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**Semester: II**

**Topic: Production and Distribution of Copper ore  
in the World**

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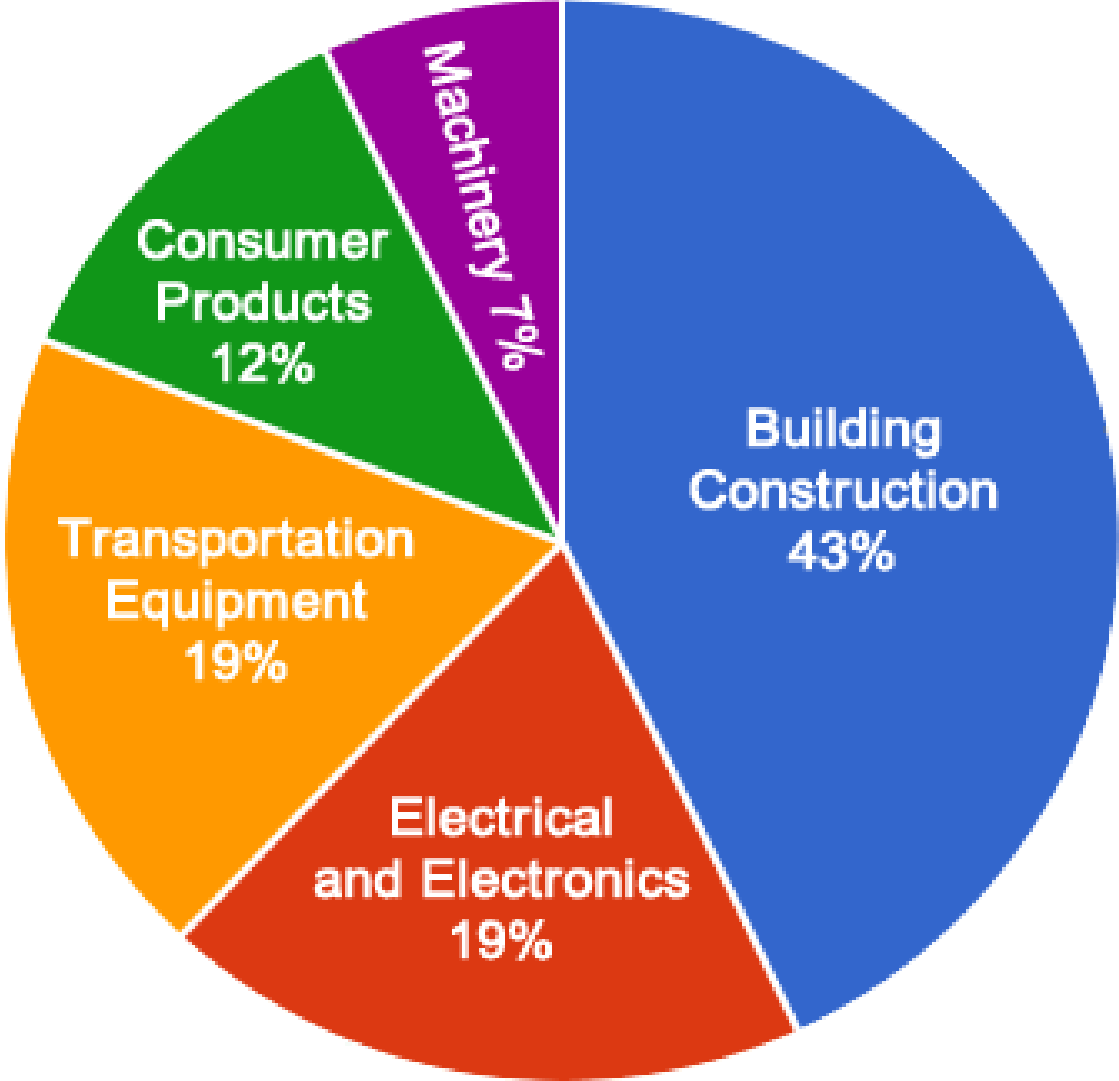
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# Introduction

