Ministry of Industry, Mine & Trade

GEOLOGICAL SURVEY OF IRAN

Iran Unique Geology and Mineral Potentials Opportunities

Indicators

- Area: 1,648,195 square kilometers (the second-largest nation in the Middle East and the 18th largest in the world)
- Population: 80 million (Second largest population, after Egypt, in the Middle East and North Africa, 19th in the world)
- GDP (ppp): 1.334 trillion US$ (2014) (19th in the world)
- GDP – per capita (ppp): 17100 $ (2014)
- GDP growth rate 2014: 3%
- Age below 54 years old: 88%
- Literacy: 87%
- Labor force: 28.4 million
- Official language is Farsi (Persian), Turkish , Kurdish and Arabic are spoken as well
- Official exchange rate: 26000 rls vs. 1USD$

History of Mining

Geology of Iran

Metallogenic and Mining Provinces, Belts and Zones of Iran

Metallogenic and Mineralization Phases of Iran

Metallogeny and Distribution of Minerals

The Position of Iranian Mining Industry in the World

Investment Opportunities

History of Mining

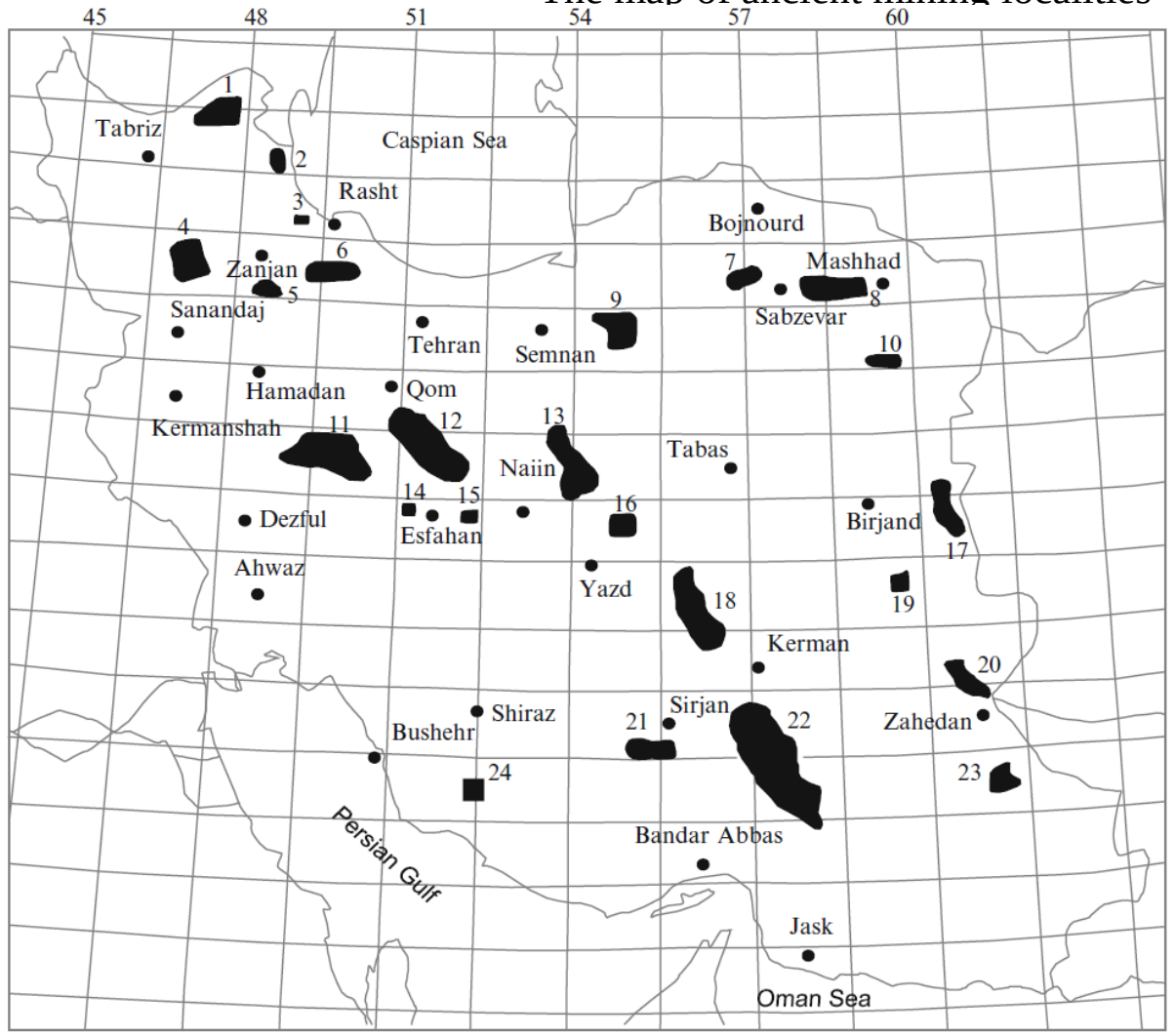
Iran has been the pioneer in mining exploration and techniques for several millennia.

- High potential of mineral deposits and their diversity
- absence of dense vegetation cover
- The knowledge and talent of primeval Iranians

- There are a few known metallic deposits in Iran that do not have the footprint of the ancient activities
- Numerous mining localities, tools, smelters, and miners' residence have existed since the fourth millennium B.C.
- The evidence of copper utilization in Iran (at Tal-e-Eblis) dates back to around 9,000 B.C.

1 Ahar area (Cu, Au, Fe), 2 Ardabil area (Cu), 3 Masooleh area (Fe), 4 Takab area (Shiz) (Au, As, Ag), 5 Zanjan area (Fe, Au), 6 Tarom area (Cu, Au, Pb), 7 Abbas Abad area (Cu), 8 Neyshabour area (Tr, Au), 9 West of Damghan (Au, Cu, Tr), 10 Torbat areas (Au, As), 11 Ahangaran-Shamsabad (north area of Lorestan) (Pb, Au, Ag, Fe, Sn), 12 Qom-Kashan area (Cu, Au, Fe), 13 Anarak area (Cu, Pb, Ag, Au), 14 Daran-Najaf Abad (Pb, Zn), 15 Esfahan area (Zn, Pb), 16 Zarin area (Ardakan) (Au), 17 Ahangaran area (Cu, Fe, Pb, Ag), 18 Bafq-Kuh Banan (Zn, Pb), 19 Ghaleh Zari area (Cu), 20 Lar-Asagi area (Cu, Au), 21 Neyriz area (Fe), 22 Kerman area (Cu, Au, Tr), 23 Kharestan area (Pb, Ag, Au), 24 Kuh Sormeh area (Pb, Zn)

The map of ancient mining localities

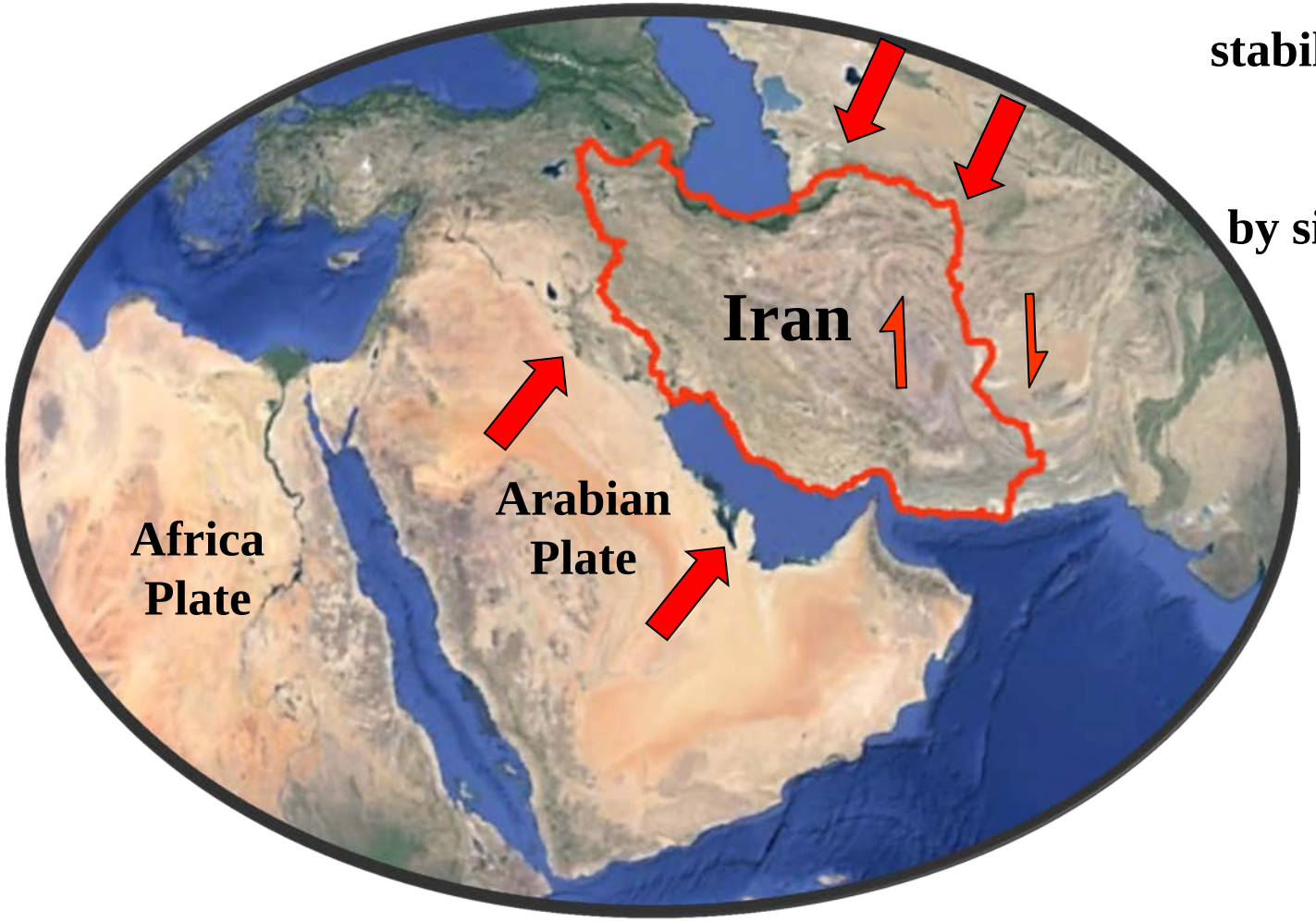


Mining provinces in ancient Iran

Locality	Type of mine	Locality	Type of mine
Ahangaran	Copper, iron, lead, and mercury	Abbas Abad	Copper
Ahar	Gold, copper, and iron	Anarak	Copper, lead, mercury, and gold
Ardebil	Copper	Bafq–Kuh Banan	Copper, gold, and iron
Damghan	Gold, copper, and turquoise	Daran–Najaf Abad	Lead–zinc
Esfahan	Lead–zinc	Kharestan	Lead, mercury, and gold
Kerman	Copper, gold, and turquoise	Kuh Sorme	Lead–zinc
Lar-Asaji	Copper and gold	Masoule	Iron
Neiriez	Iron	Neishabour	Turquoise and gold
Qal'e Zari	Copper	Qom–Kashan	Copper, gold, and iron
Shams Abad (Lorestan)	Lead, gold, silver, iron, and tin	Tarom	Copper, gold, and lead
Takab	Gold, arsenic, and mercury	Torbat	Gold and arsenic
Zanjan	Iron and gold	Zarrin	Gold

