TURKISH BORON

Ilhan TAPAN
Uludag University
Physics Department
Bursa-Turkey

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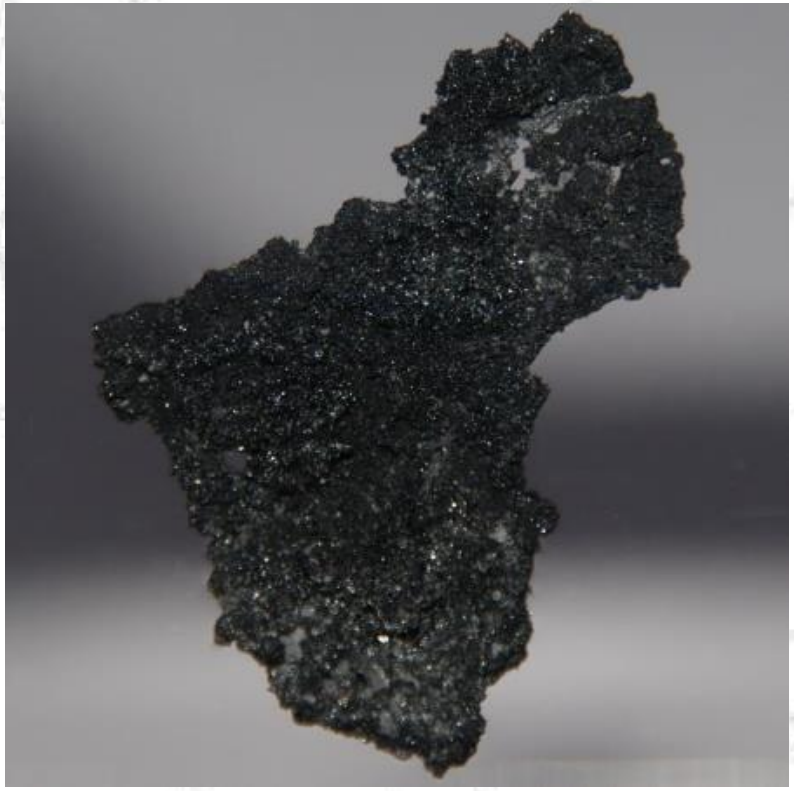
Outline

- What is Boron
- Boron Reserves
- Boron in Turkey
  - Boron Industry (Eti Mine)
  - Boron Institute (Boren)
  - Bursa's plans on Boron
- Conclusion

Boron

Boron is a hard, brittle, semi metallic element.

Chemical Symbol	B
Atomic number	5
Atomic weight	10.81
Melting Point	2348 K
Boiling Point	4273 K



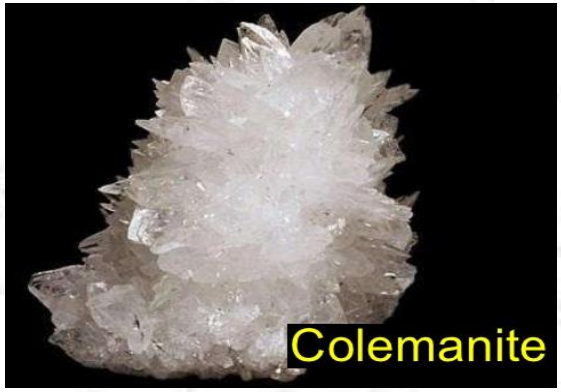
Pure crystalline boron

Boron

Boron does not occur in nature as free element, occurs in nature as a mineral with associated clay and other impurities.

The most commercially important boron minerals are:

Tincal	$Na_2B_4O_7.10H_2O$
Kernite	$Na_2B_4O_7.4H_2O$
Colemanite	$Ca_2B_6O_{11}.5H_2O$
Ulexite	$NaCaB_5O_9.8H_2O$
Datolite	$CaBSiO_4(OH)$
Hydroboracite	$CaMgB_6O_{11}.6H_2O$



Boron

These ores can be refined into a pure chemical compounds of commercial importance are;

Boric acid	H_3BO_3
Boric oxide	B_2O_3
Anhydrous borax	$Na_2B_4O_7$
Borax pentahydrate	$Na_2B_4O_7.5H_2O$
Borax decahydrate	$Na_2B_4O_7.10H_2O$
Sodium Perborate	$NaBO_3.H_2O$

Boron

Natural boron that contains 19.9% of B10 and 81.1% of B11 atoms, can be enriched up to 99%

Boron Isotopes

Stable Boron Isotopes - B Isotopes

Nominal mass	Accurate mass	% Natural abundance	Chemical form	Enrichment available %
^{10}B	10.0129369 (3)	19.9 (2)	metal, oxide	90 - 99+
^{11}B	11.0093054 (4)	80.1 (2)	metal	99+

The ^{10}Boron isotope is a strong neutron absorber and is used for both nuclear waste containment and nuclear power plant neutron radiation control.