- In the Earth's crust, the copper content is about 0.01%. Only in a few copper deposits can copper content be found at up to 3% - 5%. Copper in nature often exists in compounds. Currently, the explored copper is about 0.35 - 0.57 billion tones, and porphyry copper accounts for about 76% of total explored copper.
- Copper was one of the first metals ever extracted and used by humans, and it has made vital contributions to sustaining and improving society since the dawn of civilization. Copper was first used in coins and ornaments starting about 8000 B.C., and at about 5500 B.C., copper tools helped civilization emerge from the Stone Age. The discovery that copper alloyed with tin produces bronze marked the beginning of the Bronze Age at about 3000 B.C.
- Copper is easily stretched, molded, and shaped; is resistant to corrosion; and conducts heat and electricity efficiently. As a result, copper was important to early humans and continues to be a material of choice for a variety of domestic, industrial, and high-technology applications today.

- Presently, copper is used in building construction, power generation and transmission, electronic product manufacturing, and the production of industrial machinery and transportation vehicles. Copper wiring and plumbing are integral to the appliances, heating and cooling systems, and telecommunications links used every day in homes and businesses. Copper is an essential component in the motors, wiring, radiators, connectors, brakes, and bearings used in cars and trucks. The average car contains 1.5 kilometers (0.9 mile) of copper wire, and the total amount of copper ranges from 20 kilograms (44 pounds) in small cars to 45 kilograms (99 pounds) in luxury and hybrid vehicles.

# Uses of Copper in the United States During 2017



# Types of Copper Deposits

- Copper occurs in many forms, but the circumstances that control how, when, and where it is deposited are highly variable. As a result, copper occurs in many different minerals. **Chalcopyrite** is the most abundant and economically significant of the copper minerals.
- Research designed to better understand the geologic processes that produce mineral deposits, including copper deposits, is an important component of the USGS (United States Geological Survey) Mineral Resources Program. Copper deposits are broadly classified on the basis of how the deposits formed. Porphyry copper deposits, which are associated with igneous intrusions, yield about two-thirds of the world's copper and are therefore the world's most important type of copper deposit. Large copper deposits of this type are found in mountainous regions of western North America and in the Andes Mountains of South America.

- Another important type of copper deposit - the type contained in sedimentary rocks - accounts for approximately one-fourth of the world's identified copper resources. These deposits occur in such areas as the copper belt of Central Africa and the Zechstein basin of Eastern Europe.
- Individual copper deposits may contain hundreds of millions of tons of copper-bearing rock and commonly are developed by using open-pit mining methods. Mining operations, which usually follow ore discovery by many years, often last for decades. Although many historic mining operations were not required to conduct their mining activities in ways that would reduce their impact on the environment, current Federal and State regulations do require that mining operations use environmentally sound practices to minimize the effects of mineral development on human and ecosystem health.

