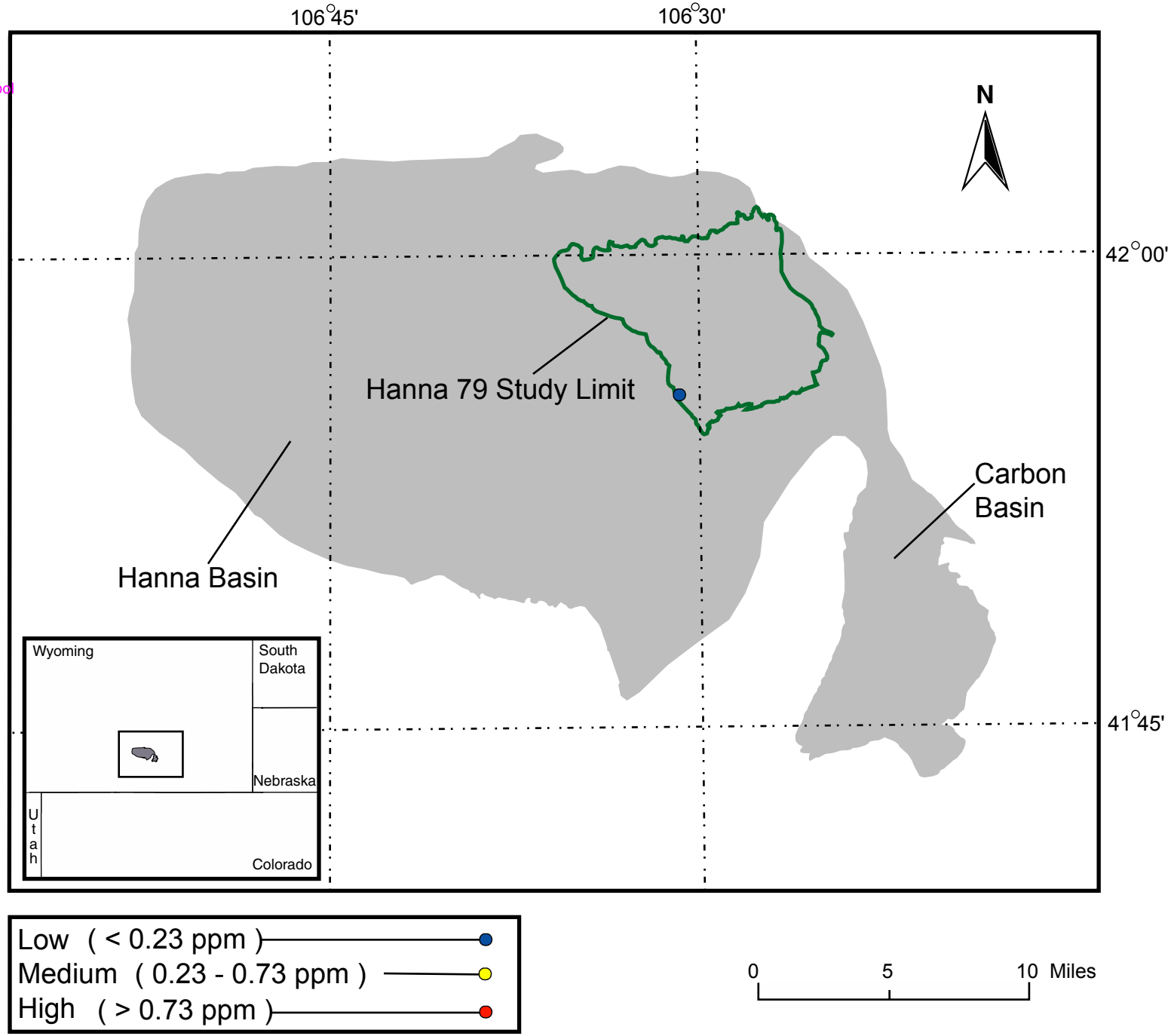

Figure HQ-76. Beryllium concentration in the Hanna 79 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

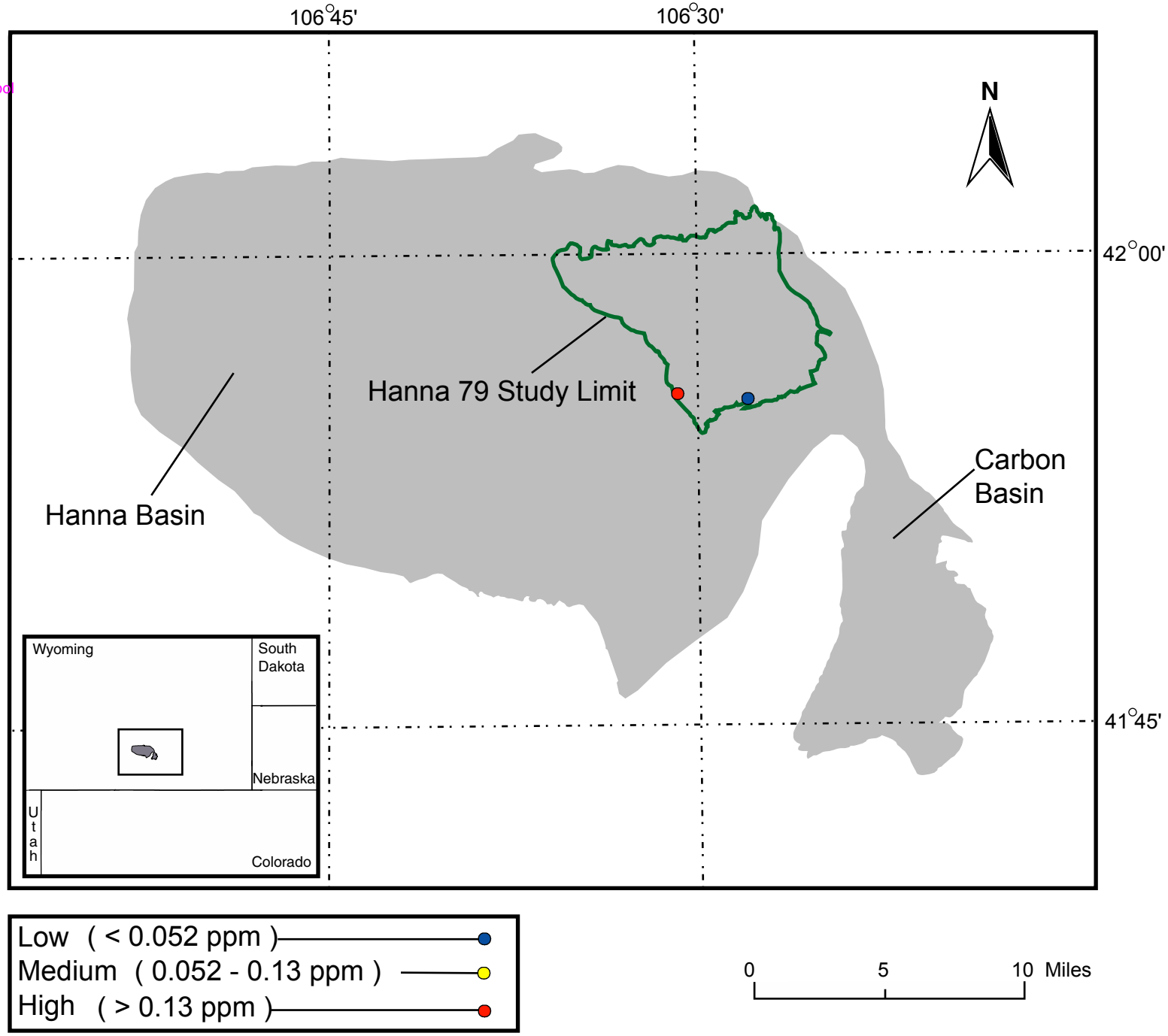

Figure HQ-77. Cadmium concentration in the Hanna 79 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

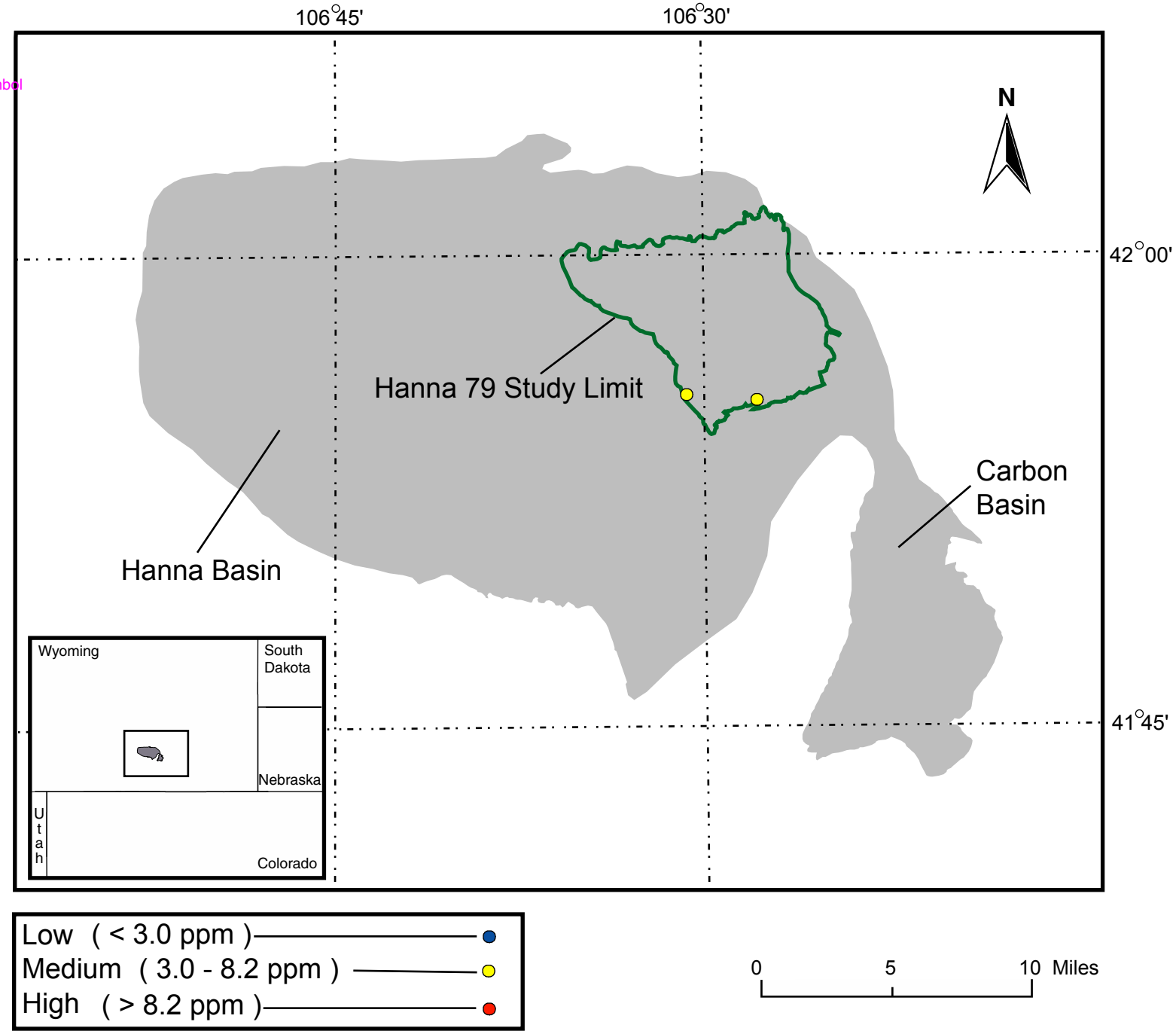

Figure HQ-78. Chromium concentration in the Hanna 79 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

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Click here or on this symbol in the toolbar to return.