The ^{11}Boron isotope is used as an additive to semiconductor grade silicon as a "doping" agent.

Boron

BORON USAGE

Boron in Agriculture
Boron in Ceramics
Boron in Glass and Glass Fibre
Boron in Timber Preservation
Boron in Detergents and Soap
Boron in Metallurgy
Boron in Corrosion Inhibitors
Boron in Adhesives
Boron in Abrasives
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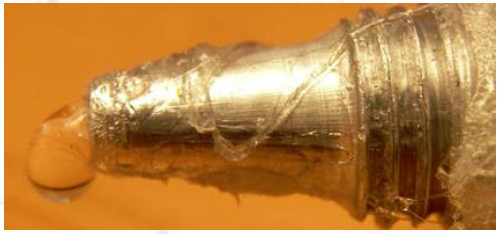
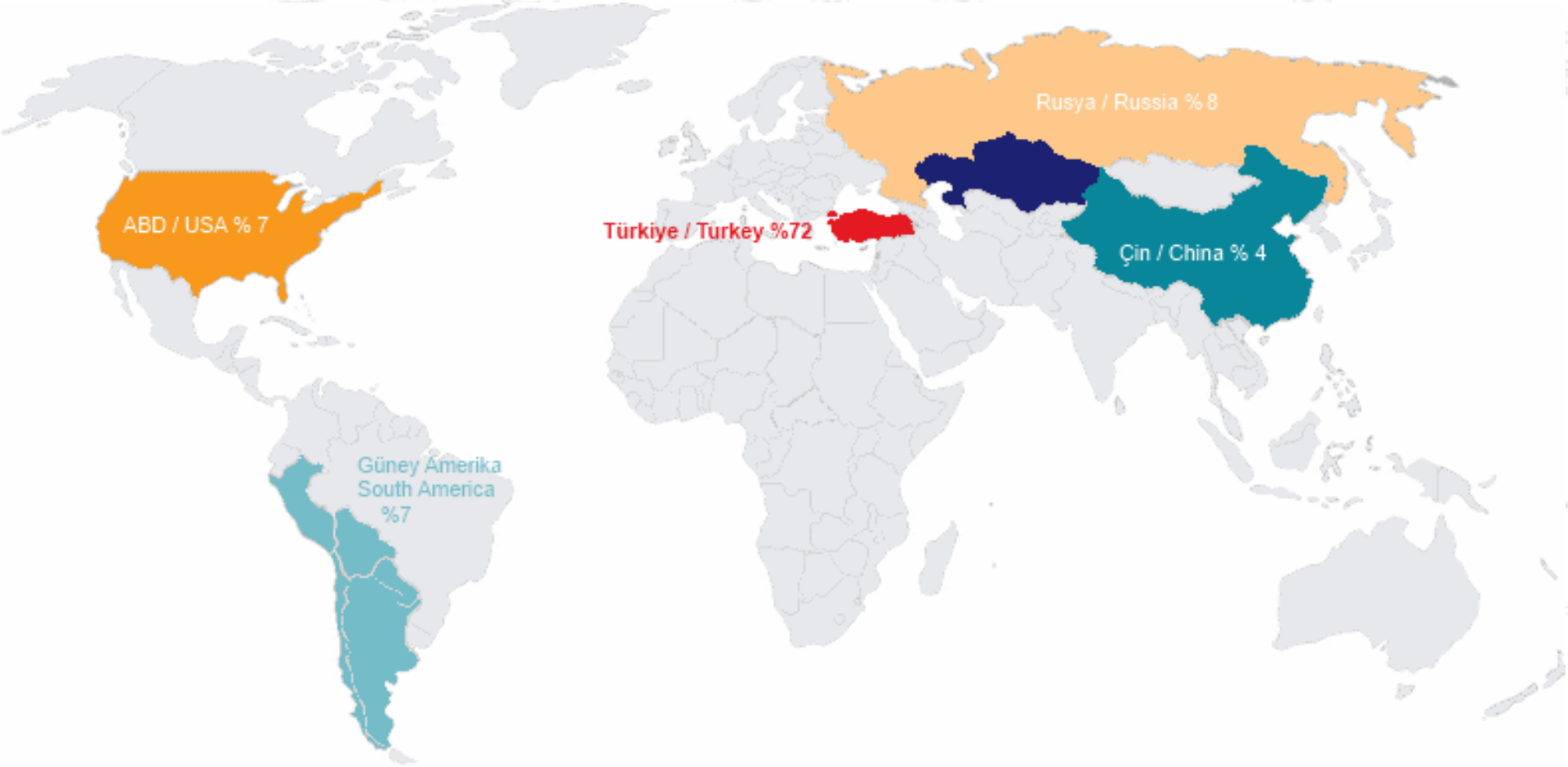