# Copper Supply, Demand and Recycling

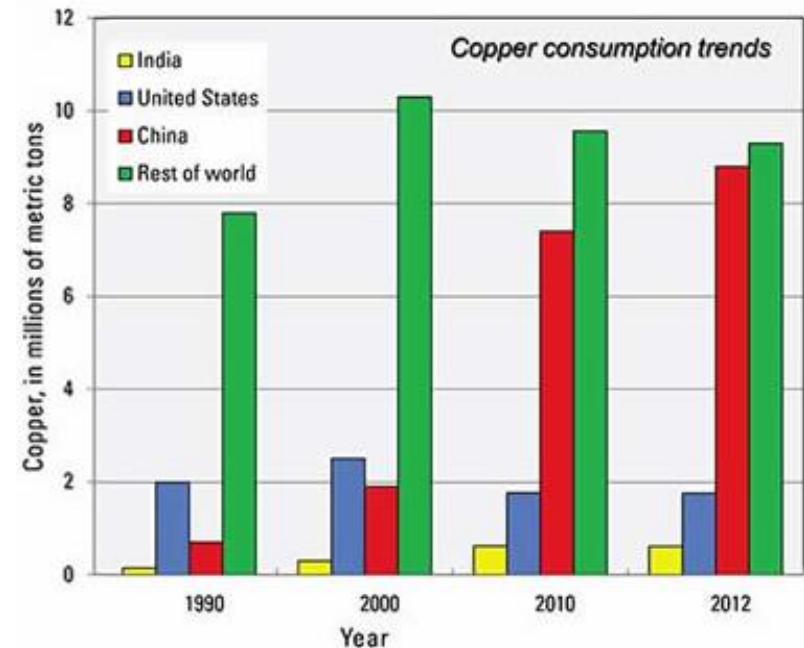
- The world's production (supply) and consumption (demand) of copper have increased dramatically in the past 25 years. As large developing countries have entered the global market, demand for mineral commodities, including copper, has increased. In the past 20 years, the Andean region of South America has emerged as the world's most productive copper region. In 2007, about 45 percent of the world's copper was produced from the Andes Mountains; the United States produced 8 percent. Virtually all copper produced in the United States comes from, in decreasing order of production, Arizona, Utah, New Mexico, Nevada, or Montana.
- The risk of disruption to the global copper supply is considered to be low because copper production is globally dispersed and is not limited to a single country or region. Because of its importance in construction and power transmission, however, the impact of any copper supply disruption would be high.
- Copper is one of the most widely recycled of all metals; approximately one-third of all copper consumed worldwide is recycled. Recycled copper and its alloys can be remolded and used directly or further reprocessed to refined copper without losing any of the metal's chemical or physical properties.

# Global Copper Resource Assessment

- The USGS assessed undiscovered copper in two deposit types that account for about 80 percent of the world's copper supply. Porphyry copper deposits account for about 60 percent of the world's copper. In porphyry copper deposits, copper ore minerals are disseminated in igneous intrusions. Sediment-hosted strata bound copper deposits, in which copper is concentrated in layers in sedimentary rocks, account for about 20 percent of the world's identified copper resources. Globally, mines in these two deposit types produce about 12 million tons of copper per year.
- This study considered potential for exposed and concealed deposits within 1 kilometer of the surface for porphyry deposits and up to 2.5 kilometers of the surface for sediment-hosted strata bound deposits. For porphyry deposits, 175 tracts were delineated; 114 tracts contain 1 or more identified deposits. Fifty tracts were delineated for sediment-hosted strata bound copper deposits; 27 contain 1 or more identified deposits.