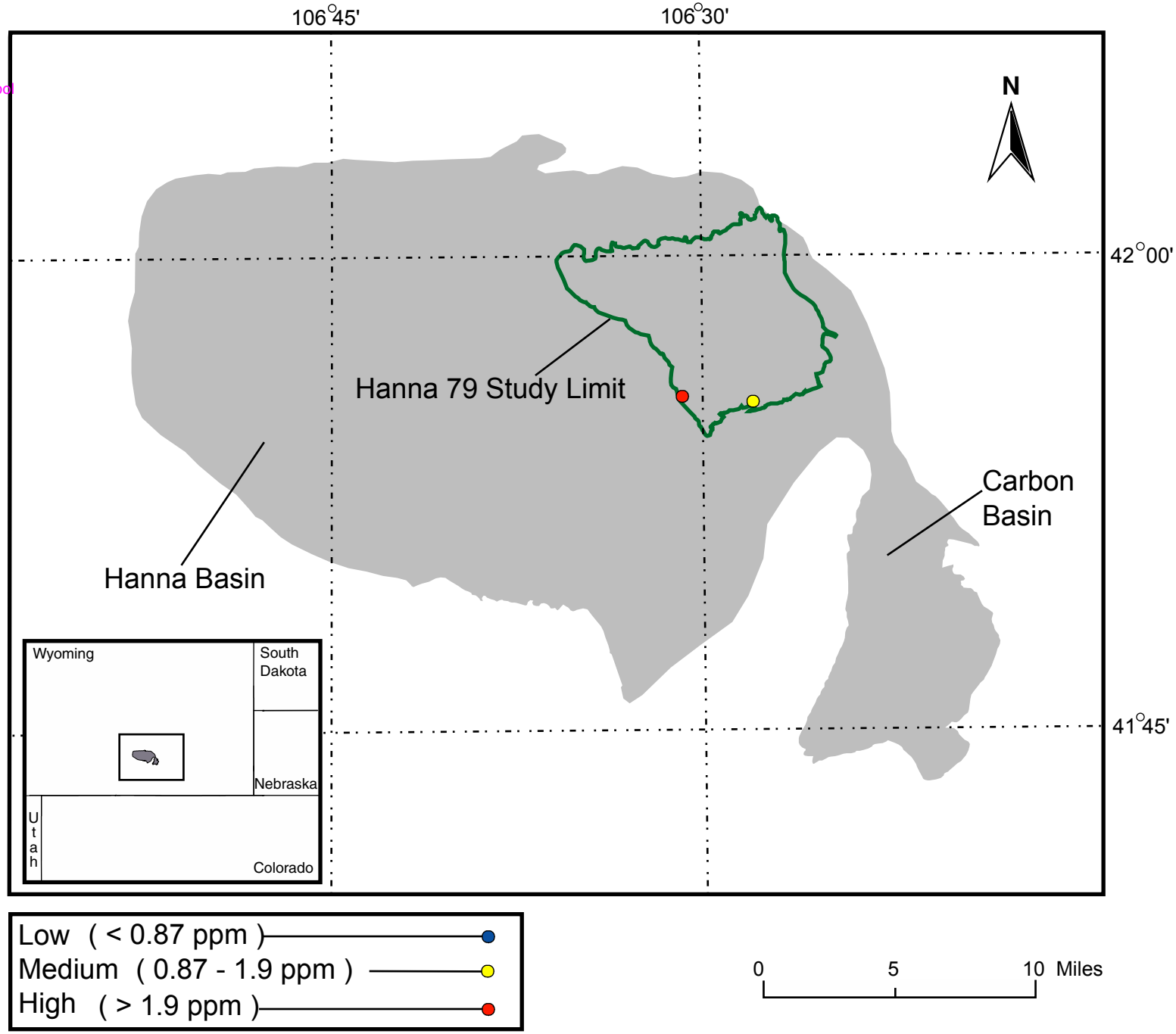

Figure HQ-79. Cobalt concentration in the Hanna 79 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

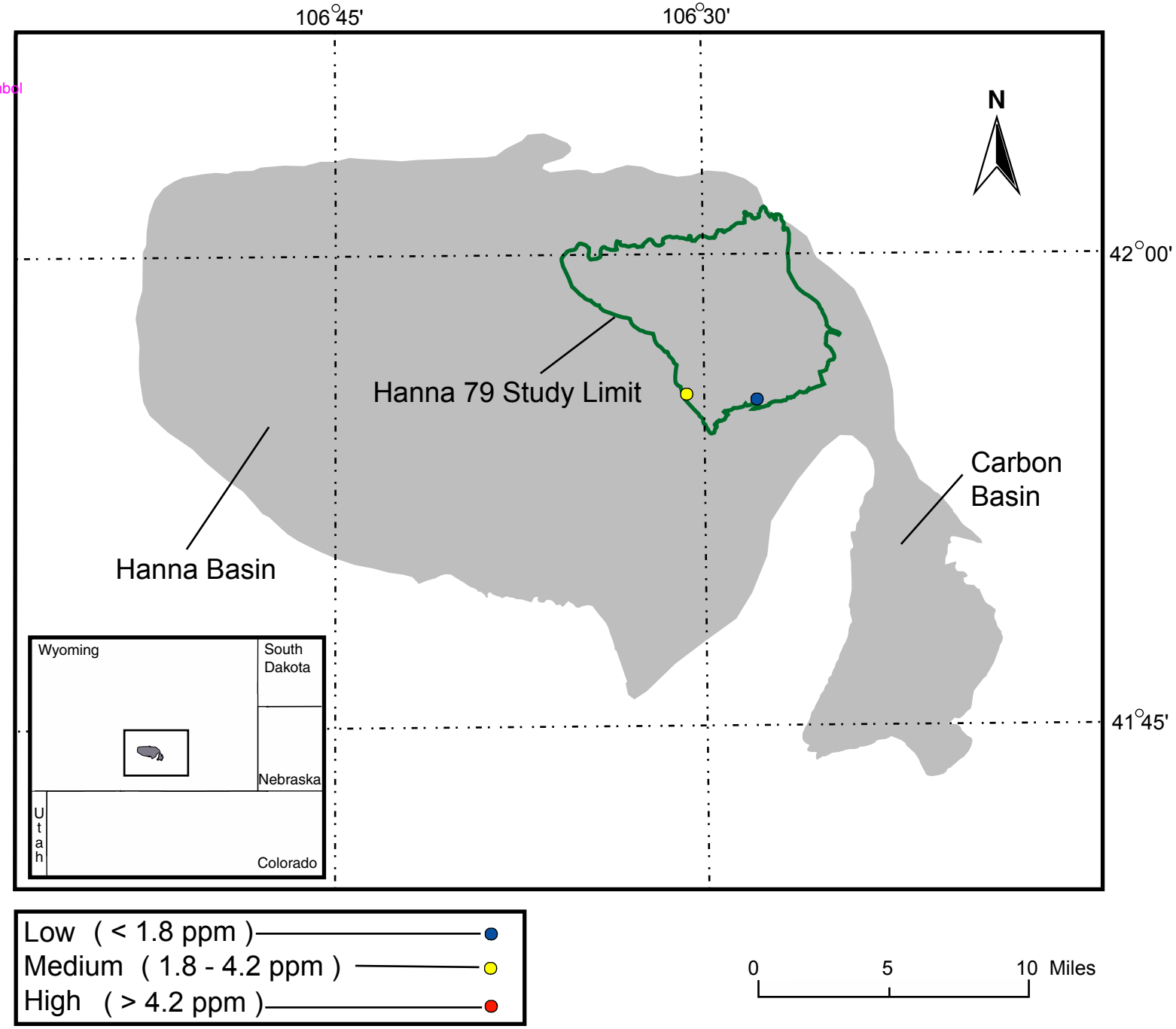

Figure HQ-80. Lead concentration in the Hanna 79 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

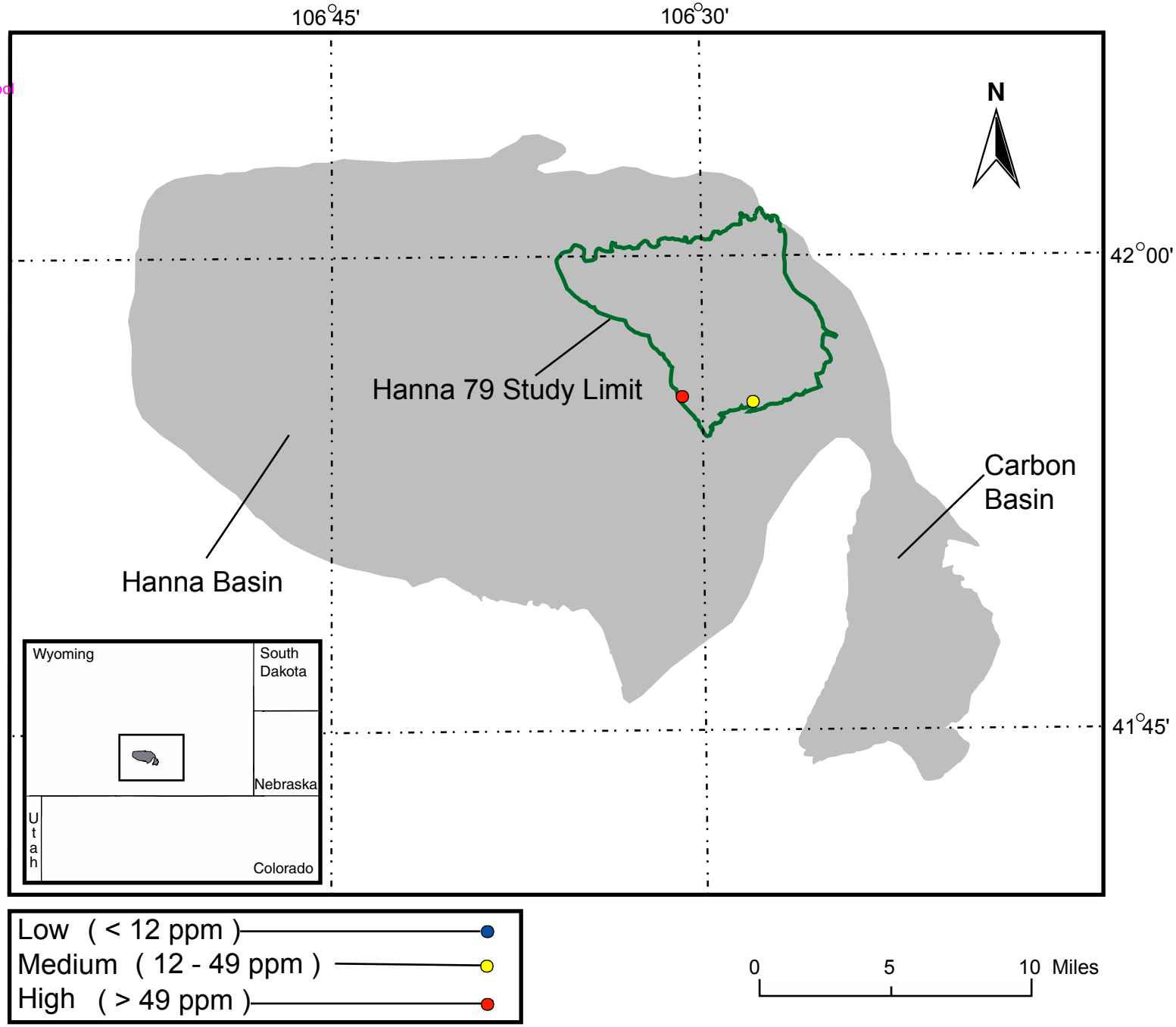

Figure HQ-81. Manganese concentration in the Hanna 79 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