Boron Reserves

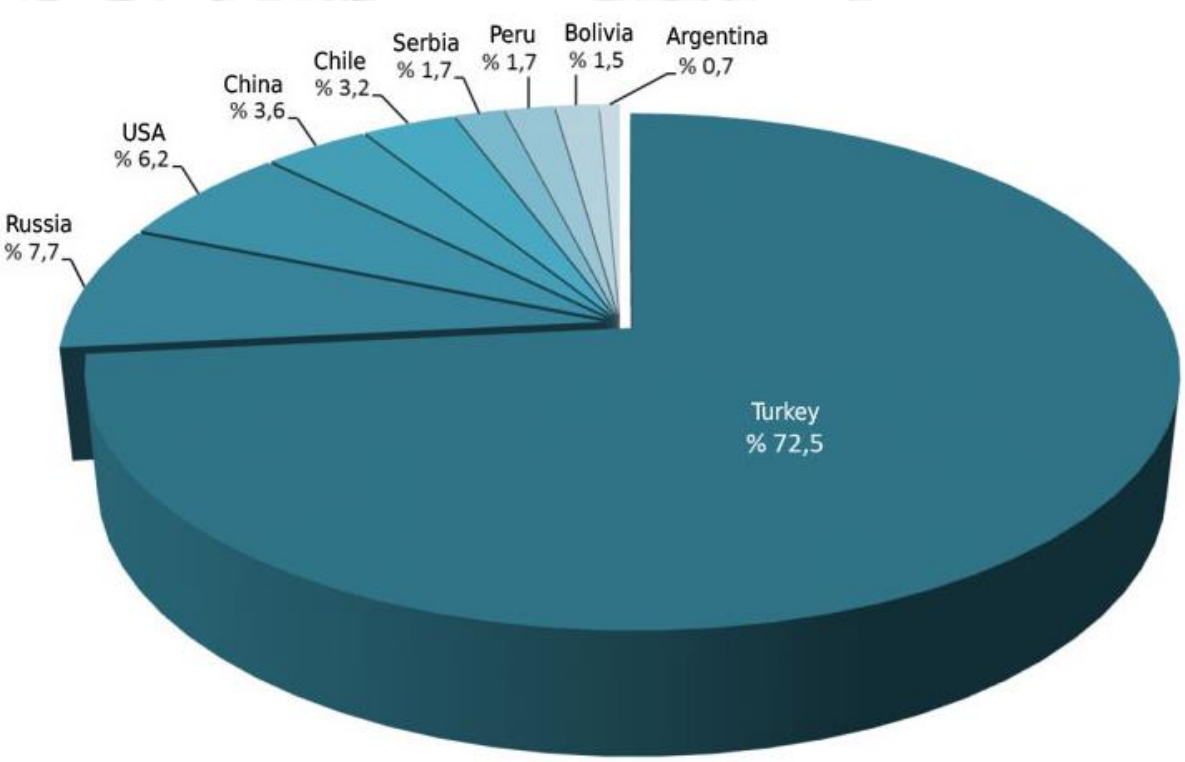
Turkey, USA , Russia, South America countries and China have the important boron mines.



Boron Reserves

The important factor for industrial application of boron minerals are B_2O_3 content.