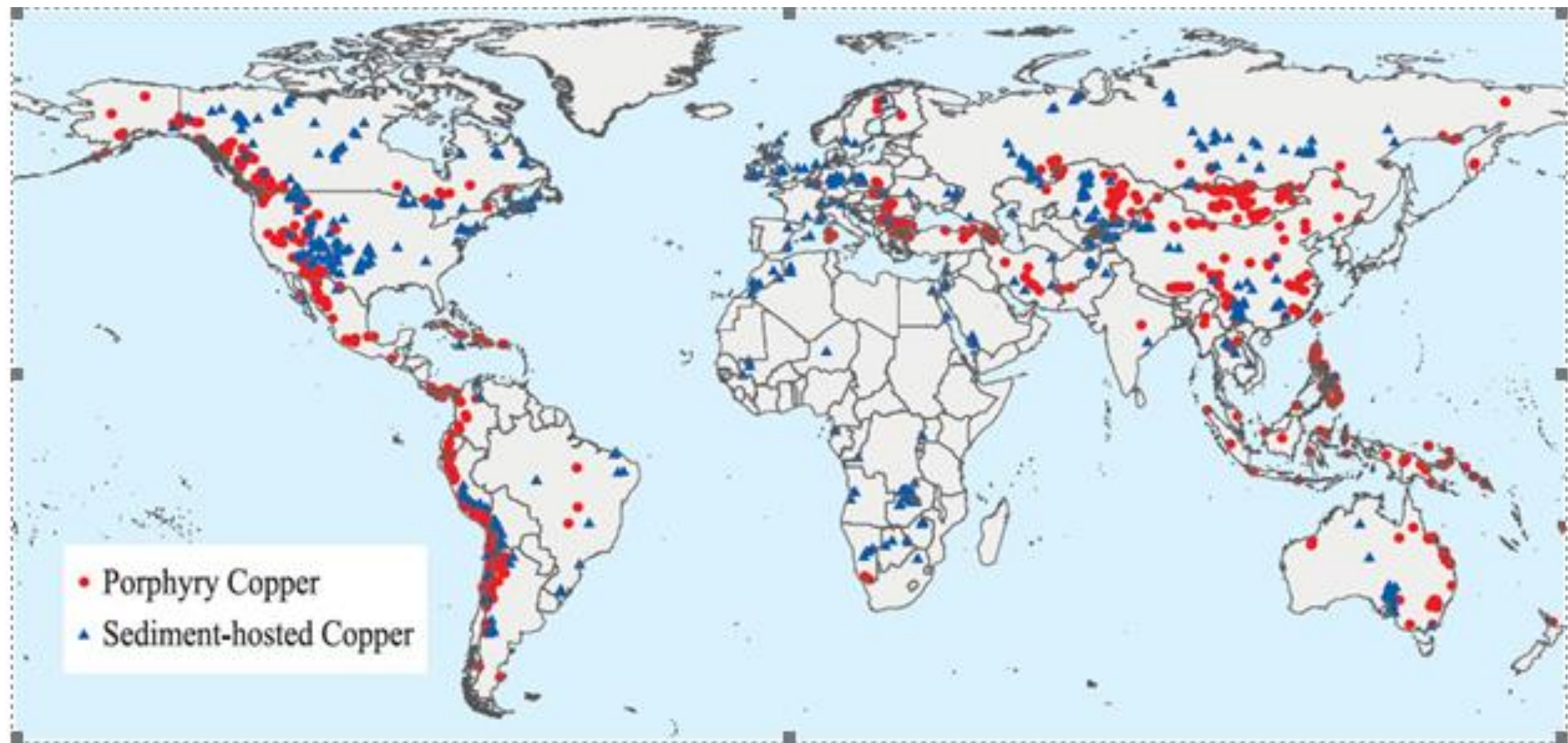


- Results of the assessment are provided by deposit type for 11 regions.(Table) The mean total undiscovered resource for porphyry deposits is 3,100 million tons, and the mean total undiscovered resource for sediment-hosted deposits is 400 million tons, for a global total of 3,500 million tons of copper. The ranges of resource estimates (between the 90th and 10th percentiles) reflect the geologic uncertainty in the assessment process. Approximately 50 percent of the global total occurs in South America, South Central Asia and Indochina, and North America combined.



- **COPPER CONSUMPTION**

- The qualities of copper that have made it the material of choice for a variety of domestic, industrial, and high – technology applications have resulted in a steady rise in global copper consumption. USGS studies of copper consumption shows some interesting trends for the 1990 to 2012 time period. Copper consumption in emerging economies, such as China and India, rose considerably, whereas the consumption rate in the US fell slightly. Until 2002, the US was the copper consumer and annually used about 16 percent of total world refined copper (about 2.4 million tons). In 2002, the US was overtaken by China as the world's leading user of refined copper. The booming economy in China contributed to a quadrupling of its annual refined copper consumption during the 12 years from 2000 to 2012. (See the graph by USGS)
- The distribution of copper deposits in 2008 is shown in a map. Red indicates copper associated with igneous intrusions (porphyry copper deposits) and blue indicates copper contained in sedimentary rocks (sediment – hosted copper deposits). Map by USGS.



- **South America** has the largest identified and undiscovered copper resources (about 20 percent of the total undiscovered amount). The world's largest porphyry deposits are mined in this region. Chile and Peru are among the world's top copper-producing countries.
- **Central America and the Caribbean** host two undeveloped giant (>2 million ton copper) porphyry copper deposits in Panama. Most of the undiscovered resources are in a belt that extends from Panama to southwestern Mexico.
- **North America** hosts highly mineralized porphyry copper tracts that include supergiant (>25 million tons copper) porphyry deposits in northern Mexico, the western United States, and Alaska, as well as giant deposits in western Canada. The estimated undiscovered porphyry copper resources are approximately equal to the identified resources. The leading copper-producing states in the U.S.A. are Arizona, Utah, New Mexico, Nevada, and Montana. In the United States, undiscovered sediment-hosted strata bound copper deposits in Michigan, Montana, and Texas are estimated to contain about three times as much copper as has been identified. Two giant deposits are known, in Michigan and Montana.