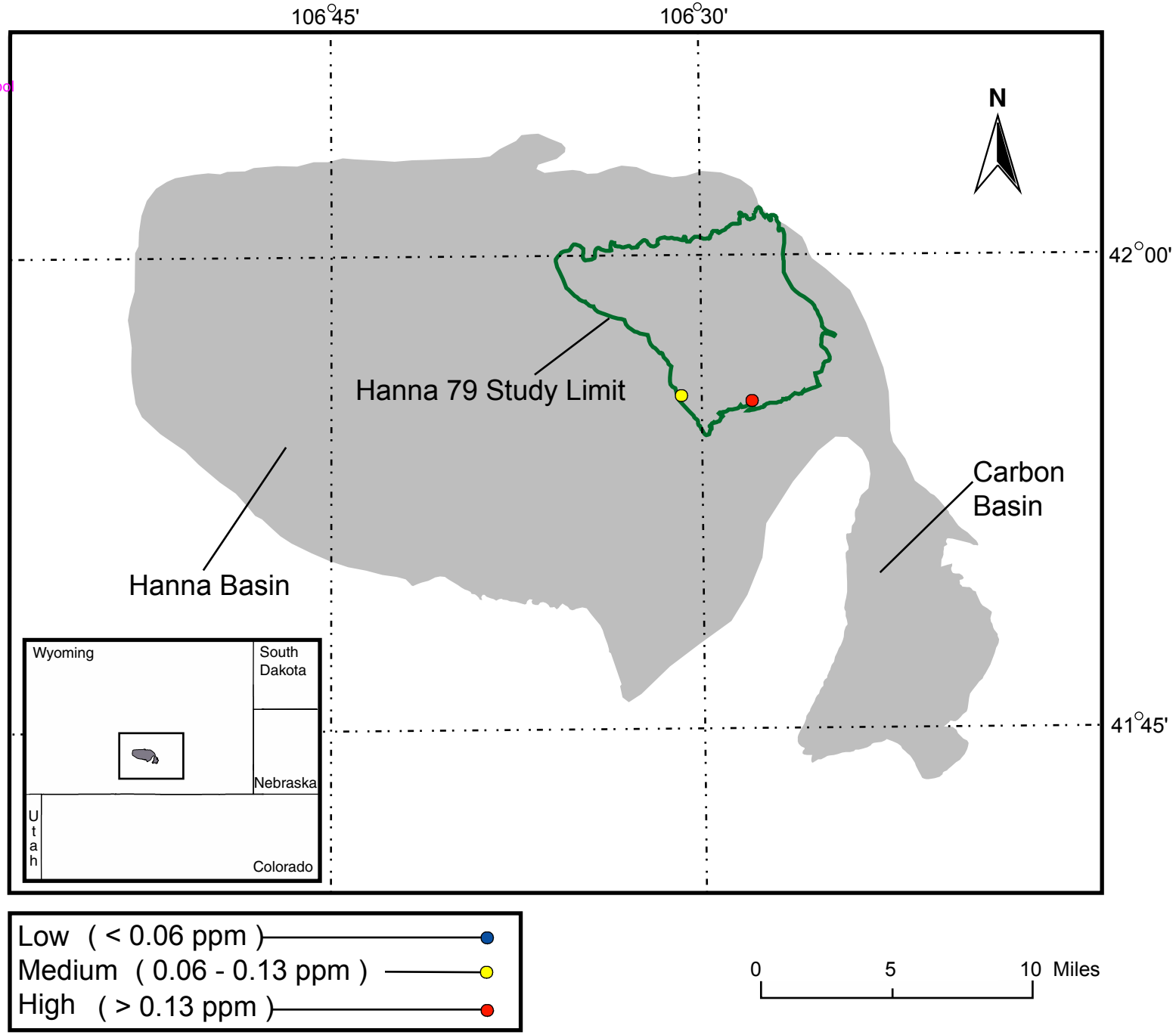

Figure HQ-82. Mercury concentration in the Hanna 79 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

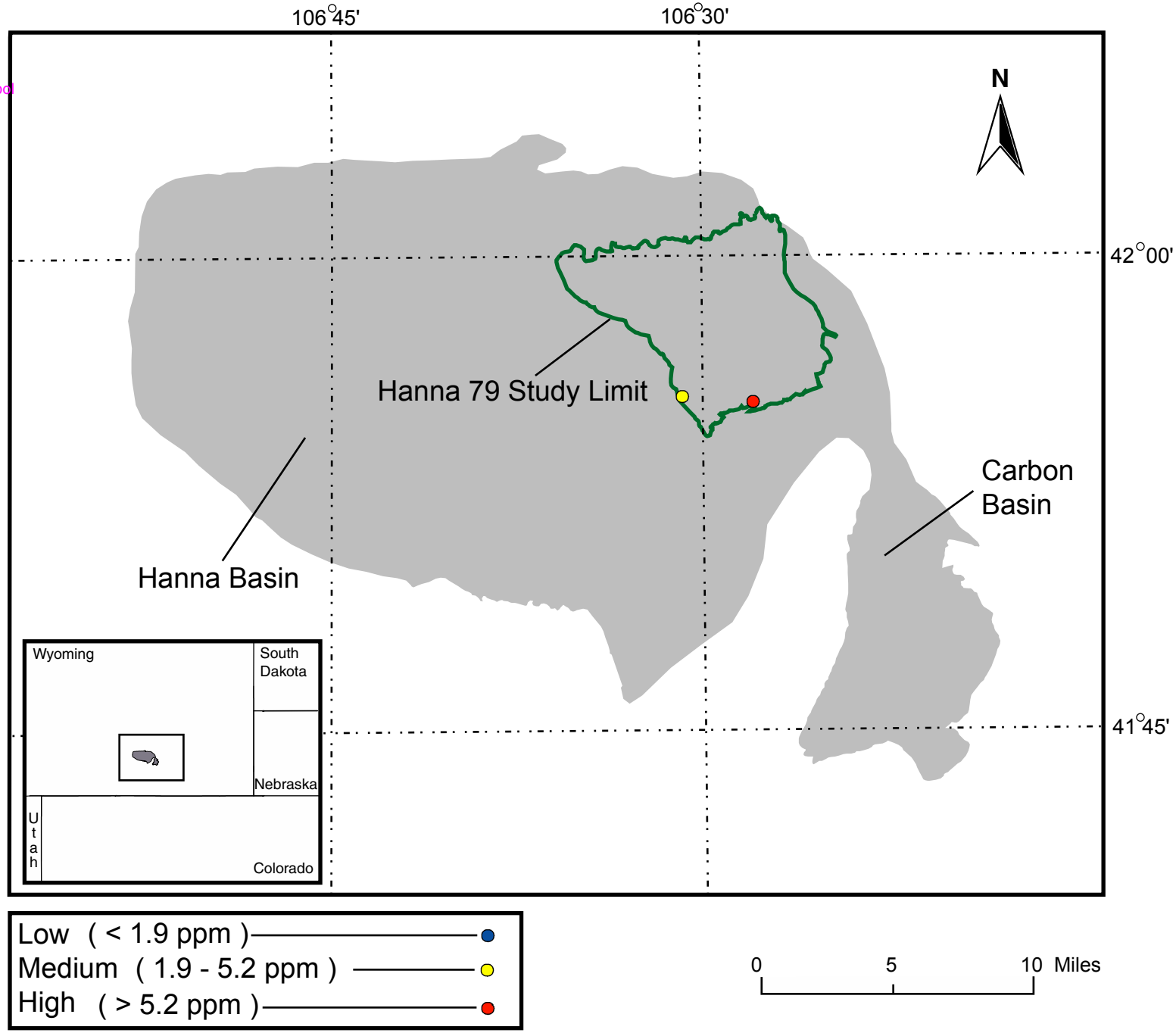

Figure HQ-83. Nickel concentration in the Hanna 79 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