The relationship between the names of mining products and that of geographical locations

Part of the name	Localities of mines
Zar (gold)	Zarin, Zarshouran, Kuh-e Zar, Zargaran, Zarvand
Mes (copper)	Talmesi, Meskani, Mejdar (Mesdar) Kuh-e Mes, Chahmesi, Dare Mes, Sang-e Mes, Meskan
Zangar (copper)	Zangarlou, Zangalou
Sorme (lead–zinc)	Kuh Sorme, Khane Sorme
Noqre (silver)	Dare Noqre (near Golpayegan), Noqre Kamar, Kuh-e Zardan Noqrei (Baluchestan),
Ahan or Asen (iron)	Ahangaran (Malayer), Kuh-e Ahangaran (Shams Abad), Ahangaran (Qa'en) Asen Abad (Marivan)
Zaj or Zaglik (alunite)	Zajkan (Tarom), Dare Zaglik (Ahar)
Boraq (borax)	Boraq (Taft)
Gel (clay)	Gelkan, Gelou
Naft or Tashi (oil or gas)	Naftoon (Masjed Soleyman), Tape Tashi (Ramhormoz)



stabilization of the basement in Iran occurred in the Late Proterozoic to Early Cambrian

This is supported by similar Gondwanic features in both the Iranian and the Arabian basements.

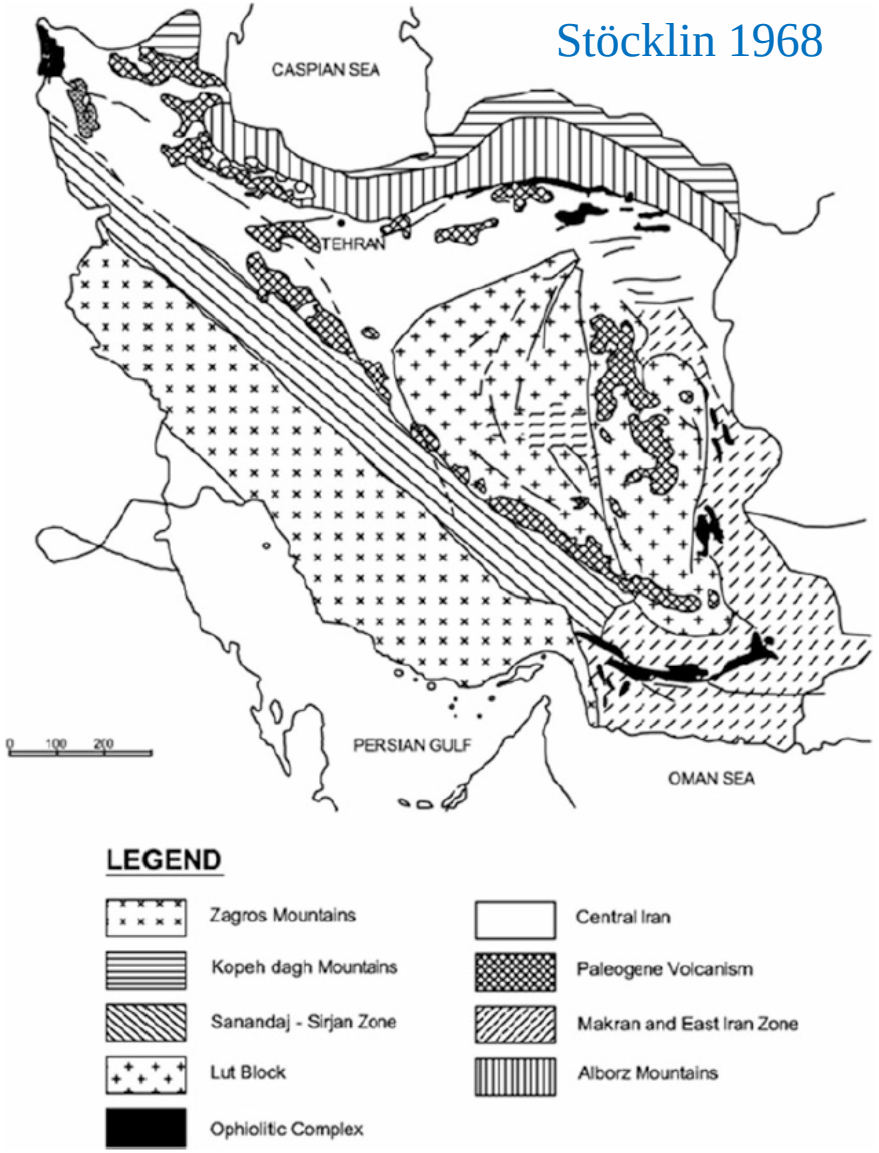
The oldest rocks in Iran, based on the radiometric ages, are as old as 900 million years. This was the time when Doran-type granites and Gharehdash series formed.

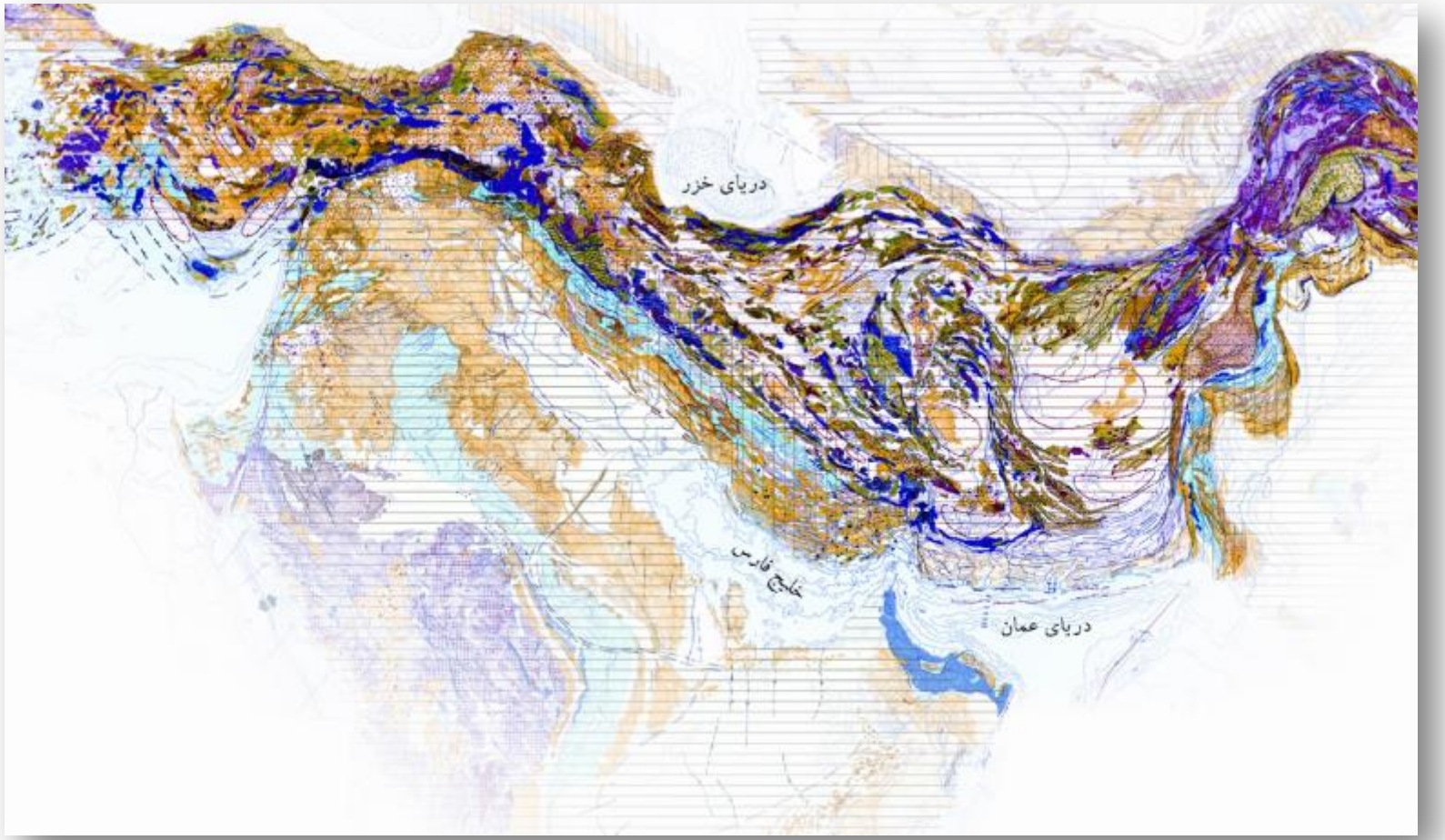
The cratonization happened transitionally from Africa toward Iran as evident from the age of the basements; Central Africa has a basement of Late Archean–Early Proterozoic while in Northern Africa, there is no Archean basement; besides, the extent of Precambrian domains reduces from Central Africa toward north. Some authors believe that cratonization of Iran has been due to Baikalian, Asynitic, or Pan-African orogenies.