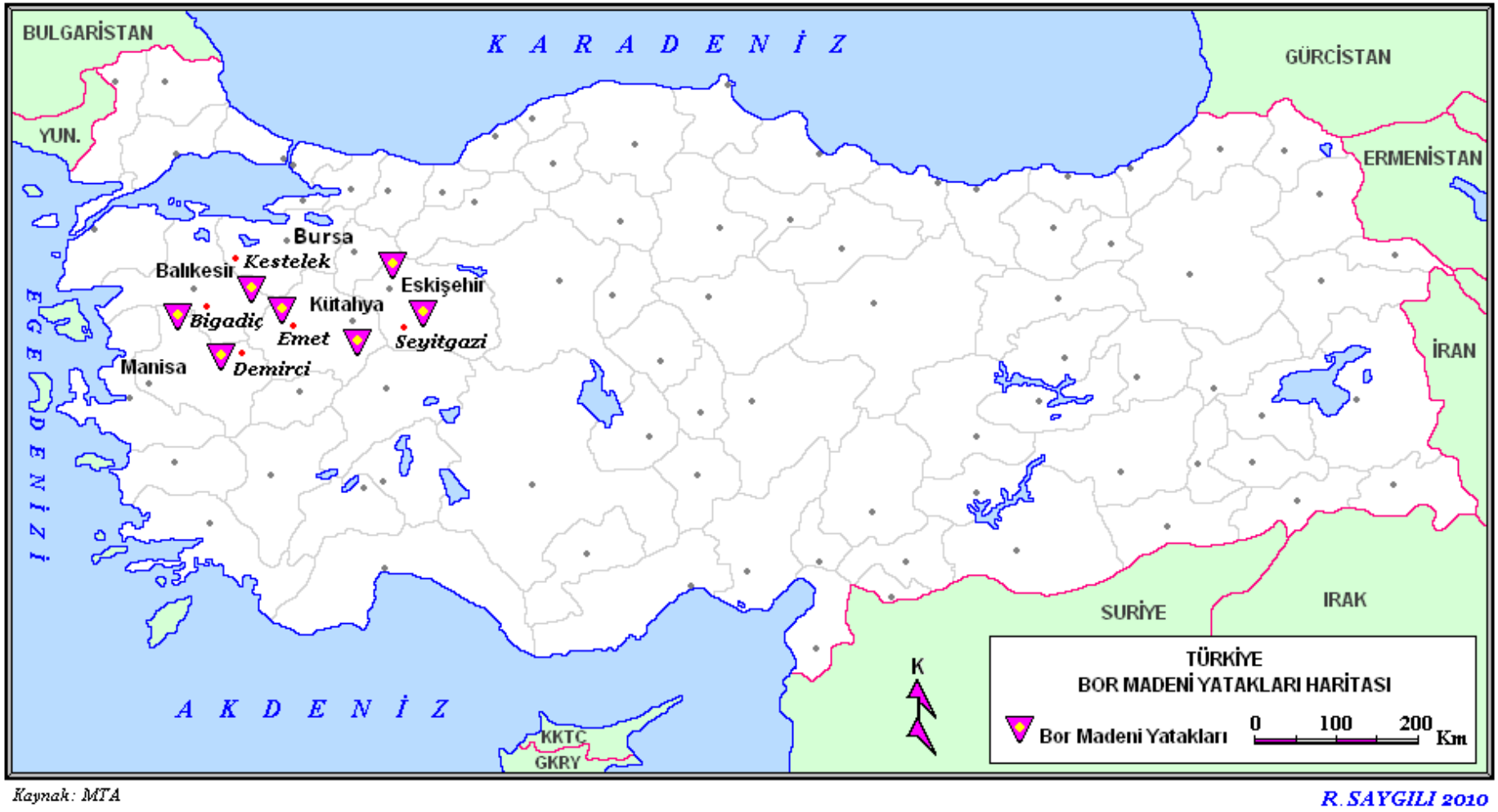
Total world boron reserves are 1,176 million tons. With a share of %72.50, Turkey has a total boron reserves of 851 million tons on the basis of B_2O_3 content .



Distribution of the World Boron Reserves

Boron Reserves

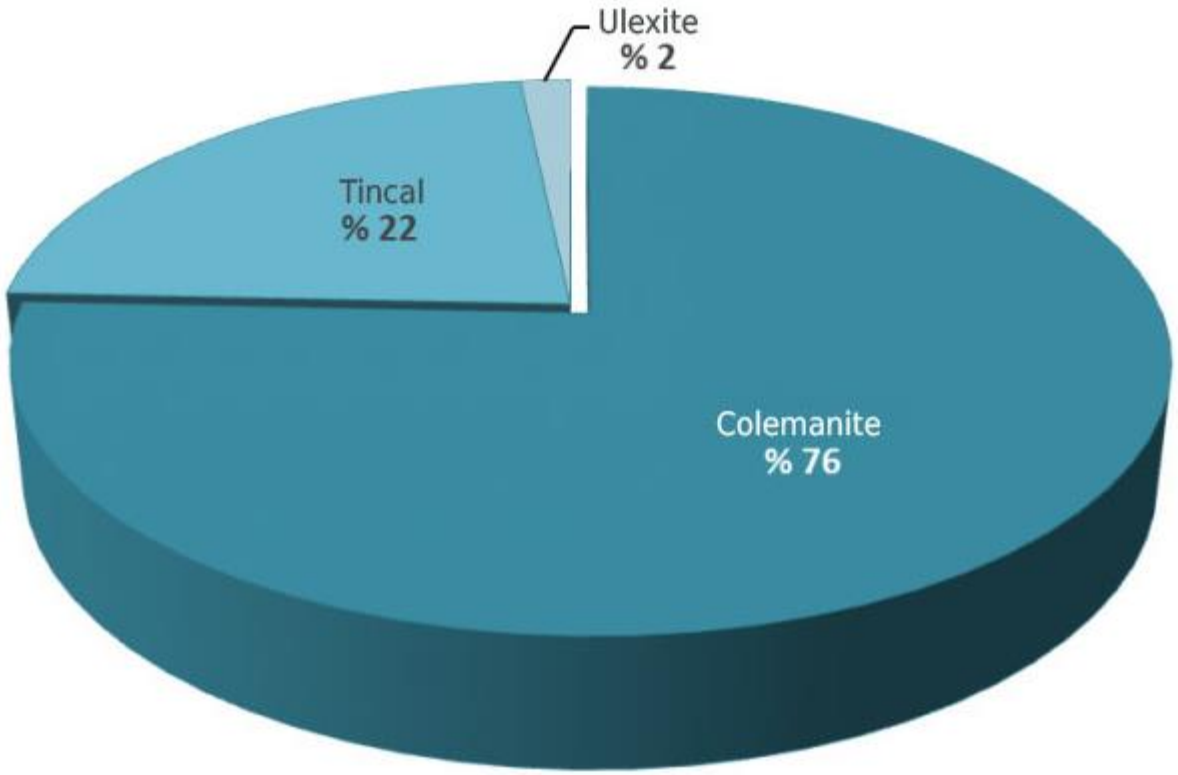
The Turkish borate deposits are located in five main districts in Western Anatolia.