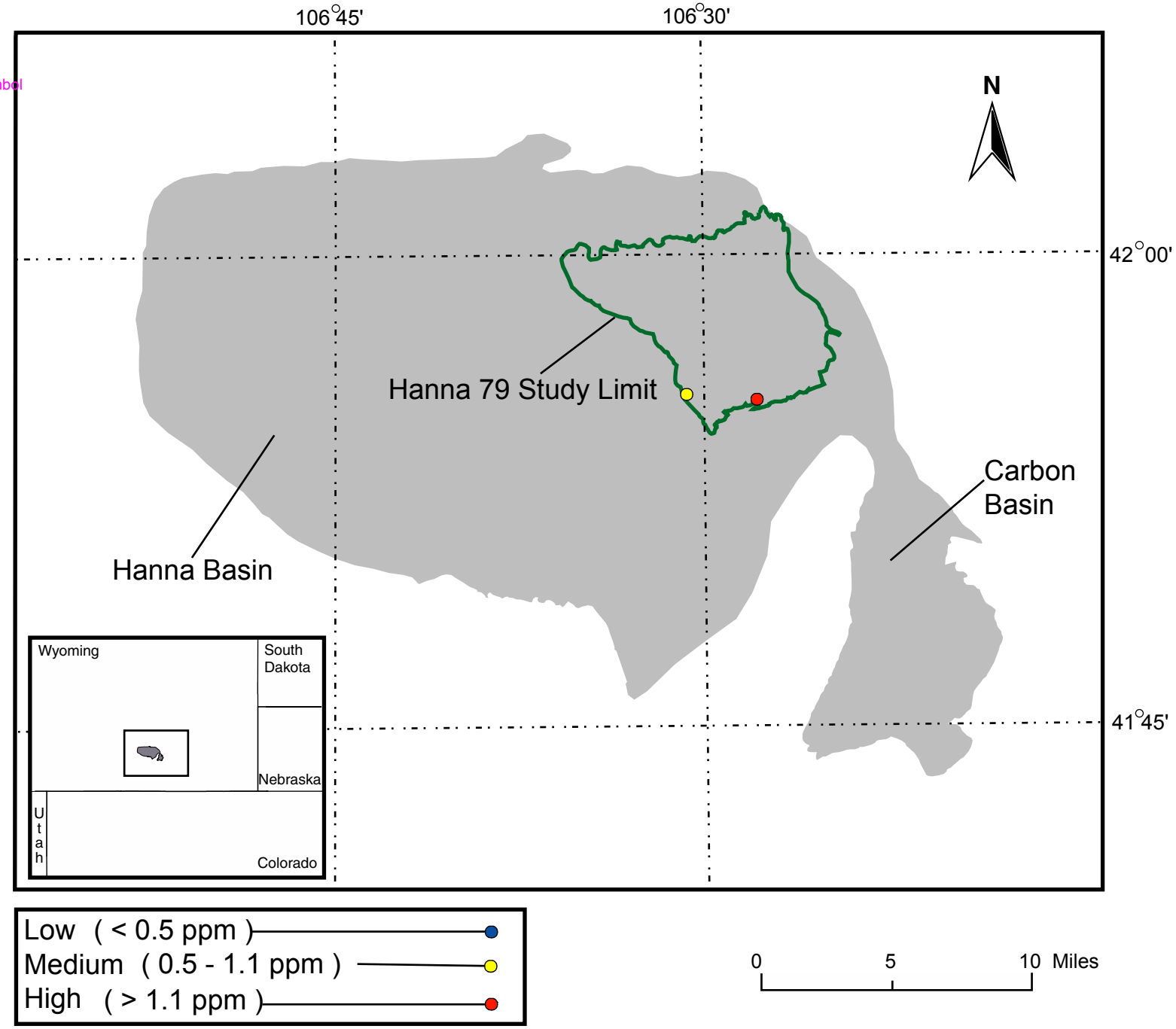

Figure HQ-84. Selenium concentration in the Hanna 79 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

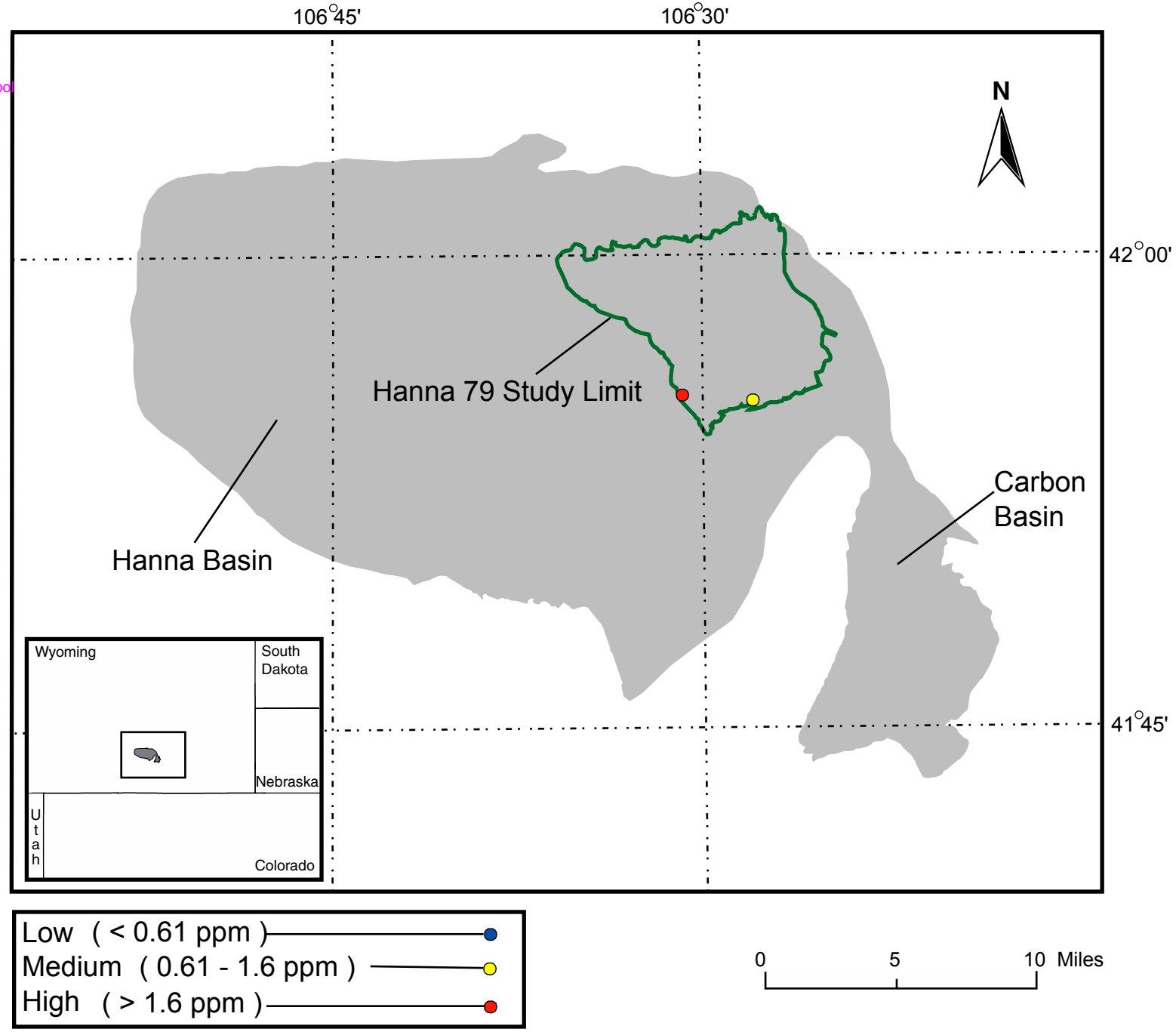

Figure HQ-85. Uranium concentration in the Hanna 79 coal zone, Hanna coalfield, Hanna Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

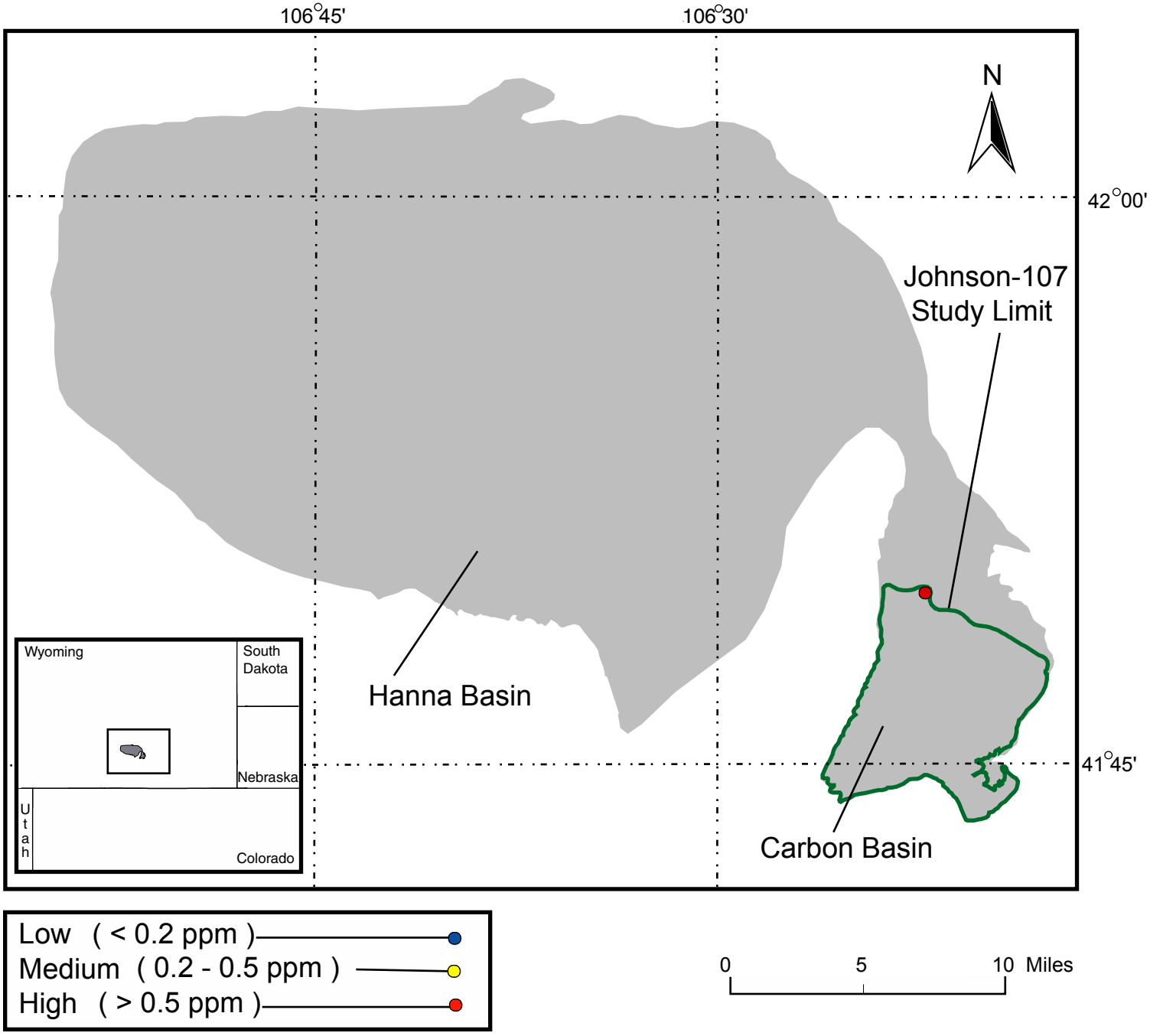

Figure HQ-86. Antimony concentration in the Johnson-107 coal zone, South Carbon coalfield, Carbon Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