The systematic geological studies in Iran started in the late 1960s with the establishment of the Geological Survey of Iran

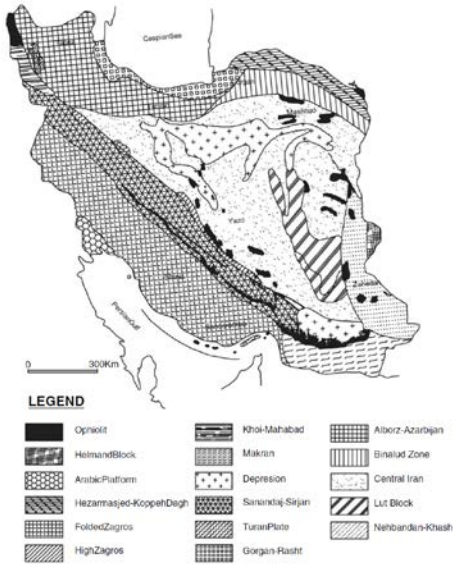
Unique record of stratigraphy, magmatic activities, metamorphism, orogenic events, tectonics and overall geological style.

Stöcklin 1968

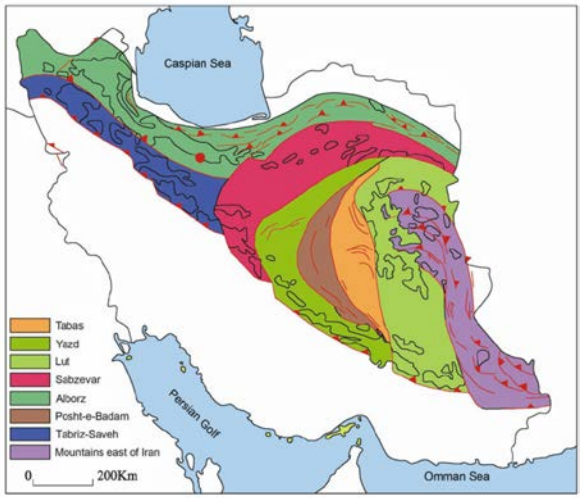




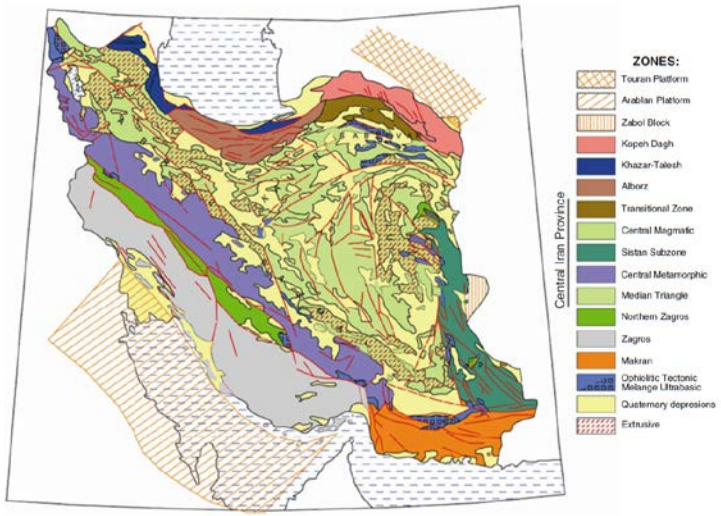
Nabavi 1976



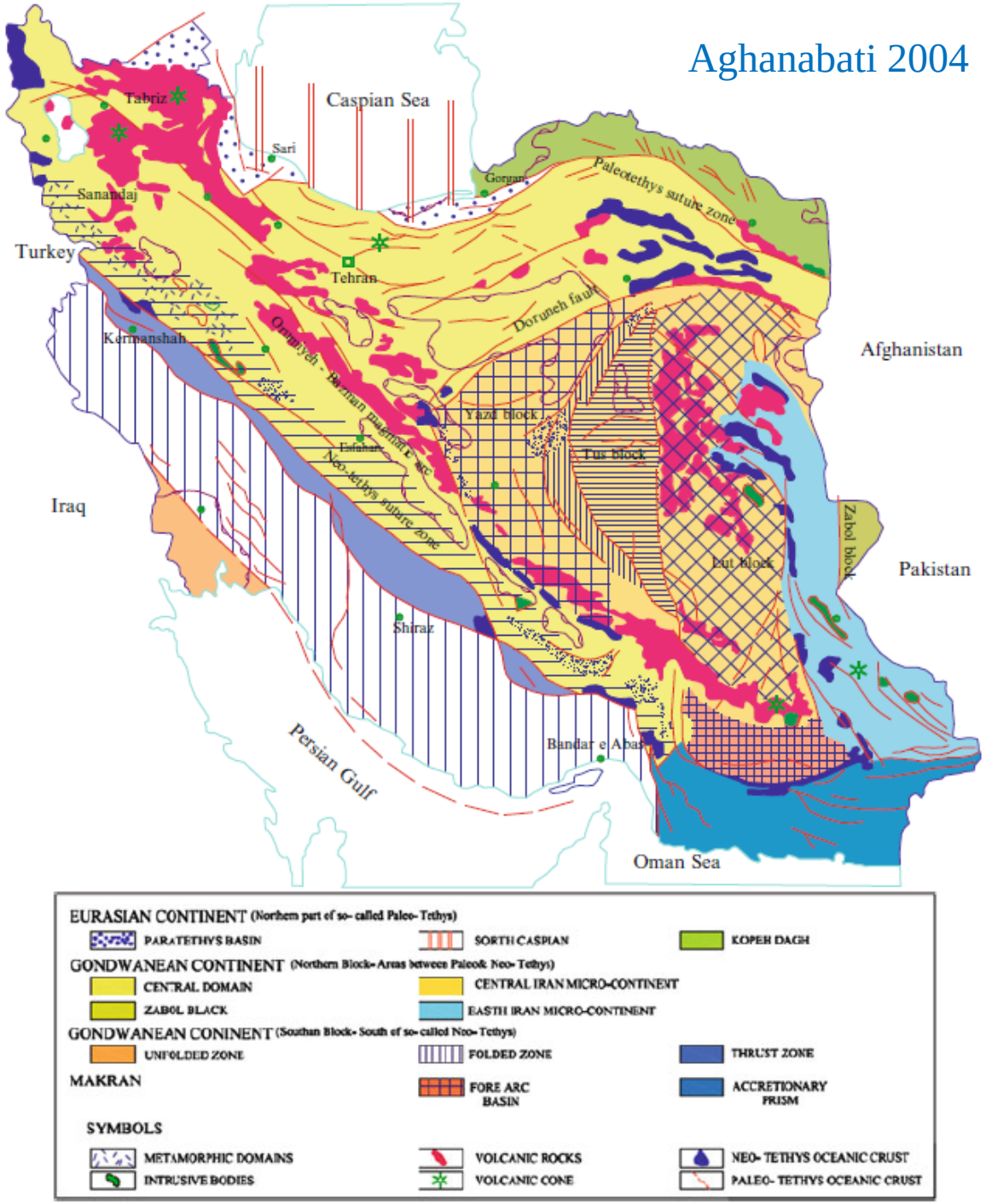
Alavi 1991



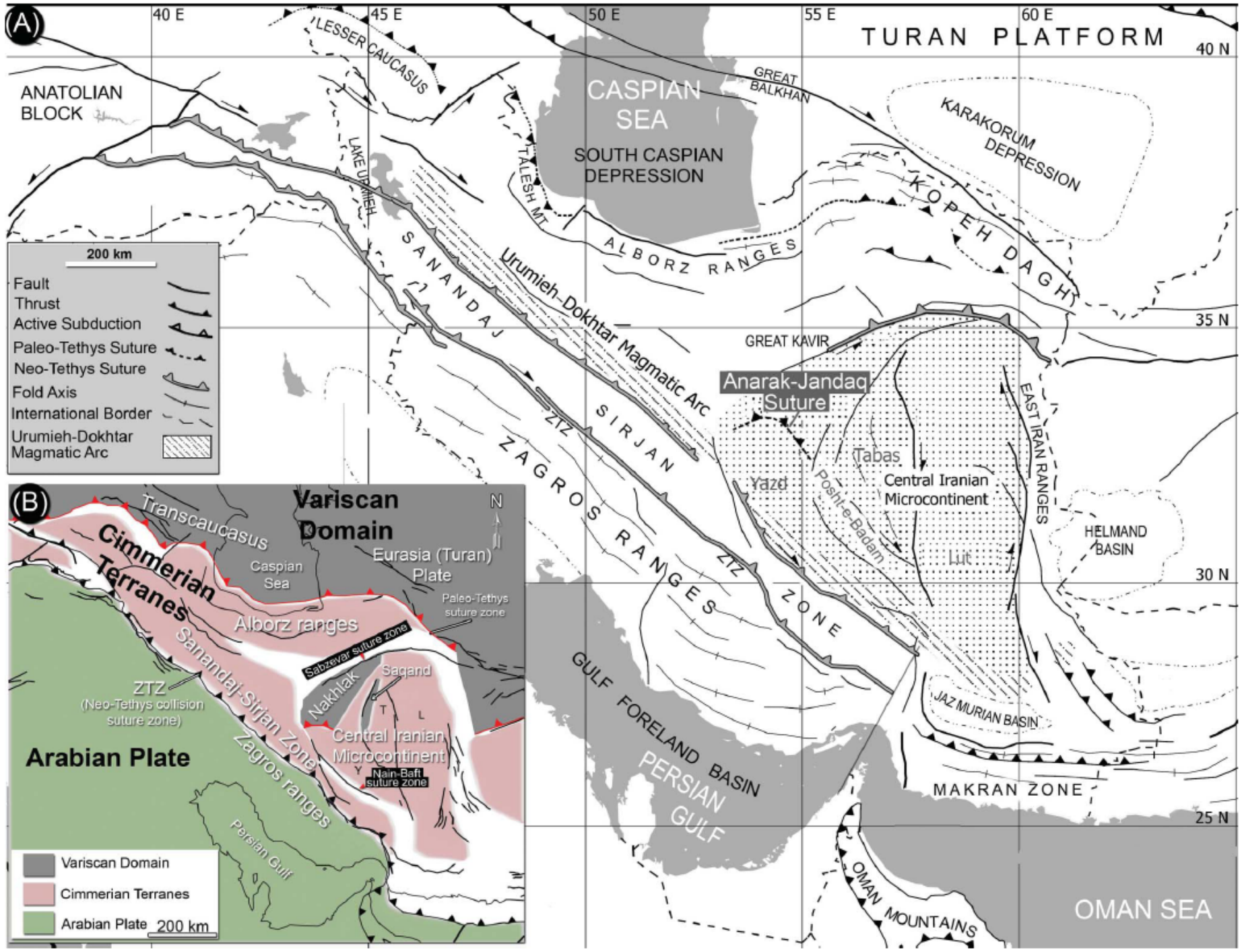
Nogole-Sadat 1993

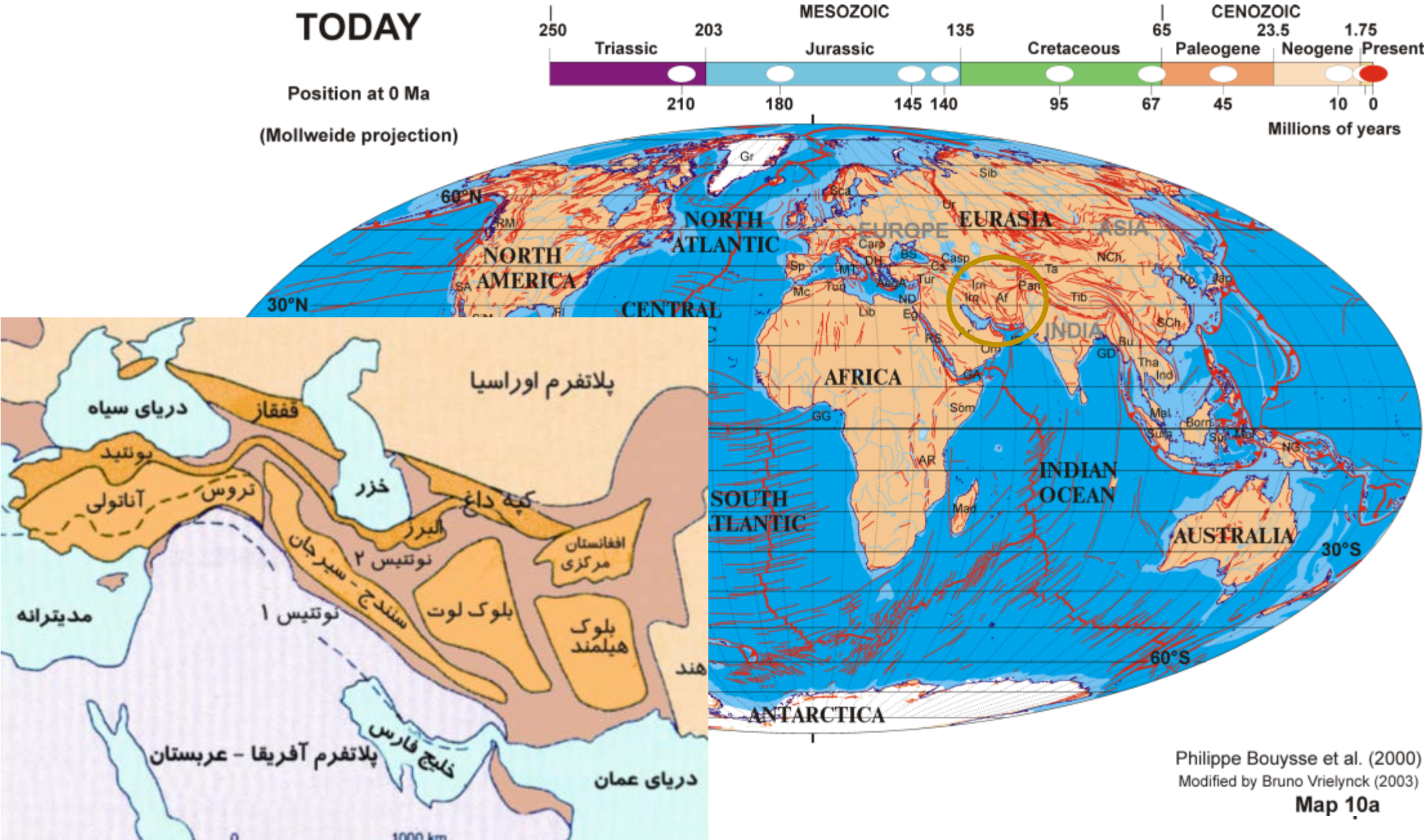


Aghanabati 2004



Role	Geographic situation	Closure	Opening	Tethys Ocean		
Separated Eurasia from Gondwana	North of Kopet Dagh (Out of IRAN)	Late Paleozoic	Precambrian -Lower Paleozoic	First Paleo-Tethys	Paleo-Tethys	Tethys
Separated Northern Gondwana (Kopet Dagh from Iran plateau)	South of Kopet Dagh	Late Triassic	Late Paleozoic	Second Paleo-Tethys		
Separated Iran plateau from Zagros	Zagros Suture Zone	Late Cretaceous	Late Triassic	First Neo-Tethys	Neo-Tethys	
• Derivation in Iran plateau • Separation of Lut block from Afghan • Derivation in Iran plateau	• Round of Micro-plate • Eastern Iran • Makran	• Late Cretaceous • Middle Miocene • Active Now	Early Jurassic-Cenomanian stage	Second Neo-Tethys		