Boron Reserves

Turkish Boron Reserves

The most common boron ores in terms of reserve in Turkey are tincal ($Na_2O.2B_2O_3.10H_2O$) and colemanite ($2CaO.3B_2O_3.5H_2O$).



Distribution of Boron Reserves in Turkey (Mineral basis-2012)

Boron Industry (Eti Mine)

In order to operate mining resources more effectively, the boron operation in Turkey has been transfered to Eti Mine by law.

http://en.etimaden.gov.tr/

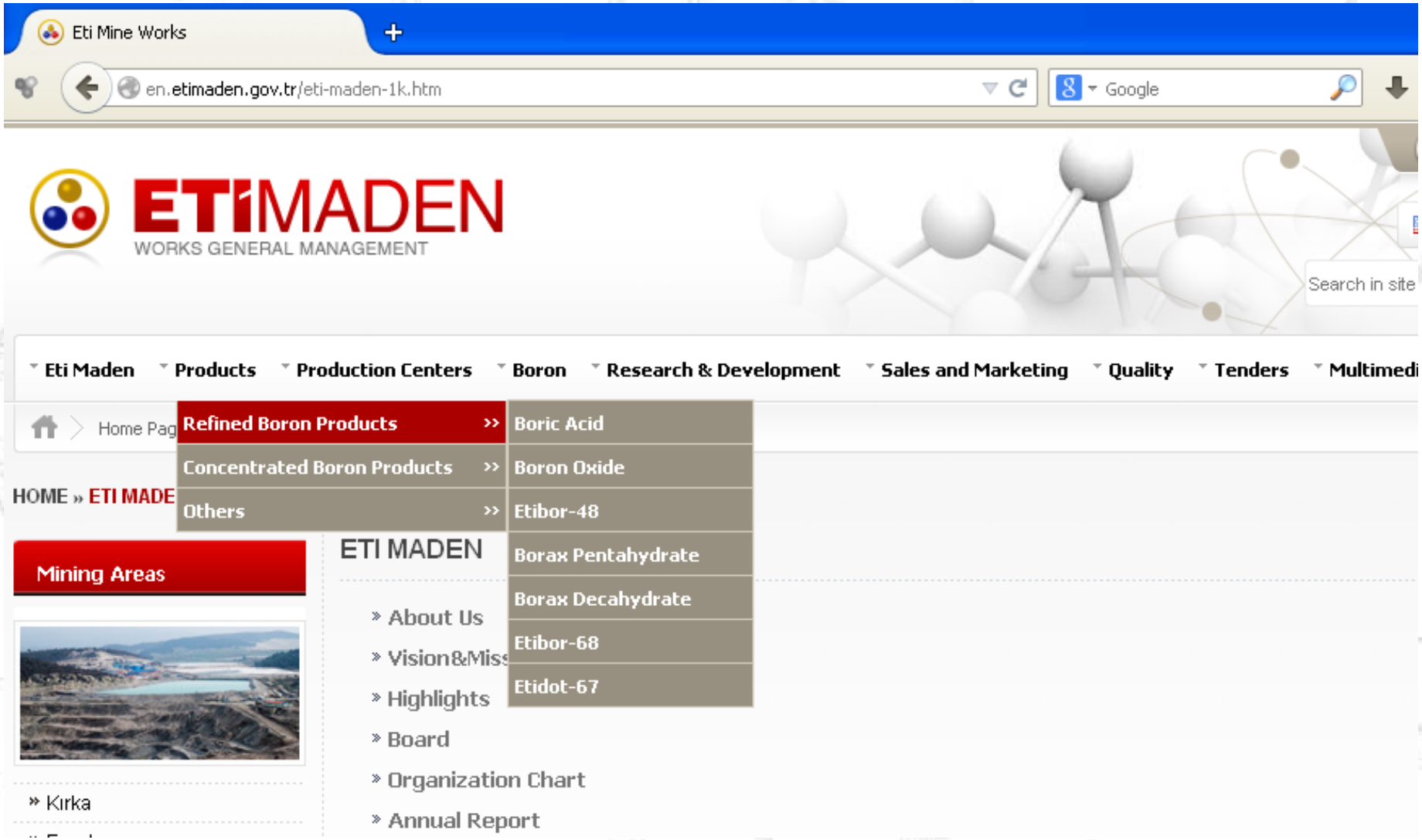
Eti Mine is not selling boron as raw material

The original concentration of colemanite when mined is 35-36 percent; it is increased up to 41-42 percent through some physical processes.