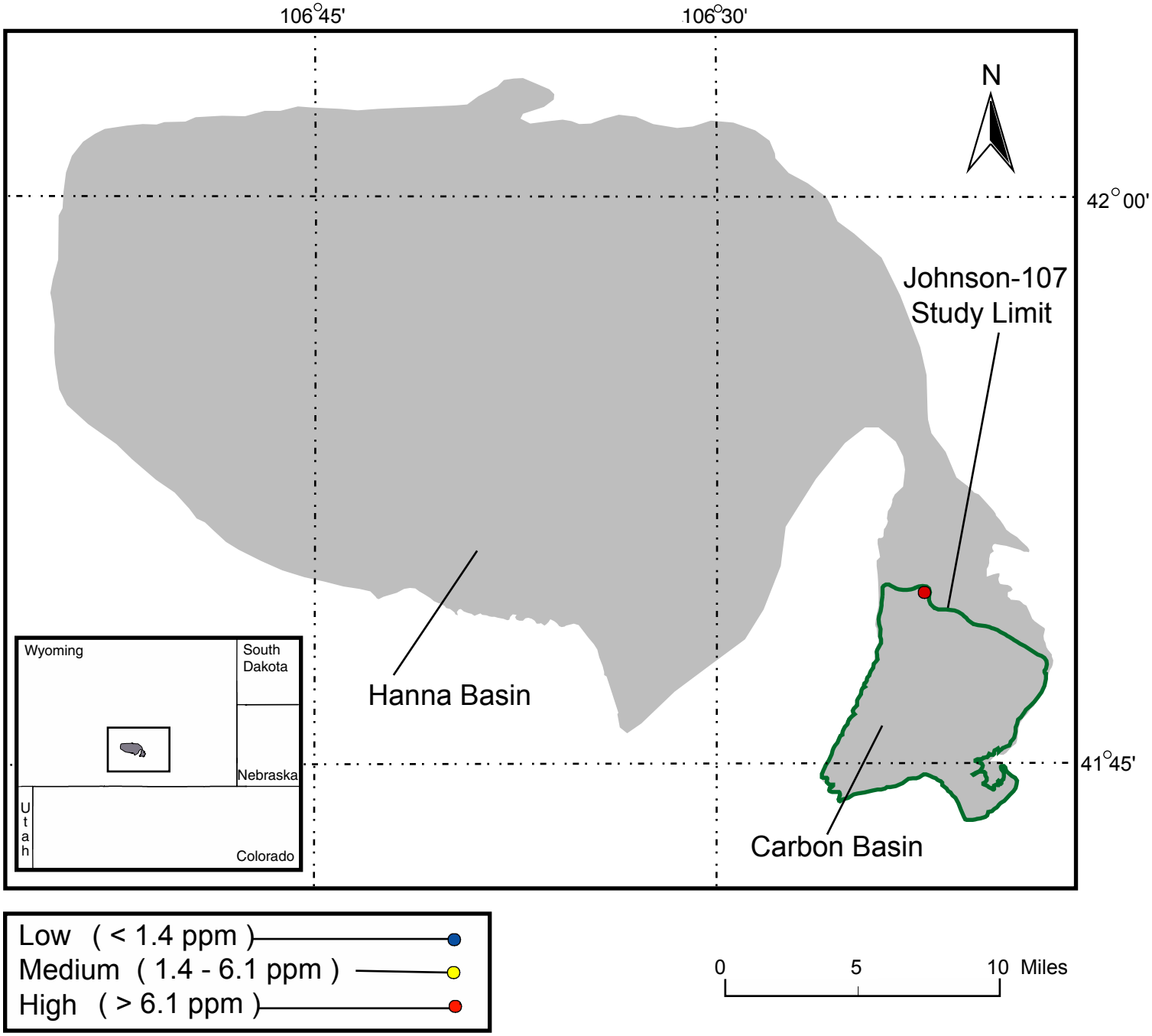

Figure HQ-87. Arsenic concentration in the Johnson-107 coal zone, South Carbon coalfield, Carbon Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

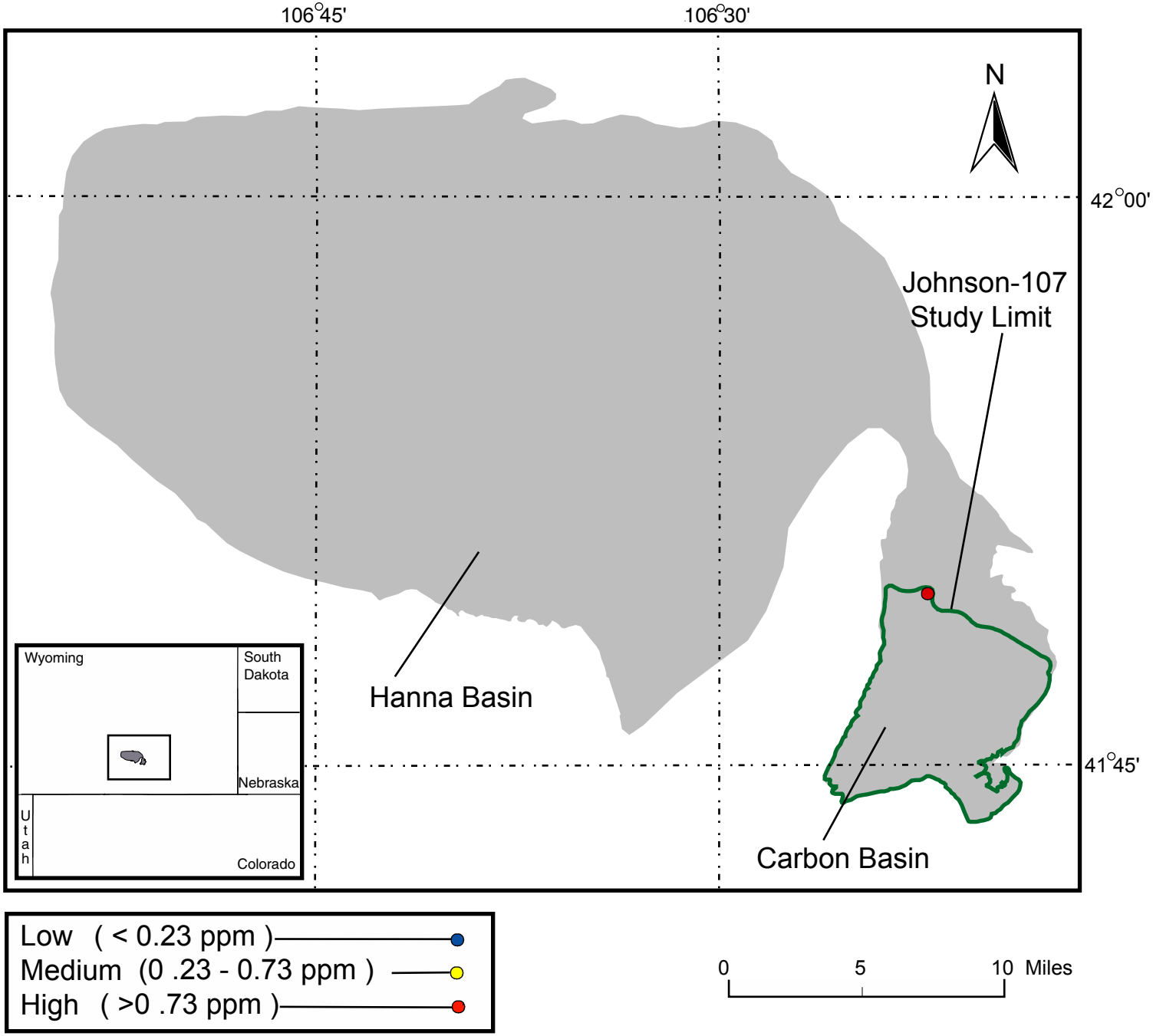

Figure HQ-88. Beryllium concentration in the Johnson-107 coal zone, South Carbon coalfield, Carbon Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

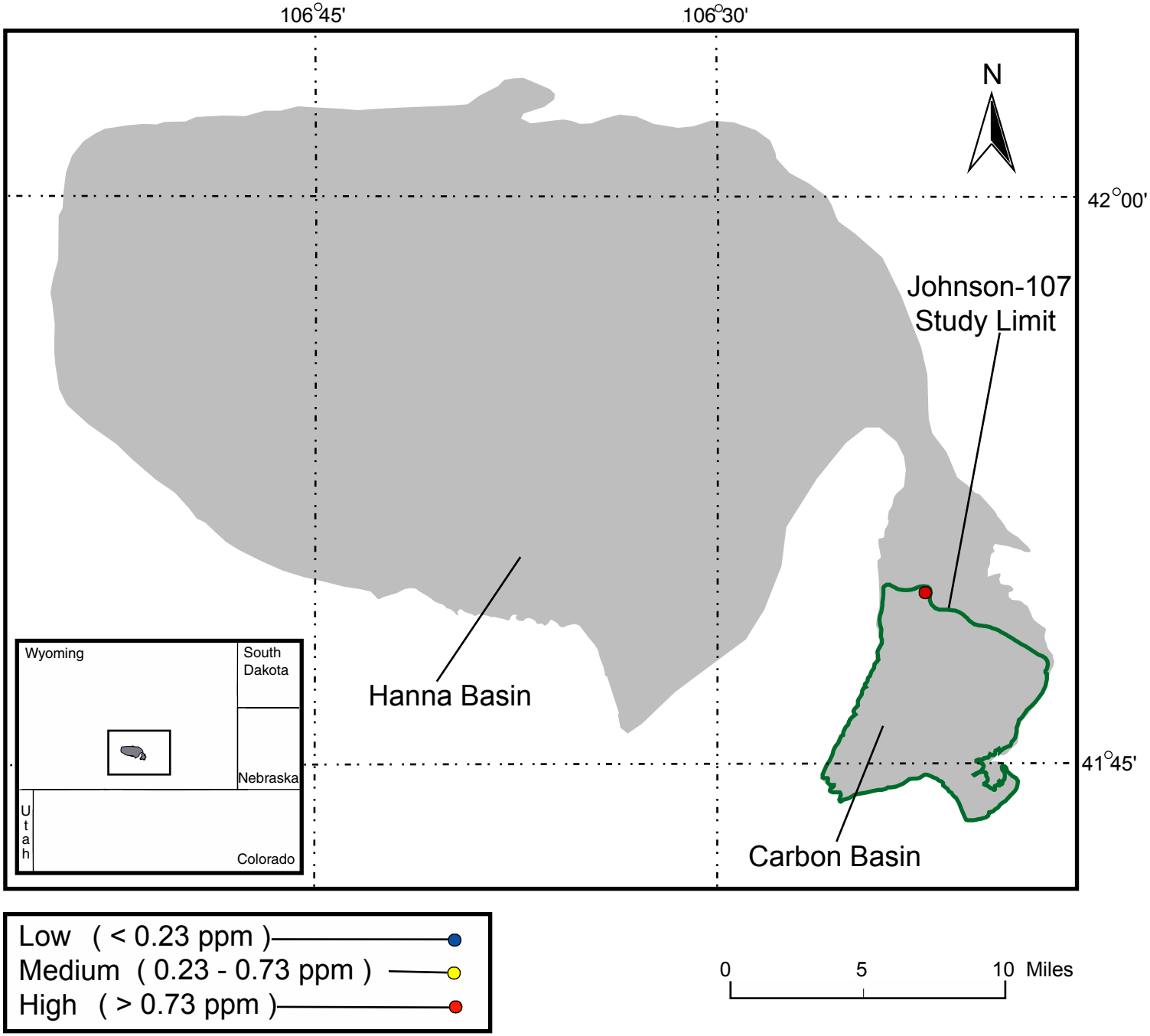

Figure HQ-89. Cadmium concentration in the Johnson-107 coal zone, South Carbon coalfield, Carbon Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