(A)
40 E
45 E
50 E
55 E
60 E
40 N
35 N
30 N
25 N
TURAN PLATFORM
LESSER CAUCASUS
ANATOLIAN BLOCK
CASPIAN SEA
SOUTH CASPIAN DEPRESSION
GREAT BALKHAN
KARAKORUM DEPRESSION
KOPEH DAGH
LAKE URMIEH
TALESH MT
ALBORZ RANGES
SANANDAJ
Urumieh-Dokhtar Magmatic Arc
SIRJAN
ZTZ
ZAGROS RANGES
ZTZ ZONE
GREAT KAVIR
Anarak-Jandaq Suture
EAST IRAN RANGES
Tabas
Yazd
Posht-e-Badam
Central Iranian Microcontinent
Lut
HELMAND BASIN
JAZ MURIAN BASIN
GULF FORELAND BASIN
PERSIAN GULF
MAKRAN ZONE
OMAN MOUNTAINS
OMAN SEA
200 km
Fault
Thrust
Active Subduction
Paleo-Tethys Suture
Neo-Tethys Suture
Fold Axis
International Border
Urumieh-Dokhtar Magmatic Arc
(B)
N
Variscan Domain
Transcaucasus
Cimmerian Terranes
Caspian Sea
Eurasia (Turan) Plate
Paleo-Tethys suture zone
Alborz ranges
Sabzevar suture zone
Sanandaj-Sirjan Zone
Saqand
Nakhlak
ZTZ
(Neo-Tethys collision suture zone)
Central Iranian Microcontinent
Nain-Baft suture zone
Arabian Plate
Zagros ranges
Persian Gulf
Variscan Domain
Cimmerian Terranes
Arabian Plate
200 km

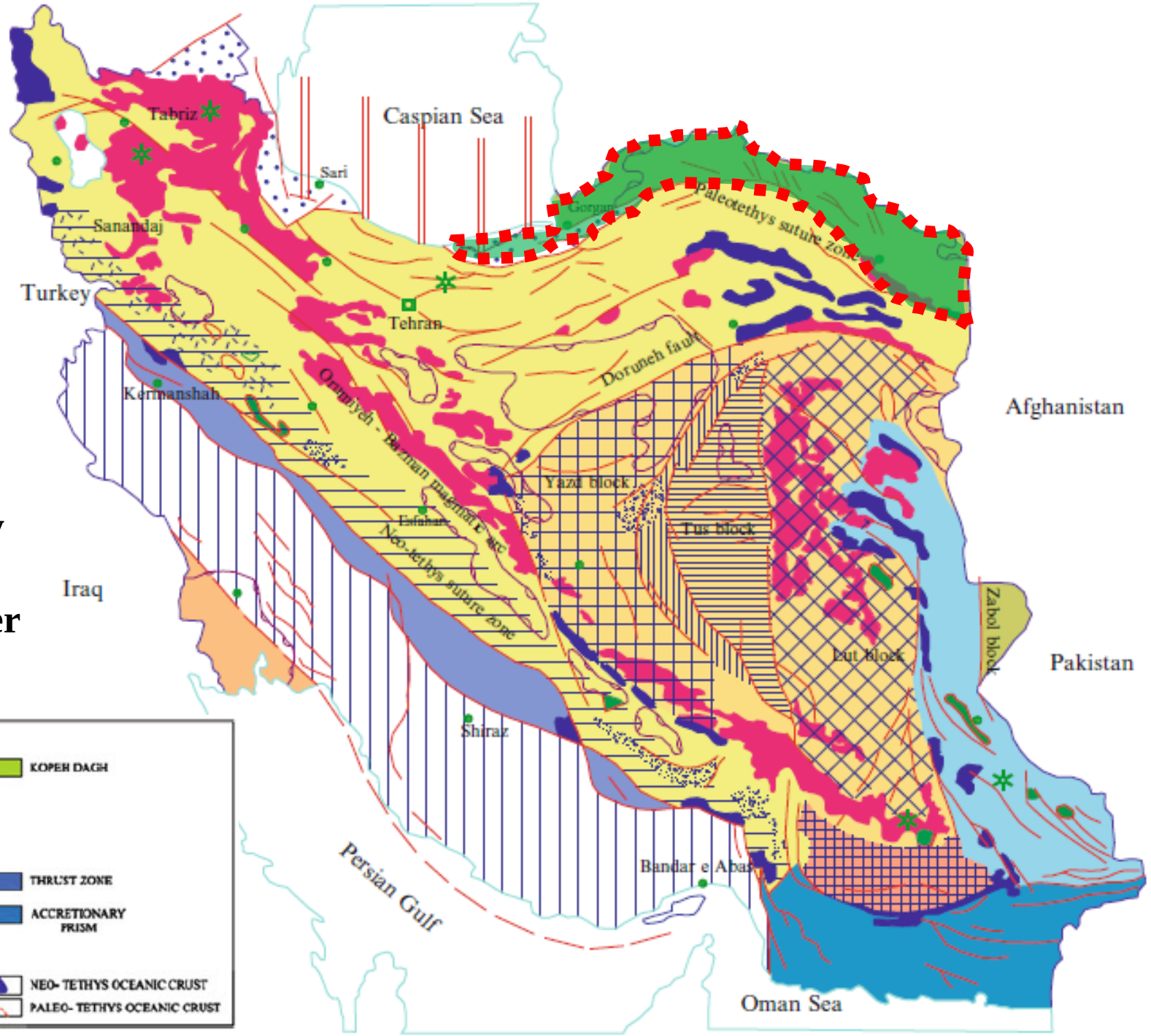


Philippe Bouysse et al. (2000)
Modified by Bruno Vrielynck (2003)

