

Iron ore (megatons)	
China	880
Australia	390
Brazil	300
India	245
Russia	92
Ukraine	66
S Africa	55
Iran	33
Canada	32
US	27

Aluminum (megatons)	
Australia	65
China	40
Brazil	28
India	16
Guinea	15
Jamaica	8
Russia	6
Kazakhstan	5
Suriname	4
Venezuela	3

## From Iron to Gold

### World Leaders in the Production of 15 Essential Metals

Silver (tons)	
Mexico	5100
China	3700
Peru	3500
Australia	1800
Russia	1400
Poland	1300
Bolivia	1250
Chile	1150
US	1000
Argentina	750

Gold (tons)	
China	330
Australia	250
US	230
Russia	205
S Africa	190
Peru	165
Indonesia	130
Canada	95
Uzbekistan	90
Ghana	90

Copper (kilotons)	
Chile	3350
Peru	1110
China	940
Australia	830
US	800
Russia	750
Indonesia	630
Zambia	610
Poland	430
Zambia	380

Lead (kilotons)	
China	1410
Australia	640
US	450
Peru	330
Mexico	120
India	78
Canada	75
Sweden	62
Poland	60
Ireland	54

Nickel (kilotons)	
China	320
Russia	265
Japan	160
Canada	105
Australia	100
Norway	90
Colombia	50
Finland	45
New Caledonia	40
S Africa	35

Tin (kilotons)	
China	115
Indonesia	55
Peru	37
Bolivia	20
Brazil	13
Congo	9
Vietnam	4
Malaysia	2
Australia	1
Russia	1

Zinc (kilotons)	
China	3100
Peru	1510
Australia	1290
US	740
India	700
Canada	690
Kazakhstan	480
Bolivia	420
Mexico	390
Ireland	380

Chromium (kilotons)	
S Africa	9700
India	3900
Kazakhstan	3600
Turkey	1900
Oman	800
Russia	750
Brazil	630
Finland	610
Zimbabwe	480
Pakistan	320

Cobalt (kilotons)	
Congo	36
Russia	6
China	6
Zambia	5
Australia	5
Canada	4
Cuba	3
Morocco	2
Philippines	2
Brazil	1

Molybdenum (kilotons)	
China	94
US	48
Chile	35
Peru	12
Canada	9
Mexico	8
Armenia	4
Russia	4
Iran	4
Mongolia	3

Tungsten (kilotons)	
China	51
Russia	3
Canada	2
Bolivia	1

Vanadium (kilotons)	
S Africa	24
China	19
Russia	14
Kazakhstan	1

Platinum (tons)	
Russia	83
S Africa	75
US	13
Canada	7
Zimbabwe	6
Japan	6
Botswana	3
Australia	1

- 1. The United States** is one of the top-ten producers of \_\_\_\_\_ different metals.
- 2. Russia** is one of the top-ten producers of \_\_\_\_\_ different metals.
- 3. Number 1.** \_\_\_\_\_ is the number-one producer of the most different metals.
- 4. Four by four.** Name four countries (outside of China, Russia, and the US) that are in the top ten producers of at least four important metals.  
\_\_\_\_\_
- 5. Choose one of these metals.** \_\_\_\_\_  
Find out what it is used to make. \_\_\_\_\_  
Be ready to explain what it is, where it comes from, and how we use it.

## Teacher's Guide: **Metal Mining World Leaders**

Overview: Students examine a table of metal production data and try to identify countries that are major producers of a number of metals.  The real lesson, however, is about how to approach data tables like this – not as a task to memorize but as mystery that can be solved by looking for patterns that are easier to understand.	Grade: 7 - 12
	Related Discipline: Economics
	CC Standard: math, writing
	Time: ½ to 1 class period

**Setup:** Life as we know it would be impossible without a number of metals – far more than are listed in this table, comprehensive as it may appear at first glance. Memorizing patterns of production for all these metals is a difficult and arguably pointless task. We're going to try to pull out a few key facts that will help us put other facts in perspective as we encounter them.

**Procedure:** This activity can be run as individual or group inquiry or as a whole-class discussion guide. The handout is almost self-explanatory, but it is important to emphasize that the goal is to find patterns, not to memorize all these numbers (or even a modest fraction of them).

One should not go to the other extreme, however, and say that it is easy to find information like this on the web – it's not, at least not in terms that are easy to compare. Students should appreciate when a source has done this comparative work for them.

**Answers:** 1. Eight 2. Thirteen 3. China 4. At least nine countries pass this threshold. Students can correct each other and try for the most in each group.

**Debrief:** One important conclusion is that large countries like Australia, China, Russia, and the United States are likely to have large supplies of mineable metals, while large economies such as China and India are likely to be mining even marginal reserves to supply their vast and growing needs. There is a correlation with mountains – the geologic processes that make mountains also tend to emplace metal ores (see the South America and Russia clickable pdf presentations in the Model Curriculum).

**Vocabulary:** metal mine production ore reserves

**Extension:** Students can investigate individual metals on websites such as the CIA Factbook or <http://www.indexmundi.com/minerals/> or even Wikipedia. The same caution applies – the goal is to understand relative importance, possible changes, and geopolitical implications, not to memorize production figures for any one year (or from any one source!) Keep the implied assessment clearly on the process of discussing and comparing, not reproducing numbers.

The xTra project folder has a sample presentation about neodymium, one of the so-called “rare-earth” elements. It has become an essential part of many modern products, from hybrid cars to wind generators and cell phones. At least half a dozen other rare earths have similarly critical roles and interesting stories, as do elements like Beryllium, Germanium, Lithium, Scandium or many others that tend to get ignored by geography books that focus on big metals like iron, copper, and aluminum.