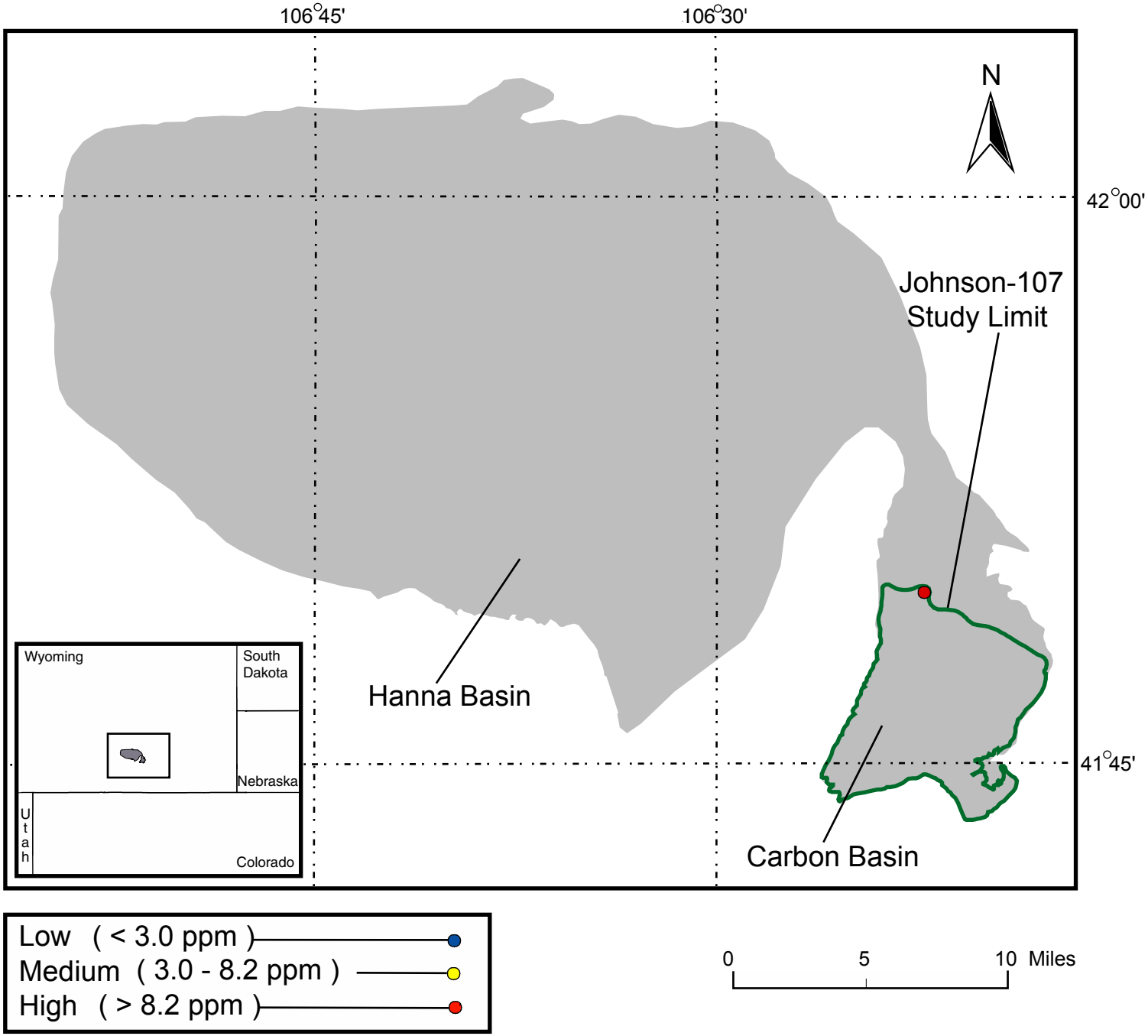

Figure HQ-90. Chromium concentration in the Johnson-107 coal zone, South Carbon coalfield, Carbon Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

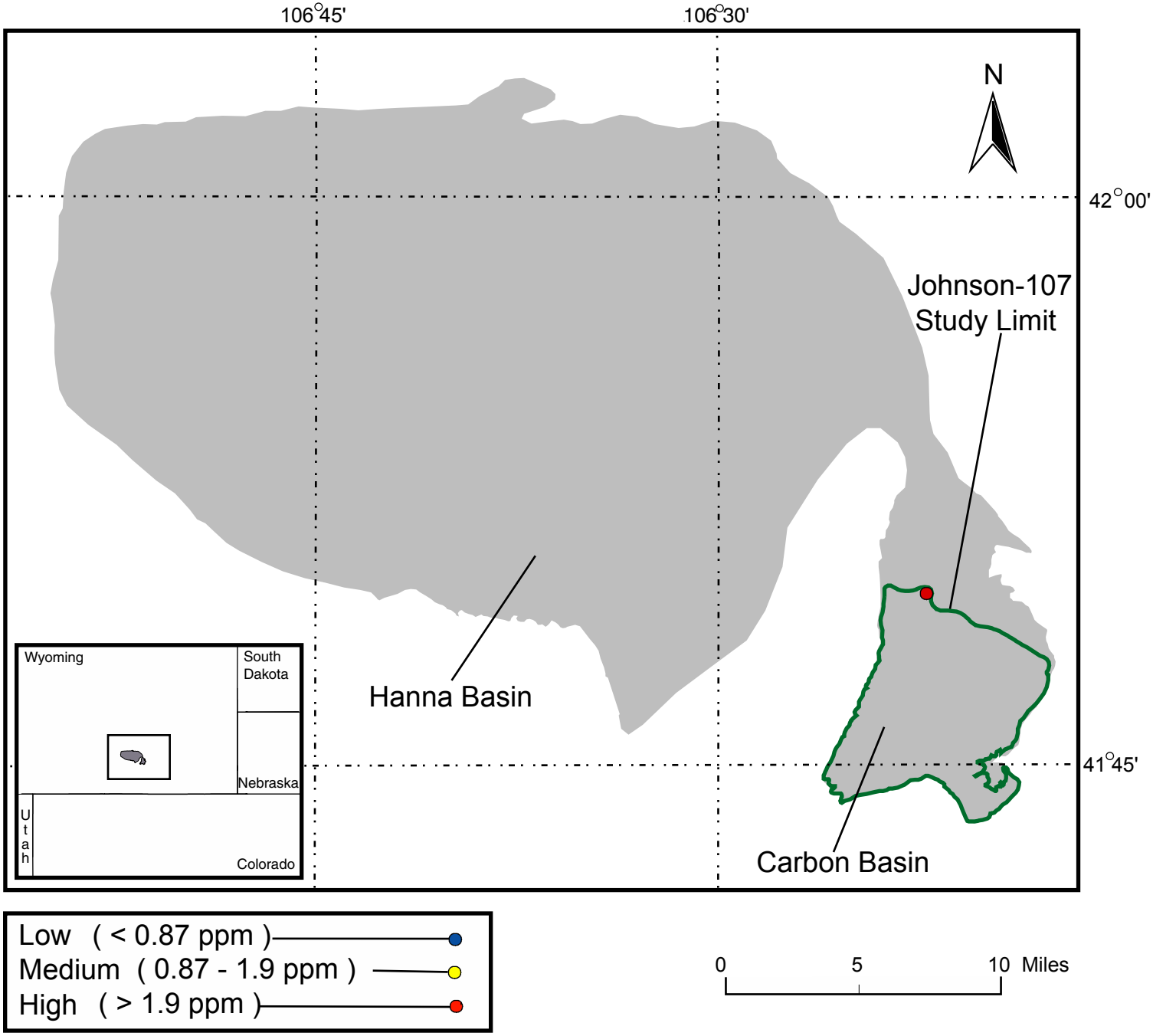

Figure HQ-91. Cobalt concentration in the Johnson-107 coal zone, South Carbon coalfield, Carbon Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

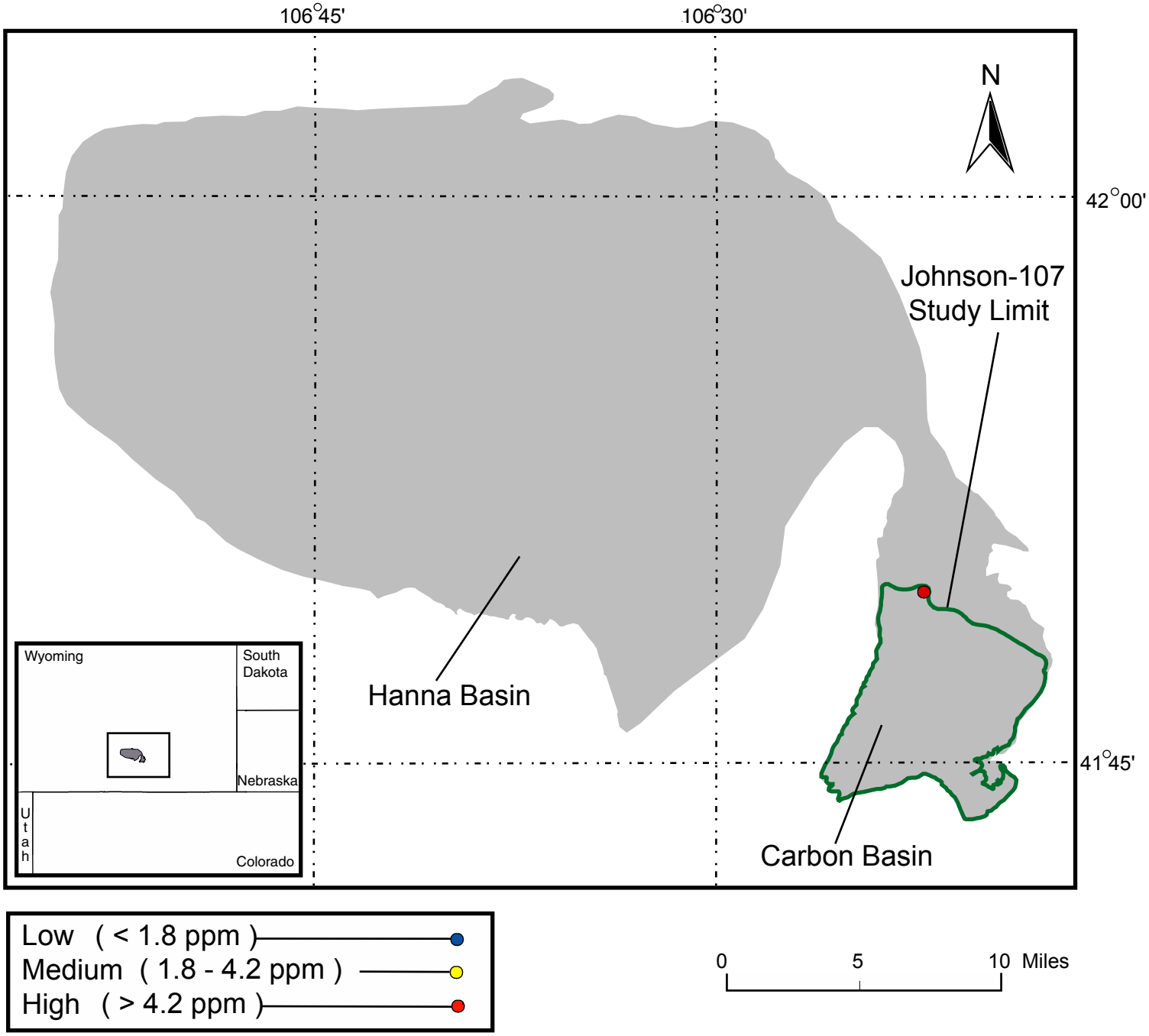

Figure HQ-92. Lead concentration in the Johnson-107 coal zone, South Carbon coalfield, Carbon Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