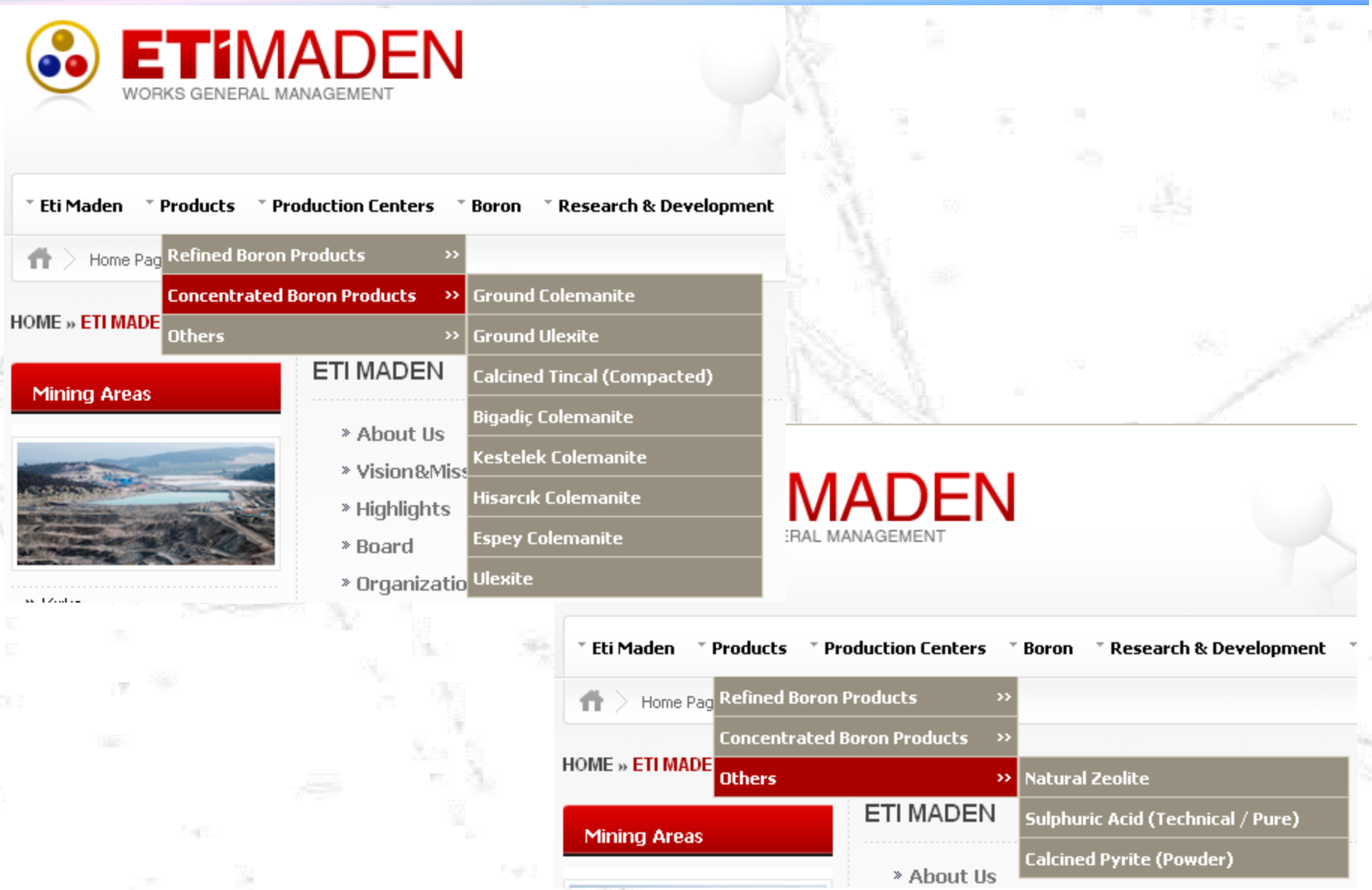
The original concentration of tincal when mined is 26 percent; it is increased up to 32 percent concentrated material to feed chemical factories for boron derivatives.

The 32 percent concentrated substance that goes into the process is turned into 48 percent concentrated boron chemical after this process.

