Iron (Fe) is the most common element, by mass, forming the planet Earth, and is the fourth most common element found in the Earth’s crust. One of the important features of iron ore is the presence of penalty elements.

### Aluminum
Aluminum (Al) is present in clays, micas, and feldspars in some iron ore deposits and in limestone flux used in steel making. Small amounts of Al (< 1%) can increase the viscosity of the slag, which impedes the operation of the furnace.

### Sulfur
Sulfur (S) can be present as sulfides in iron ore and the coal used in the smelting process. At concentrations > 300 ppm, S causes brittleness in hot iron so the iron cannot be used in steel making.

### Phosphorous
Phosphorous (P) can increase the hardness and strength of steel when present between 700 and 1200 ppm, yet the presence of P > 2000 ppm can make steel brittle at room temperature. Phosphoric iron is less susceptible to oxidation.

### Silicon
At temperatures above 1300 °C, silica (SiO2) will form an alloy with the iron, forming grey iron – less brittle and easier to finish than white iron – which is better for casting.

### Delivering Value to the Mining Industry
Thermo Scientific Portable XRF Analyzers