## Leading Copper Producers

(Thousand Metric Tons)



Country	Production (Metric Tons)
Australia	920,000
Canada	620,000
Chile	5,330,000
China	1,860,000
Congo	850,000
Indonesia	650,000
Mexico	755,000
Peru	2,390,000
United States	1,270,000
Zambia	755,000
Other Countries	4,300,000
<b>Total</b>	<b>19,700,000</b>

Data from USGS Mineral Commodity Summaries (2017)

- **Northeast Asia** is relatively underexplored, with modest identified porphyry copper resources and only one identified giant porphyry copper deposit. However, the mean undiscovered resources are estimated to be quite large. This region has the largest ratio of undiscovered to identified resources in the study.
- **North Central Asia** has 35 porphyry copper deposits, including a supergiant deposit in Mongolia and a giant deposit in Kazakhstan. The tract area is estimated to contain about three times the amount of identified porphyry copper resource. This region also hosts three giant sediment-hosted strata bound copper deposits, in Kazakhstan and Russia. The USGS estimates that as much sediment-hosted strata bound copper as has already been discovered may be present.
- **South Central Asia and Indochina** are less thoroughly explored than many other parts of the world; however, four giant porphyry copper deposits have been identified to date in the Tibetan Plateau. Undiscovered porphyry copper deposits may contain eight times the identified amount of copper.
- **Southeast Asia Archipelagos** host world-class, gold-rich porphyry copper deposits such as a supergiant in Indonesia and about 16 giant deposits in Indonesia, Papua New Guinea, and the Philippines. Although parts of the region are well explored, undiscovered porphyry resources are likely to exceed identified resources.

- **Eastern Australia** has one giant porphyry copper deposit and several small porphyry deposits. Modest undiscovered resources are expected under cover. Australia has been a leading copper producer for decades.
- **Eastern Europe and Southwestern Asia** have been mined for copper since ancient times, and giant porphyry copper deposits have recently been identified. Undiscovered copper is predicted to be about twice the identified resources, both for porphyry deposits along a belt from Romania through Turkey and Iran and for sediment-hosted strata bound deposits in Afghanistan.
- **Western Europe** has the largest sediment-hosted strata bound copper deposit in the world, in Poland. Undiscovered sediment-hosted strata bound copper resources in southwestern Poland are estimated to exceed identified resources by about 30 percent.
- **Africa and the Middle East** have the world's largest accumulation of sediment-hosted strata bound copper deposits, with 19 giant deposits in the Central African Copper belt in the Democratic Republic of Congo and Zambia. Significant undiscovered copper resources remain to be discovered.

**Reserves (Data in thousand metric tons of copper content)**

<b>United States</b>	<b>39,000</b>
<b>Australia</b>	<b>87,000</b>
<b>Canada</b>	<b>10,000</b>
<b>Chile</b>	<b>190,000</b>
<b>China</b>	<b>30,000</b>
<b>Congo (Kinshasa)</b>	<b>20,000</b>
<b>Indonesia</b>	<b>28,000</b>
<b>Kazakhstan</b>	<b>7,000</b>
<b>Mexico</b>	<b>38,000</b>
<b>Peru</b>	<b>70,000</b>
<b>Poland</b>	<b>26,000</b>
<b>Russia</b>	<b>30,000</b>
<b>Zambia</b>	<b>20,000</b>
<b>Other countries</b>	<b>90,000</b>
<b>World total (rounded)</b>	<b>690,000</b>

Source: Copper- U.S. Geological Survey, **Mineral Commodity Summaries**, February 2014