Map 10a

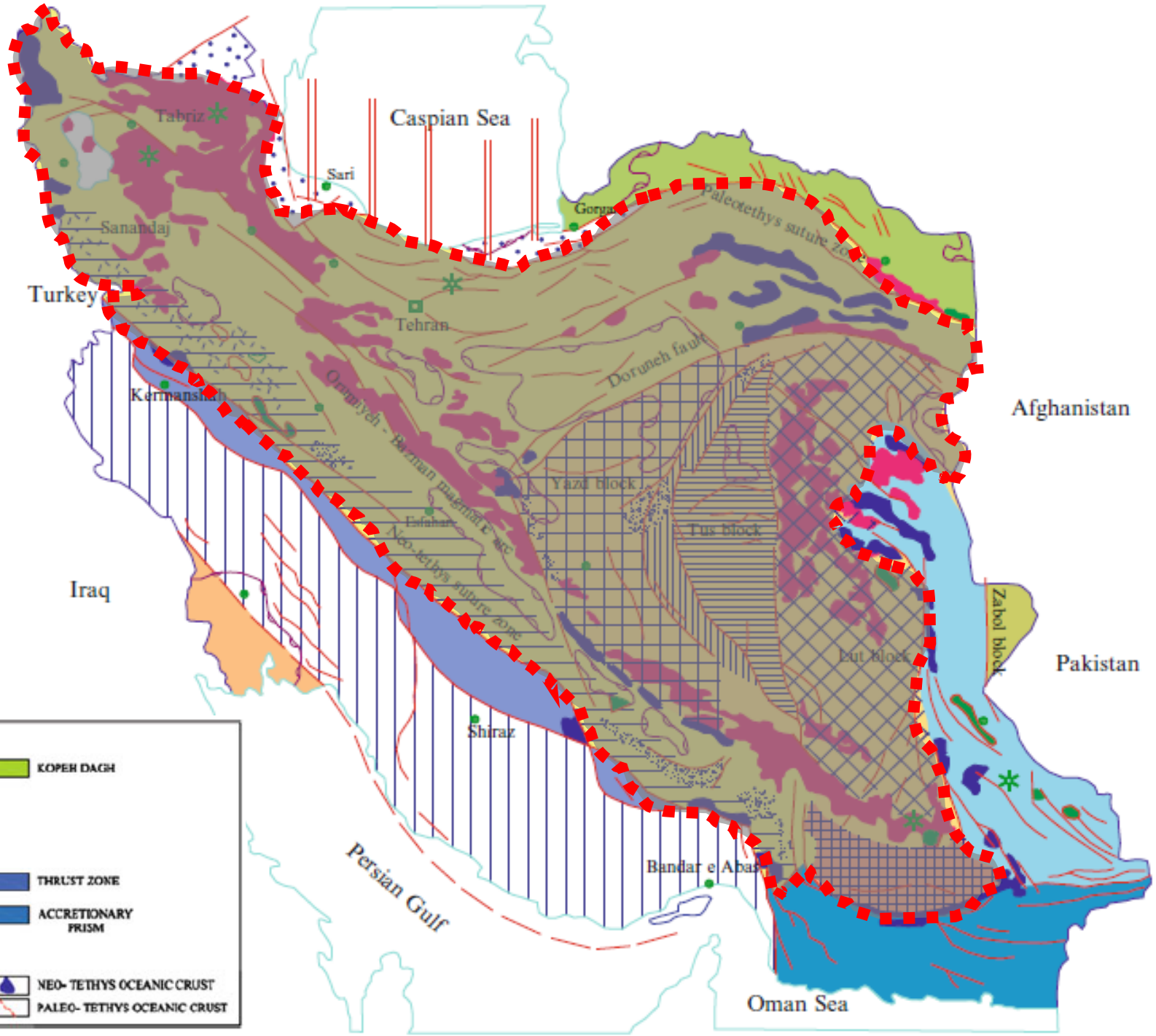
Kopet Dagh

From Middle Jurassic, it was covered with a vast continental shelf sea. In this period of time and due to transgression as well as rapid subsidence basin, the western part became deeper. In this basin, a thick sequence of continuous marine and continental sediments was deposited (about 10 km). No major sedimentary gap or volcanic activities during Jurassic to Oligocene have ever been reported.



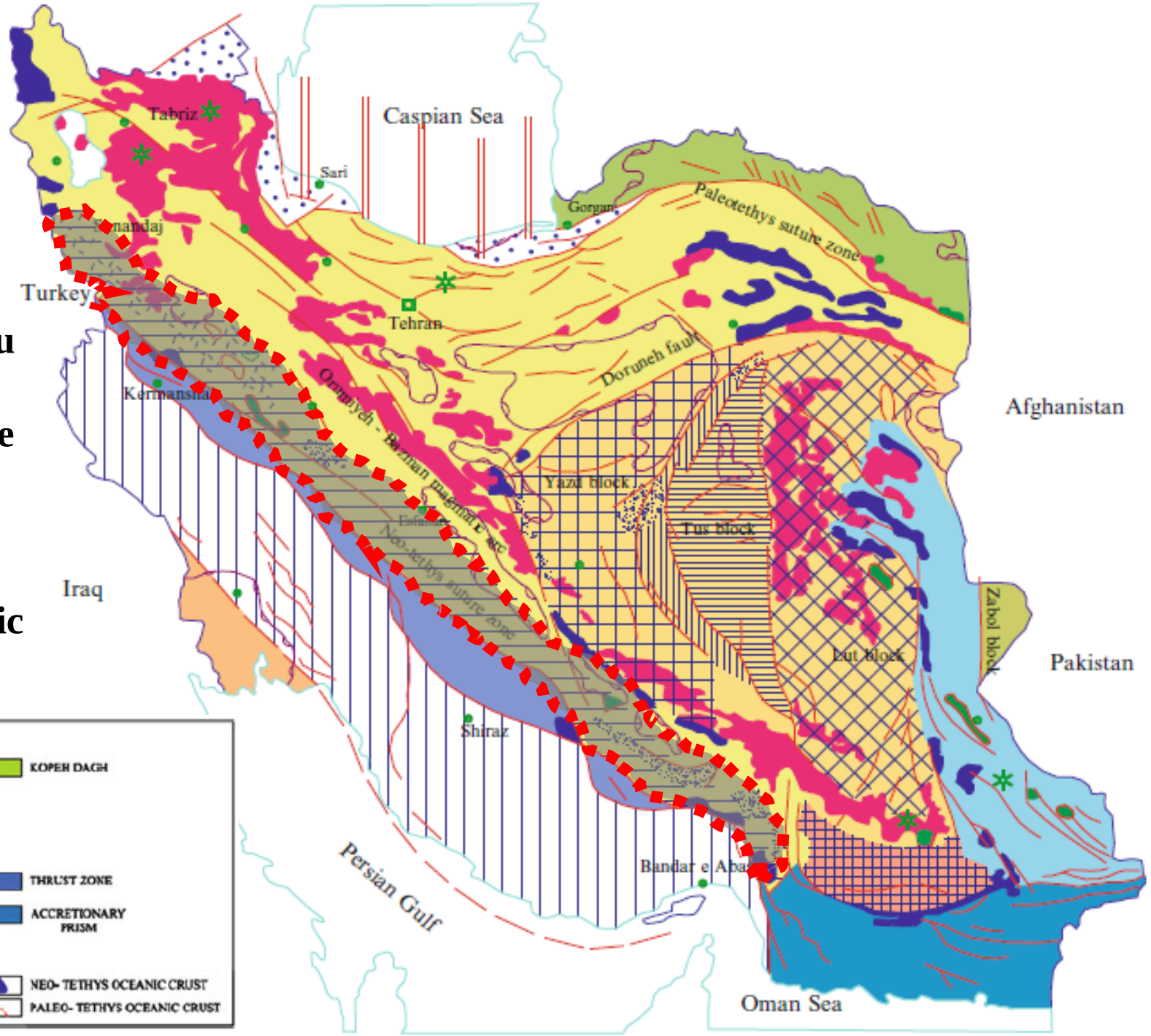
Central Iran

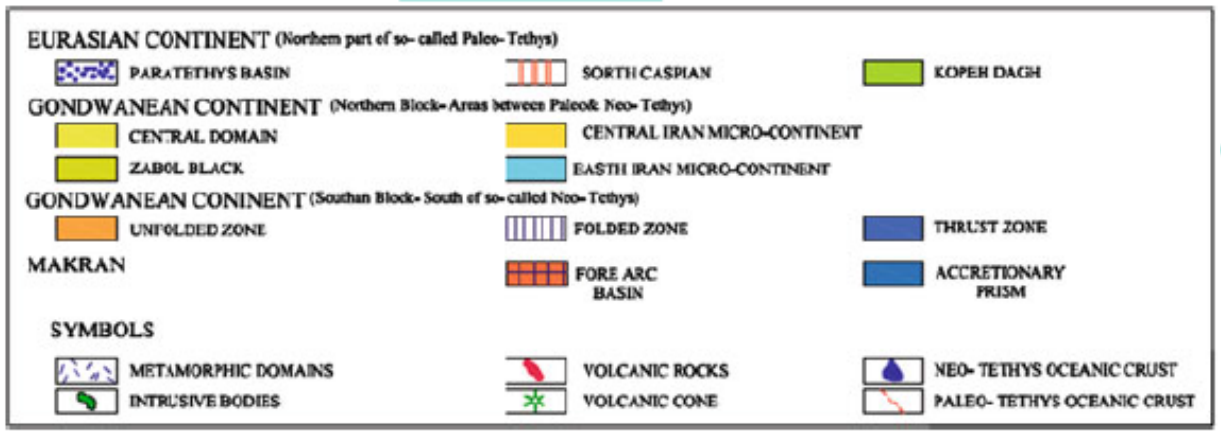
Located as a triangle in the middle of Iran, Central Iran is one of the most important and complicated structural zones in Iran. Here, rocks of all ages, from the Precambrian to the Quaternary, and several episodes of orogeny, metamorphism, and magmatism can be recognized. There is not a consensus regarding the boundaries of Central Iran.