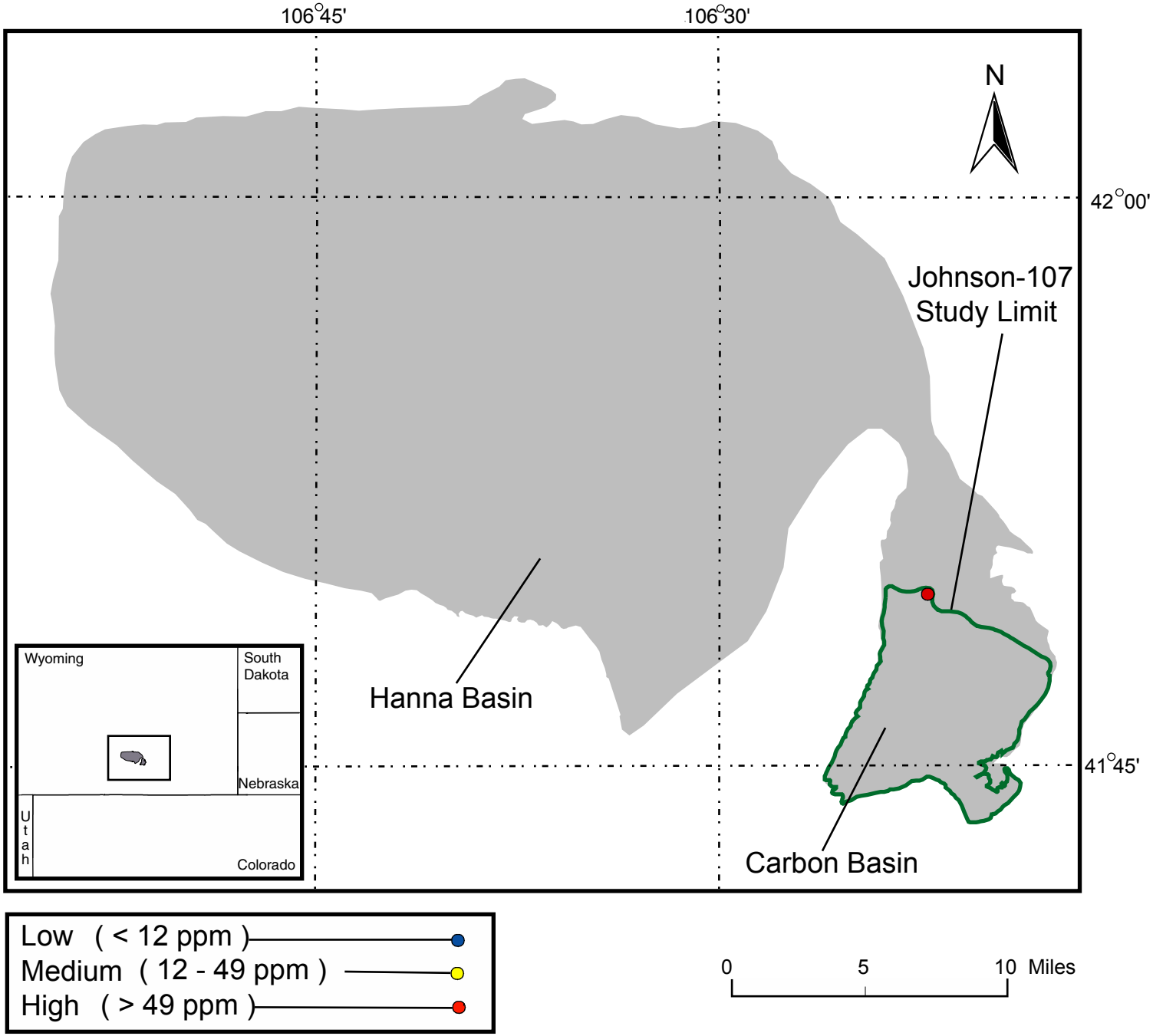

Figure HQ-93. Manganese concentration in the Johnson-107 coal zone, South Carbon coalfield, Carbon Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

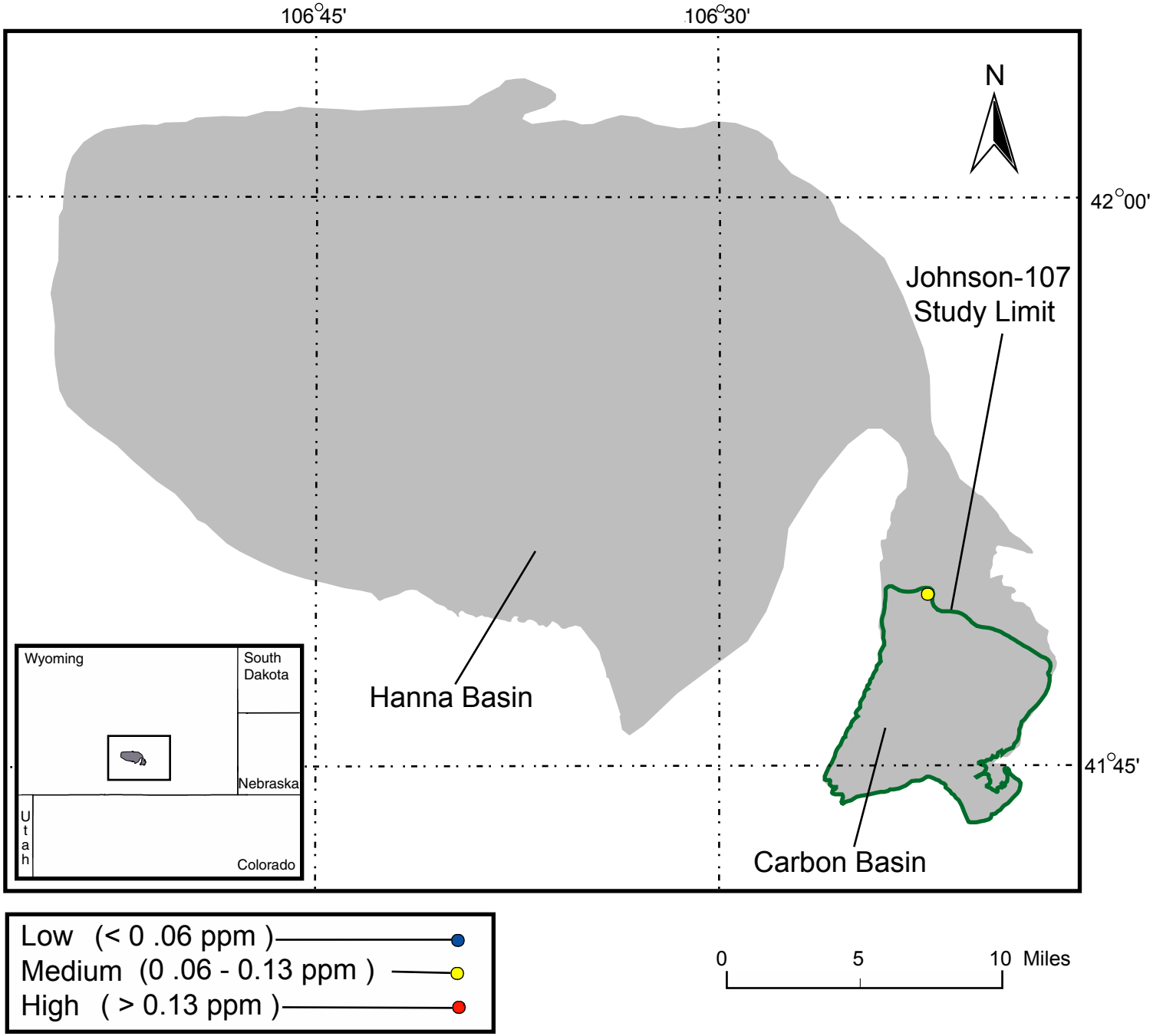

Figure HQ-94. Mercury concentration in the Johnson-107 coal zone, South Carbon coalfield, Carbon Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

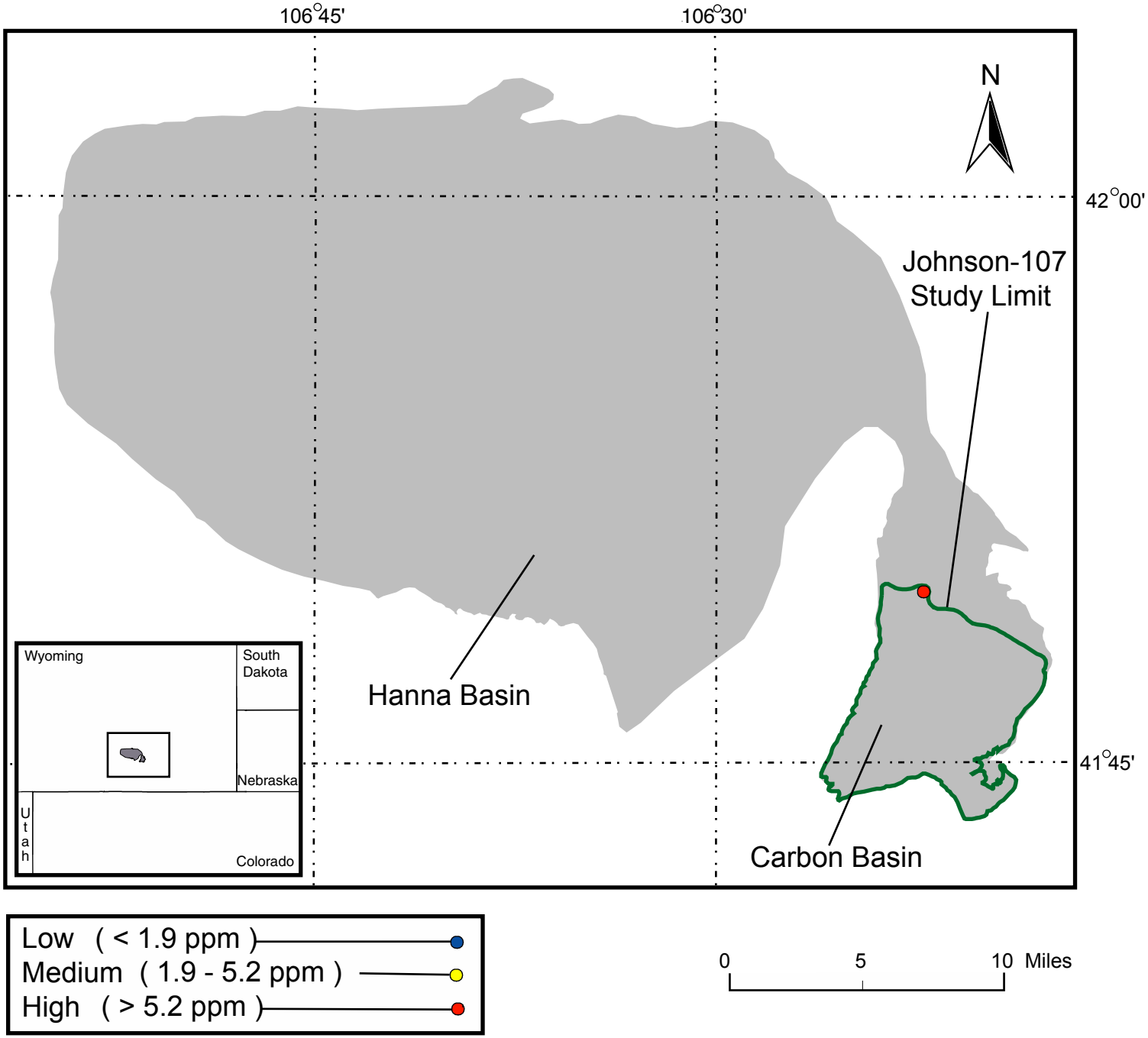

Figure HQ-95. Nickel concentration in the Johnson-107 coal zone, South Carbon coalfield, Carbon Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