Boron Industry (Eti Mine) - Products



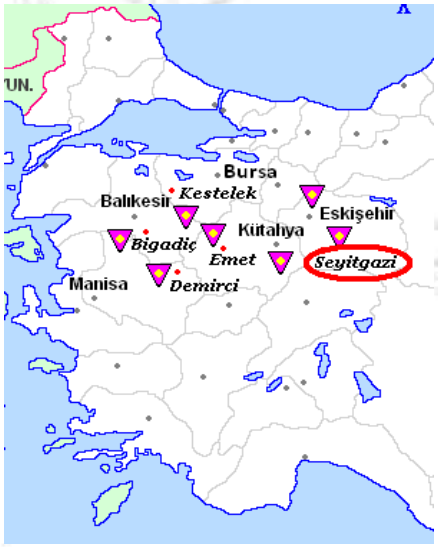
Boron Industry (Eti Mine) - Products



Boron Industry (Eti Mine) – Production Centers

KIRKA BORON WORKS

These facilities are located in the Kırka region of Seyitgazi county in Eskiehir.



Products

- Tincal ($Na_2B_4O_7.10H_2O$)
- Etibor - 48 (Borax Pentahdrate) ($Na_2B_4O_7.5H_2O$)
- Etibor - 68 (Anhydrous Borax) ($Na_2B_4O_7$)
- Calcinated Tincal ($Na_2B_4O_7.2H_2O$)
- Borax Decahydrate ($Na_2B_4O_7.10H_2O$)

Boron Industry (Eti Mine) – Production Centers

EMET BORON WORKS

The plant has been operational since 1958 in Emet county of Kütahya

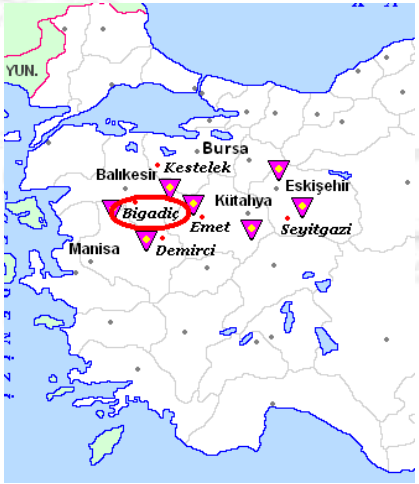
Products

- Hisarcık Colemanite ($2CaO.3B_2O_3.5H_2O$)
- Espey Colemanite ($2CaO.3B_2O_3.5H_2O$)
- Boric Acid (H_3BO_3)

Boron Industry (Eti Mine) – Production Centers

BIGADIÇ BORON WORKS

The plant is located in Bigadiç County in Balıkesir



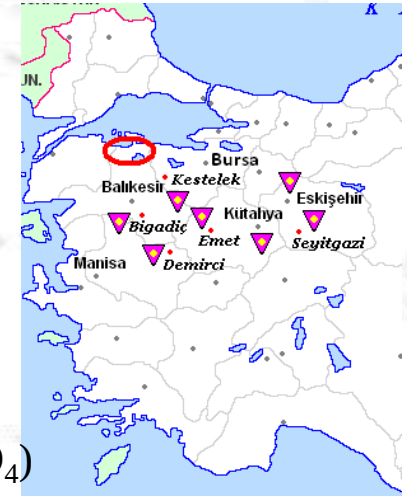
Products

- Bigadiç Colemanite ($2CaO.3B_2O_3.5H_2O$)
- Bigadiç Ulexite ($Na_2O_2.2CaO.5B_2O_3.16H_2O$)
- Kestelek Colemanite ($2CaO.3B_2O_3.5H_3O$)
- Zeolite [($Na_2K_2Ca)_3.Al_6.Si_{30}O_{72}.24H_2O$]