Sanandaj–Sirjan

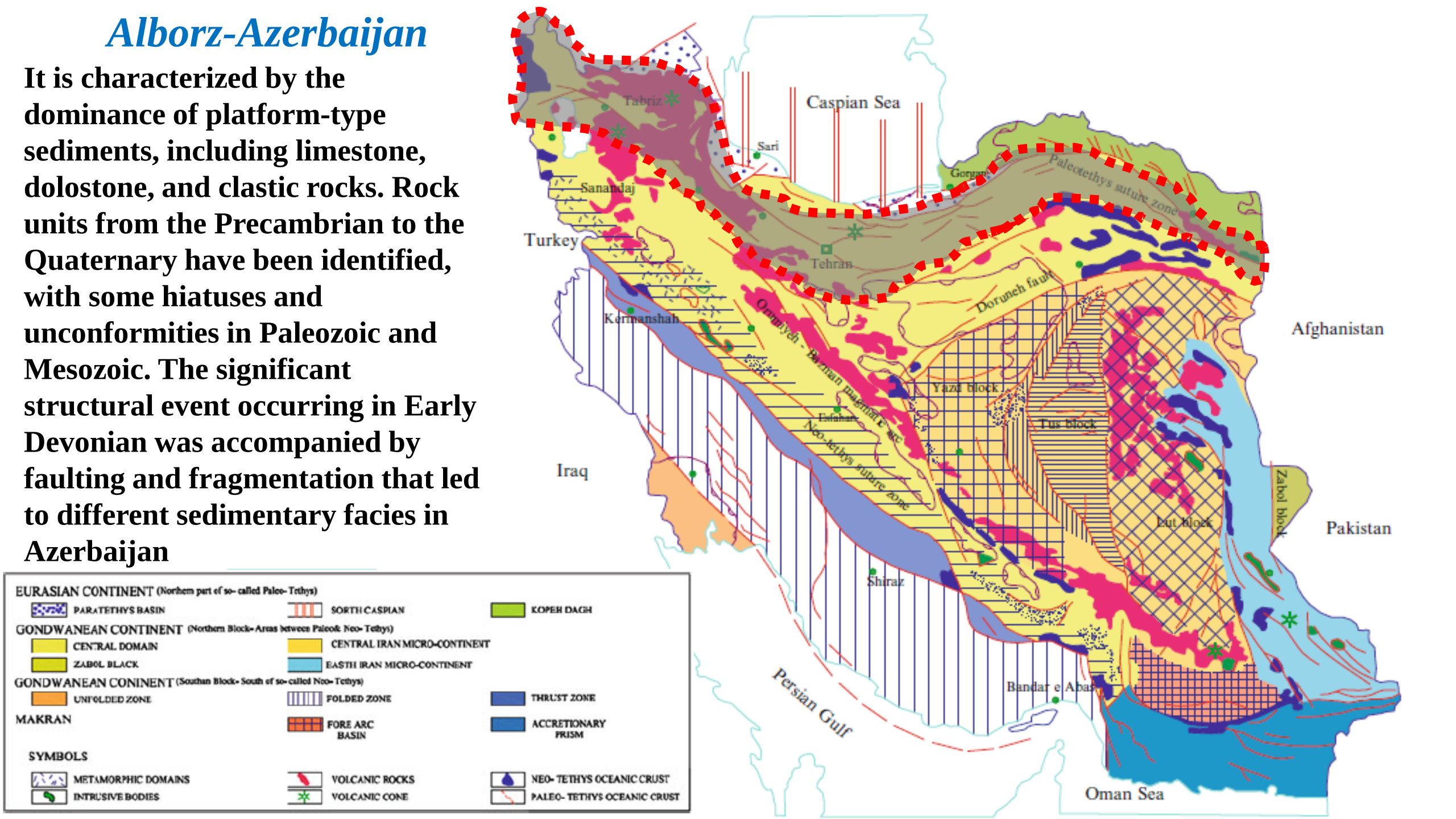
This zone is located to the south-southwest of Central Iran and the northeastern edge of Zagros range. In north and northeast, this zone is separated from Central Iran by depressions like Lake Orumiyeh, Tuzlu Gol, and Gavkhouni and faults like Shahr-e-Babak and Abadeh, and to the south-southwest by the main thrust fault of Zagros. A striking feature of this zone is the presence of immense volumes of magmatic and metamorphic rocks of Paleozoic and Mesozoic eras.





Alborz-Azerbaijan

It is characterized by the dominance of platform-type sediments, including limestone, dolostone, and clastic rocks. Rock units from the Precambrian to the Quaternary have been identified, with some hiatuses and unconformities in Paleozoic and Mesozoic. The significant structural event occurring in Early Devonian was accompanied by faulting and fragmentation that led to different sedimentary facies in Azerbaijan

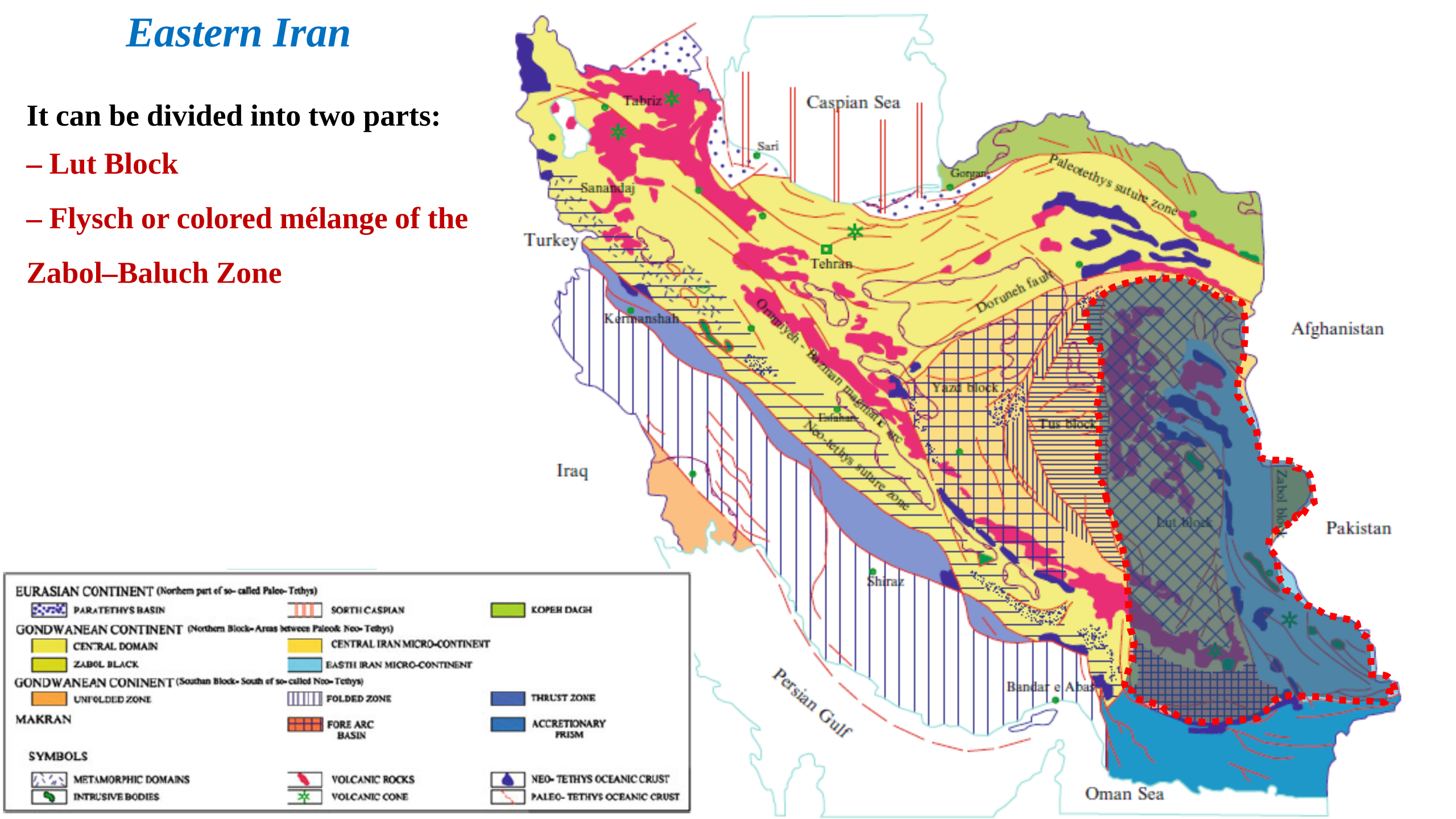


Eastern Iran

It can be divided into two parts:

