**Banded Iron Formation** (also known as **BIF**, or as **taconite** in North America) is a term that is applied to a very unique sedimentary rock of biochemical origin. These rocks are unique in their make up, unique in their age and unique in their origins.  They are found all over the world, but only in certain areas of all the major continents.  Every continent has a BIF formation.

**BIF** consists of alternating layers of iron oxides and shale, chert, tiger eye or jasper.  The alternating layers are generally only a few centimeters thick although the formations themselves can be massively thick.  The iron oxide layers are generally composed of the minerals [**magnetite**](http://www.galleries.com/minerals/oxides/magnetit/magnetit.htm)and [**hematite**](http://www.galleries.com/minerals/oxides/hematite/hematite.htm)but other rarer iron oxides are also found in these formations.  The black to gray to silver colored iron oxide layers contrast with the iron rich chert, jasper and shales which are generally red in color.

The tiger eye versions of BIF are the result of low grade metamorphism creating veins of fibrous or asbestos [**riebeckite**](http://www.galleries.com/minerals/silicate/riebecki/riebecki.htm). Often these asbestos type crystals are replaced by the mineral [**quartz**](http://www.galleries.com/minerals/silicate/quartz.htm). The formerly fibrous nature of the crystals causes the play of light that is known as Tiger's Eye and it is quite attractive and used in jewelry.

**BIF** is very old.  Some of the oldest sedimentary rocks known to scientists have banded iron formations among their constituents.  They date to as old as 3 billion years old, but most are aged at around 2.5 billion and some are as "young" as 1.8 billion.  A very young formation of BIF is known to be only 800 to 600 million years old, but this is an exception to the rule.  It is believed that banded iron formations occurred at these times in Earth's history due to unique conditions and then never again were the conditions right for the formation of this most unusual rock.  Due to the extreme age of these formations, almost all BIF formations have undergone some faulting, fracturing, folding, compaction, veining, intrusions and metamorphism.  Although all BIF formations are probably metamorphosed to some degree, their general character is still sedimentary.

Banded Iron Formations are thought to have formed from the precipitation of iron from the Earth's ancient oceans.  Photosynthetic bacteria produced, for perhaps the first time in the young Earth's oceans, free oxygen which oxidized the dissolved iron that existed abundantly at the time. Oxidized iron is not soluble in water and thus it would precipitate out of the oceans and onto the muddy sea floor.

For reasons largely unknown, this was a periodic process resulting in the alternating bands of iron oxide and shale.  The periodic process might have been due to seasonal fluctuations or storm surges or other hypothesis.  Whatever the reason, there never seemed to be a time when the iron layer formation or the shale (mud) formation persisted long enough to produce a layer thicker than 10 centimeters or so.

Since the origin of the iron layer is derived from a living organism, the photosynthetic bacteria, BIF is actually a fossil.  Fossils do not need to be the direct evidence of an organism such as a dinosaur bone or a trilobite.  BIF actually qualifies as a trace fossil.  Some of the oldest fossils known to man just predate banded iron formations.  Bacteria are believed to be the earliest life forms on Earth and eventually the oxygen producing varieties formed the BIF and helped transform the Earth.

BIF is the proof of this transformation when it was under way.  The conditions to form BIF, dissolved iron and episodic oxygenation, existed early in Earth's history and then once the Earth's oxygen levels stabilized the conditions for banded iron formation all but ceased to exist.

When polished, BIF can be very beautiful.  The red jasper or Tiger Eye makes a wonderful compliment to the sparkling silver gray of the hematite.  The banded layers, sometimes contorted by ages of folding and faulting, make for surreal landscapes of asymmetric bands.  BIF can be used for many ornamental purposes from bookends to clock faces to gravestones and monuments.  Its only major drawback is its significant weight.  Iron is not light.  But the solidification of jasper and compaction of the stone make it very durable and capable of being processed into relatively thin slabs.  This keeps the weight to usable levels and allows BIF to be used as a popular ornamental stone.  The popular polished Tiger Eye stones that are sold in rock shops around the world are usually derived from banded iron formations.

As an ore of iron, BIF is king.  The [**hematite**](http://www.galleries.com/minerals/oxides/hematite/hematite.htm)and [**magnetite**](http://www.galleries.com/minerals/oxides/magnetit/magnetit.htm)concentrations in BIF are much sought after by mining companies.  These two minerals are the best sources of iron and fortunately there is a lot of BIF to supply the world's needs for quite a while. Magnetite-rich taconite is preferred, as the ore is finely powdered and magnetic separation serves to concentrate the magnetite leaving a fine quartz powder. The magnetite is then further oxidized to hematite, which is fed into the iron-making process.  
    
Banded iron formations are found in the continental shield of all continents of the world.  The shield areas of continents contain the oldest precambrian rocks.  At one time these rocks may have been together as one continent, but later broke apart and became the core of the modern continents as they exist to day.  Although each continent has had its own geologic history that had its own impact on their shield rocks, it is somewhat amazing that most BIF rocks are very similar character.  This is truly one of the most amazing rocks found on Earth.