Boron Industry (Eti Mine) – Production Centers

BANDIRMA BORON WORKS

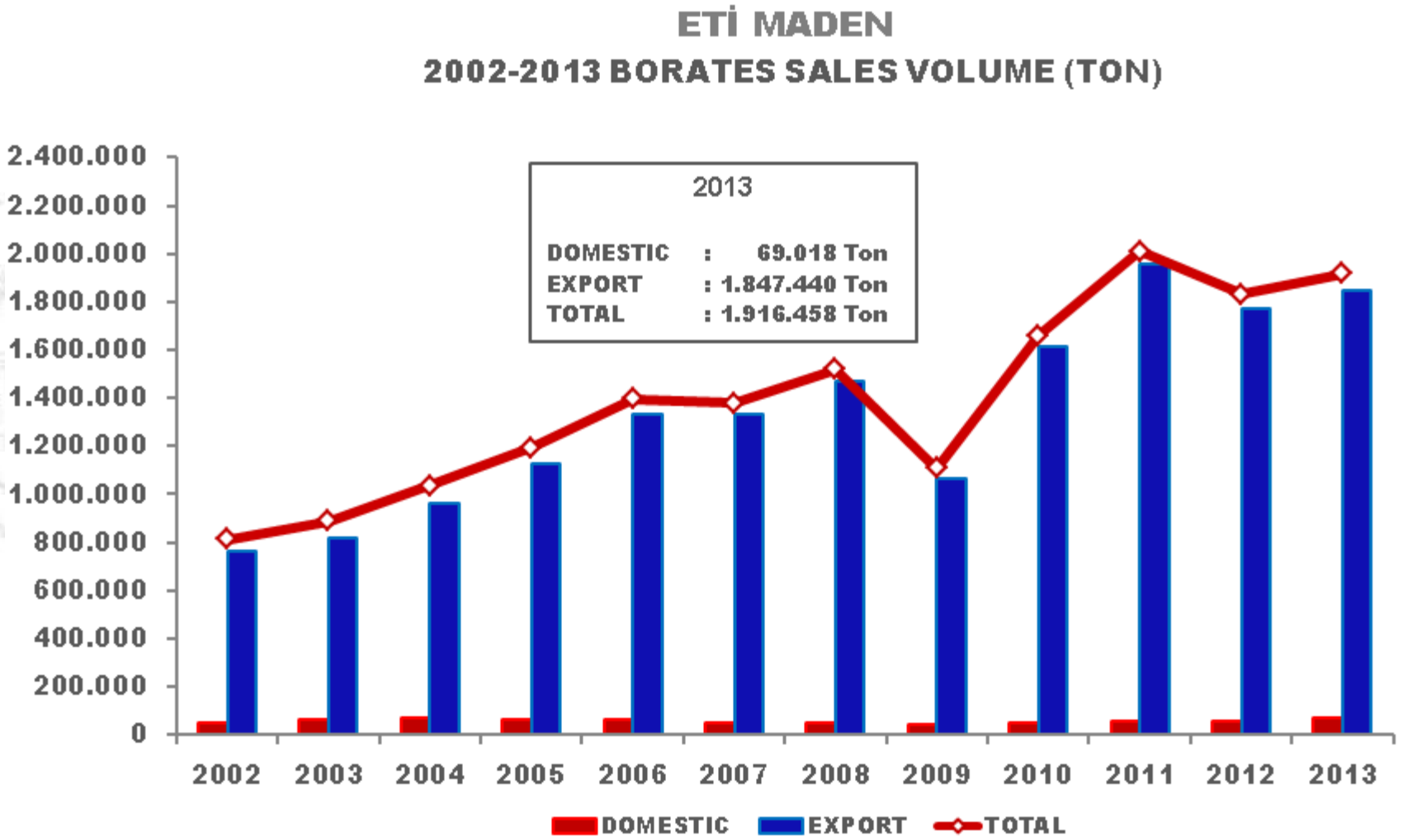
The plant has been operating since 1967 in the Bandırma county of Balıkesir.



Products

- Borax Decahydrate ($Na_2B_4O_7.10H_2O$)
- Borax Pentahydrate ($Na_2B_4O_7.5H_2O$)
- Boric Acid (H_3BO_3)
- Boron Oxide (B_2O_3)
- Etidot-67 ($Na_2B_8O_{13}.4H_2O$)
- Sodium Perborate
- Tetrahydrate ($NaBO_3.4H_2O$)
- Monohydrate ($NaBO_3.H_2O$)
- Sulphuric Acid (%98,5 H_2SO_4)
- Calcinated Pyrite Ash (Fe_2O_3 - Fe_3O_4)

Boron Industry (Eti Mine)



Boron Institute (Boren)

BOREN, the National Boron Research Institute, was founded by virtue of a special statute with a view to serving to the evolution of boron in Turkey.

http://www.boren.gov.tr/en

The National Boron Research Institute (BOREN) conducts its efforts for implementing the technologies developed through research and technology development actions in collaboration with various public and private sectoral entities under the incorporation law.

Boron Institute (Boren)

Project proposals can be submitted for

1) Increasing the potential for a widespread boron usage and/or development technological solutions to provide competitive advantage for boron usage.
2) Development of new boron products, providing new application areas for current boron products or production of the current boron products in such a way to provide contribution of our country's value chain.
3) Development of boron based technology and R&D for providing tangible economic benefit.
4) Determination of the effects of boron on the human health and environment.

Bursa's plans on Boron

- To propose B10 enrichment plant establishment
- To join RD51 works related with Boron
- To employ a new student to work on Boron

Conclusion

- **Turkey has around of %72 boron reserves and should use resources more effectively through research and technology development actions in collaboration with international institutes.**

- **Possible use of boron in the RD51 collaboration framework could be done.**