– Lut Block

– Flysch or colored mélange of the Zabol–Baluch Zone

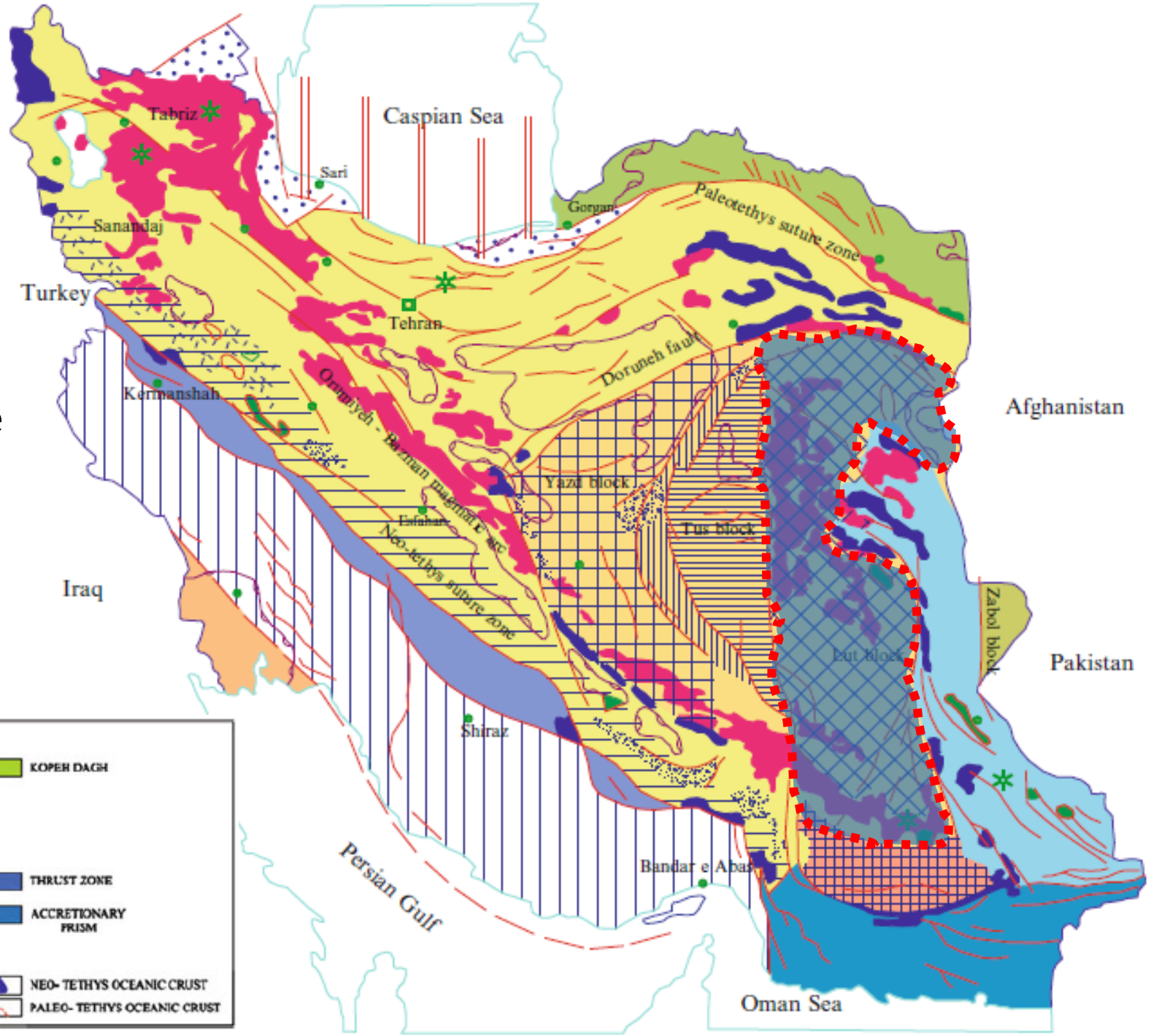


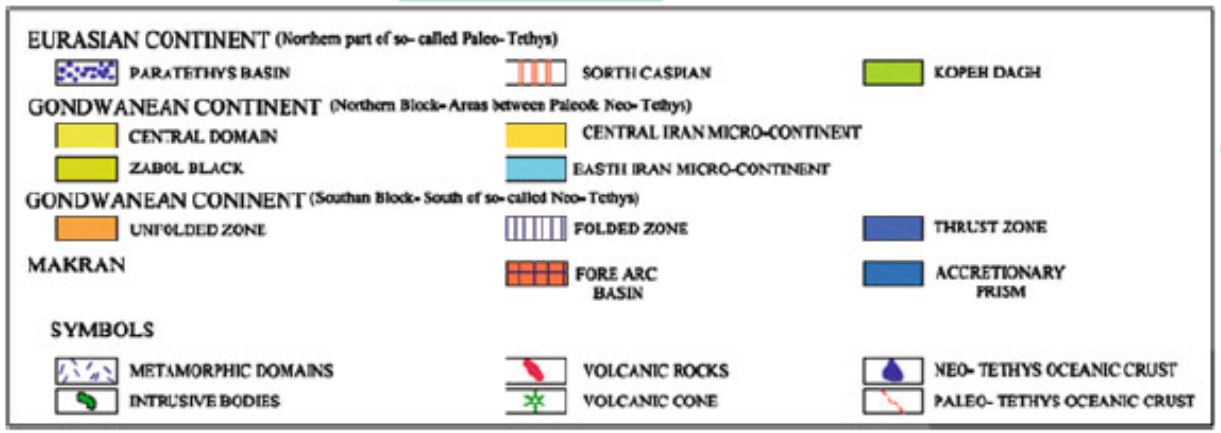
Eastern Iran

Lut Block

It extends for about 900 km in the north–south direction.

The oldest units include upper Precambrian–Lower Cambrian schists overlain by Permian limestone and other Paleozoic sedimentary rocks.