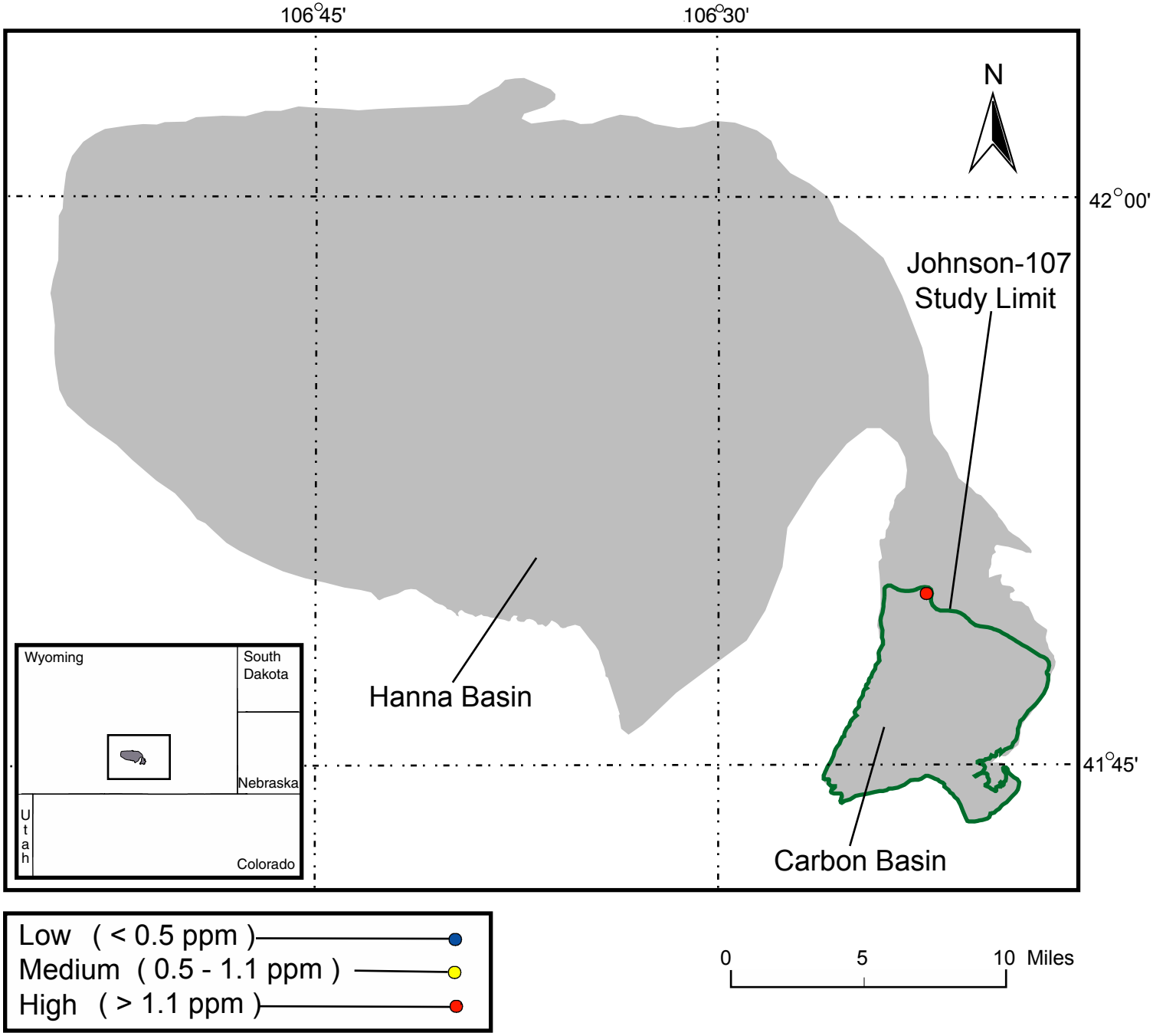

Figure HQ-96. Selenium concentration in the Johnson-107 coal zone, South Carbon coalfield, Carbon Basin, Wyoming.

Click here or on this symbol in the toolbar to return.

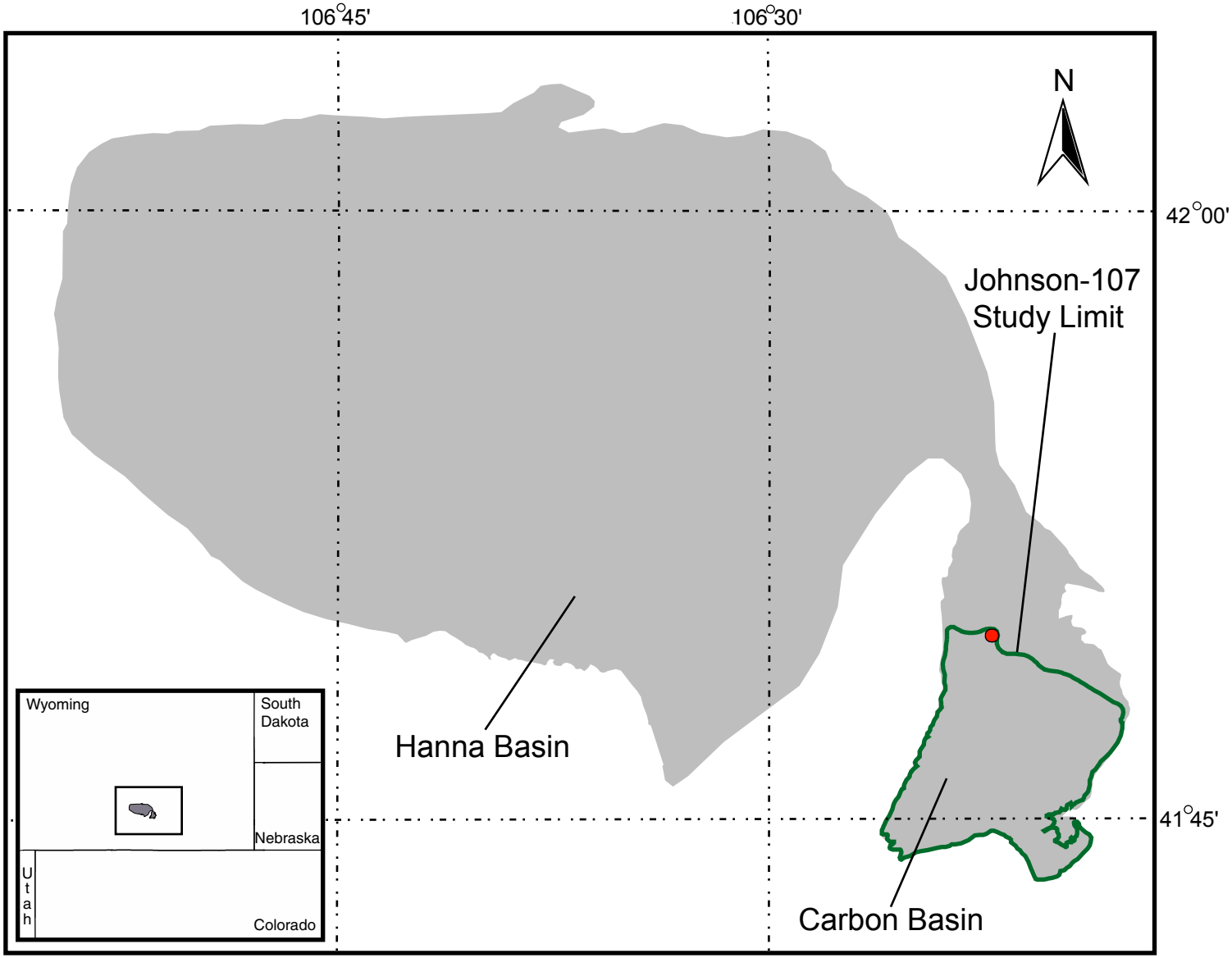

Figure HQ-97. Uranium concentration in the Johnson-107 coal zone, South Carbon coalfield, Carbon Basin, Wyoming.

Table HQ-1. Summary data for merged assessment units in the Hanna and Carbon Basin, Wyoming. Calculated from the unpublished U.S. Geological Survey coal quality database (USCHEM), February, 1992; Bragg and others (1994); and proprietary source(s)

Variable	Number of samples	Range		Mean
		Minimum	Maximum	
Moisture [1]	148	7.16	30.12	11.61
Ash [1]	148	1.97	48.70	12.48
Total sulfur [1]	147	0.30	3.91	0.96
Calorific value [2]	148	5,070	12,080	10,090
lb SO_2 [3]	147	0.57	14.08	2.07
MMMFBtu [4]	148	6,820	13,020	11,640
Antimony [5]	14	0.20	1.4	0.49
Arsenic [5]	14	1.0	7.8	4.4
Beryllium [5]	11	0.11	1.5	0.36
Cadmium [5]	14	0.027L	0.97	0.28
Chromium [5]	14	2.2	52	11
Cobalt [5]	14	0.37	5.9	2.0
Lead [5]	14	1.1L	19	4.6
Manganese [5]	14	12	170	46
Mercury [5]	14	0.005L	0.15	0.07
Nickel [5]	14	1.1	15	5.4
Selenium [5]	14	0.05L	2.9	0.80
Uranium [5]	14	0.51	4.8	1.91

[1] Values are in percent and on an as-received basis.

[2] Value is in British thermal units (Btu).

[3] Value is in pounds per million Btu and on an as-received basis.

[4] Value is in British thermal units on a moist, mineral-matter-free basis.

[5] Values are in parts per million (ppm) on a whole-coal and as-received basis; “L” denotes less than value shown.