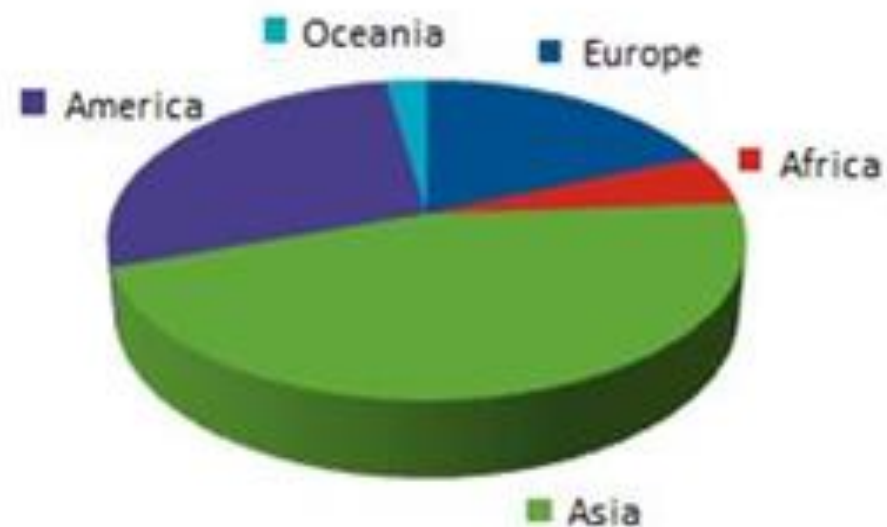
## Production and consumption

The figures of copper mine production reported by the United States Geological Survey (USGS) in 2014 were as follows:

Mine production (Data in thousand metric tons of copper content)		
Country	2012	2013
United States	1,170	1,220
Australia	958	990
Canada	579	630
Chile	5,430	5,700
China	1,630	1,650
Congo (Kinshasa)	600	900
Indonesia	360	380
Kazakhstan	424	440
Mexico	440	480
Peru	1,300	1,300
Poland	427	430
Russia	883	930
Zambia	690	830
Other countries	2,000	2,000
World total (rounded)	16,900	17,900

Source: Copper- U.S. Geological Survey, Mineral Commodity Summaries, February 2014

## World copper production 2011

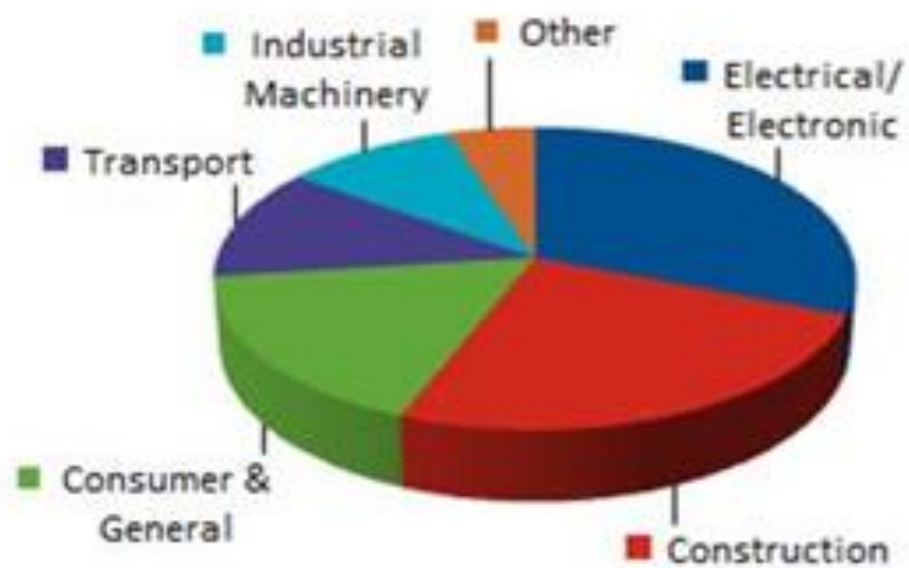


Region	%
Asia	46
America	28
Europe	19
Africa	5
Oceania	2

Source: WBMS [www.world-bureau.com](http://www.world-bureau.com)

Industry consumption 2011 were as follows:

## Industrial consumption 2011



Market Sector	%
Electrical/Electronic	31
Construction	25
Consumer & General	17
Transport	12
Industrial Machinery	10
Other	5

Source: CRU [www.crugroup.com](http://www.crugroup.com)

Source: Production and consumption-London Metal Exchange