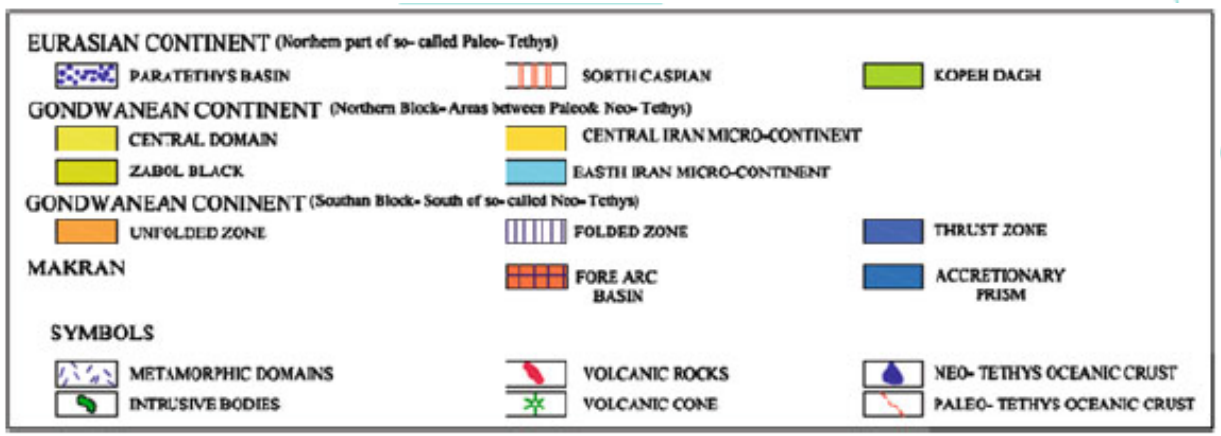


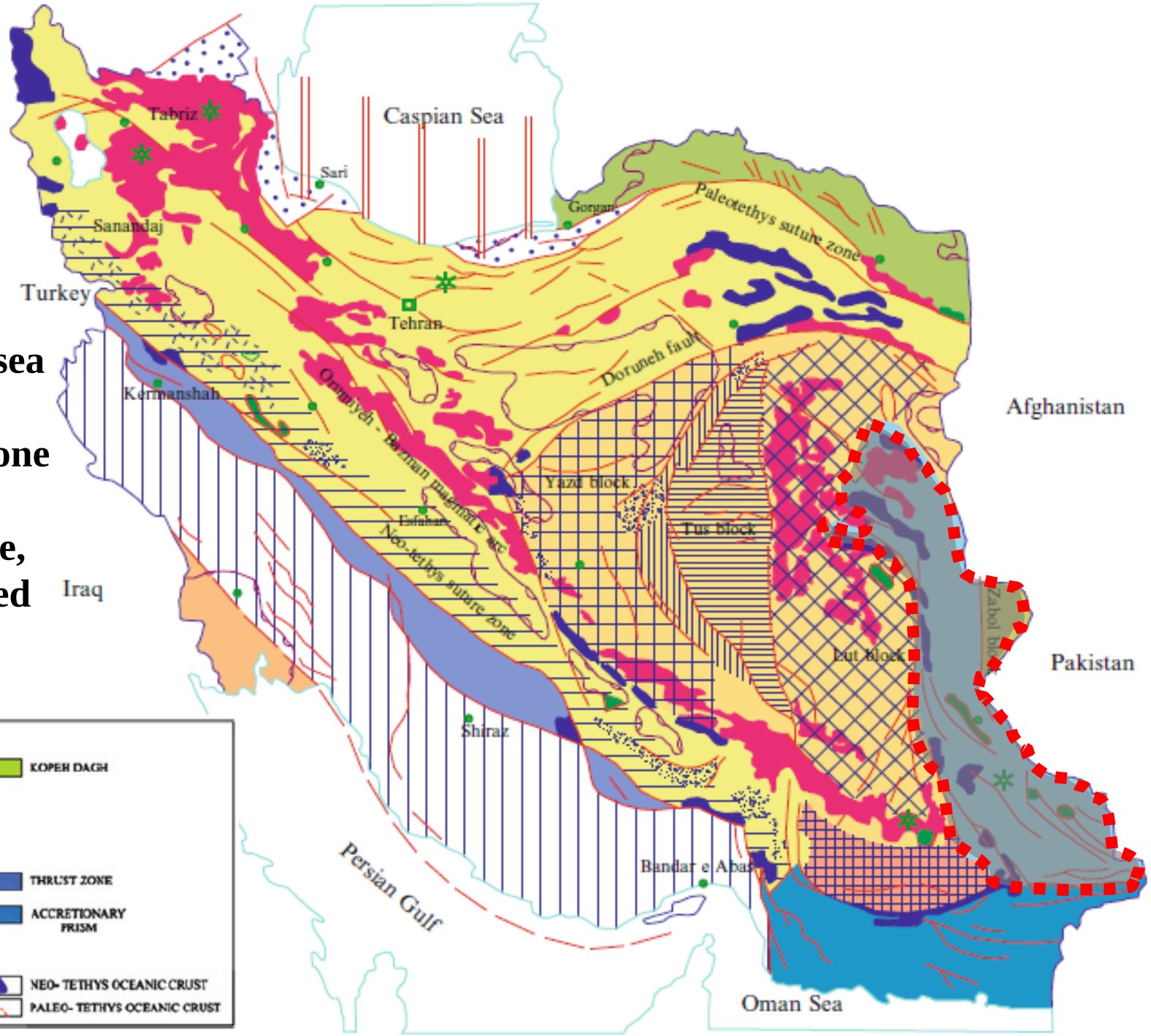


Eastern Iran

Flysch or colored mélange of the Zabol–Baluch Zone

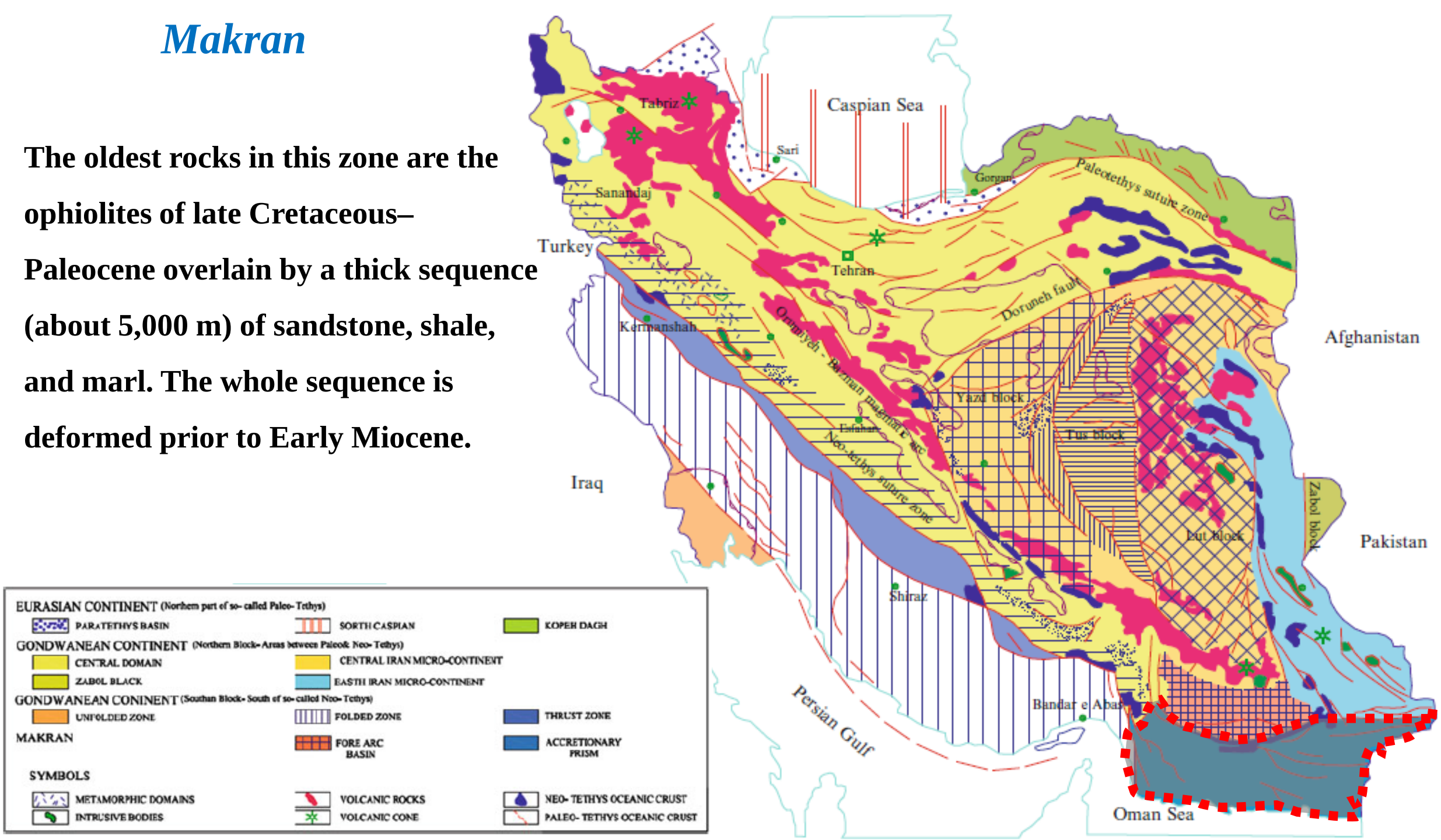
In contrast to the Lut Block, the Flysch Zone is highly deformed and tectonized and consists of thick deep-sea sediments like argillaceous and silicic shales, radiolarite, and pelagic limestone and volcanic rocks such as basalt, spilitic basalt, diabase, andesite, dacite, rhyolite, and subordinate serpentinized ultramafic rocks.





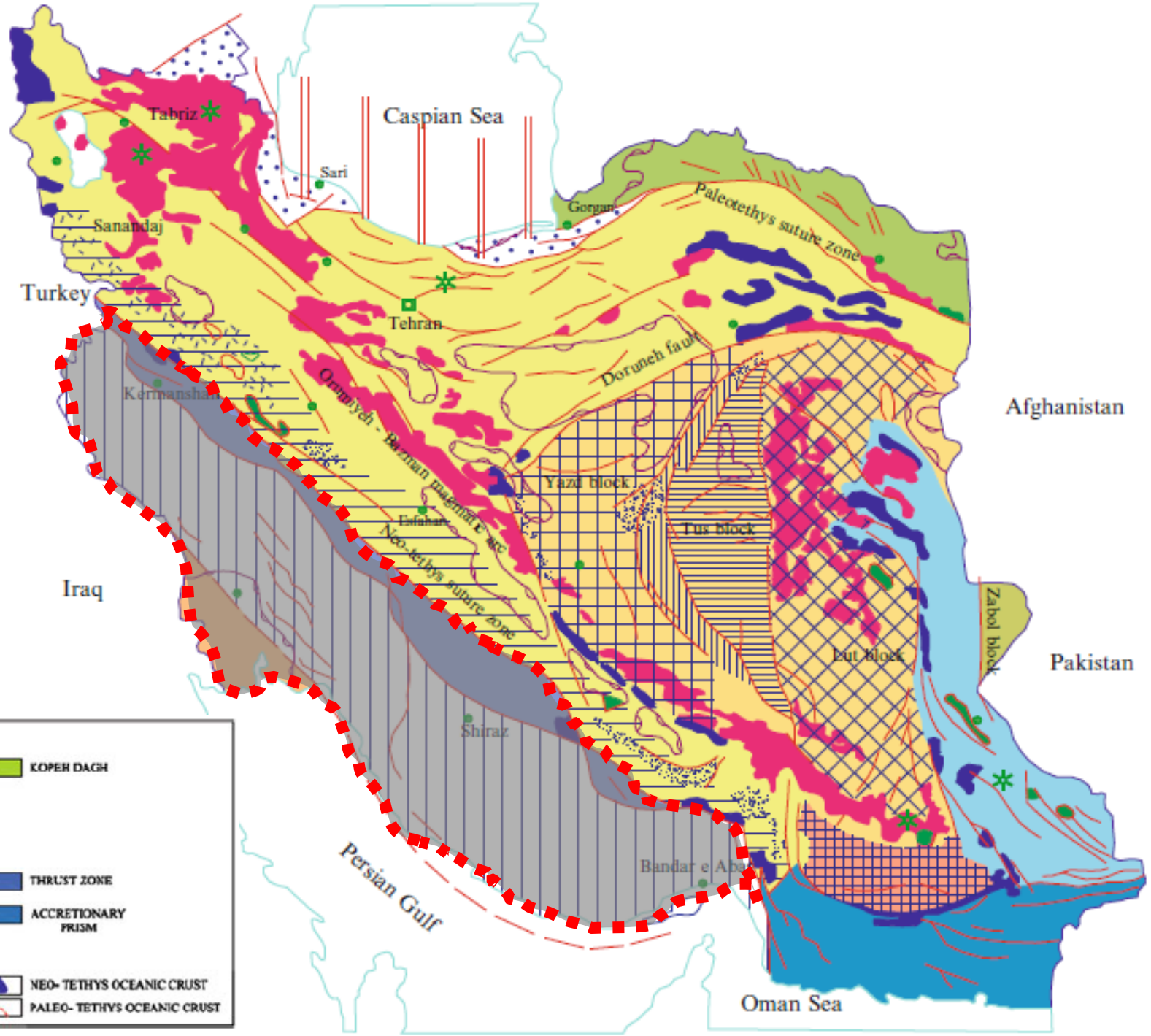
Makran

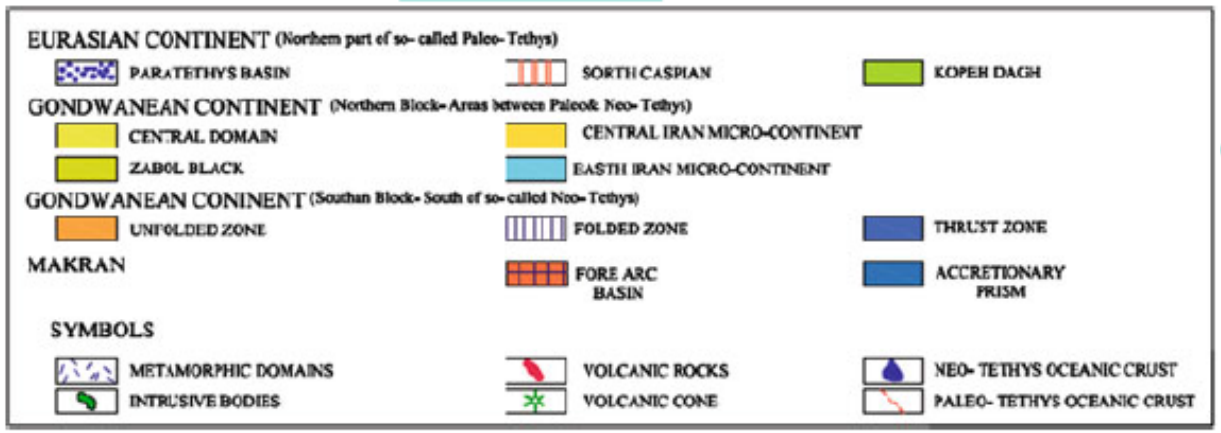
The oldest rocks in this zone are the ophiolites of late Cretaceous–Paleocene overlain by a thick sequence (about 5,000 m) of sandstone, shale, and marl. The whole sequence is deformed prior to Early Miocene.



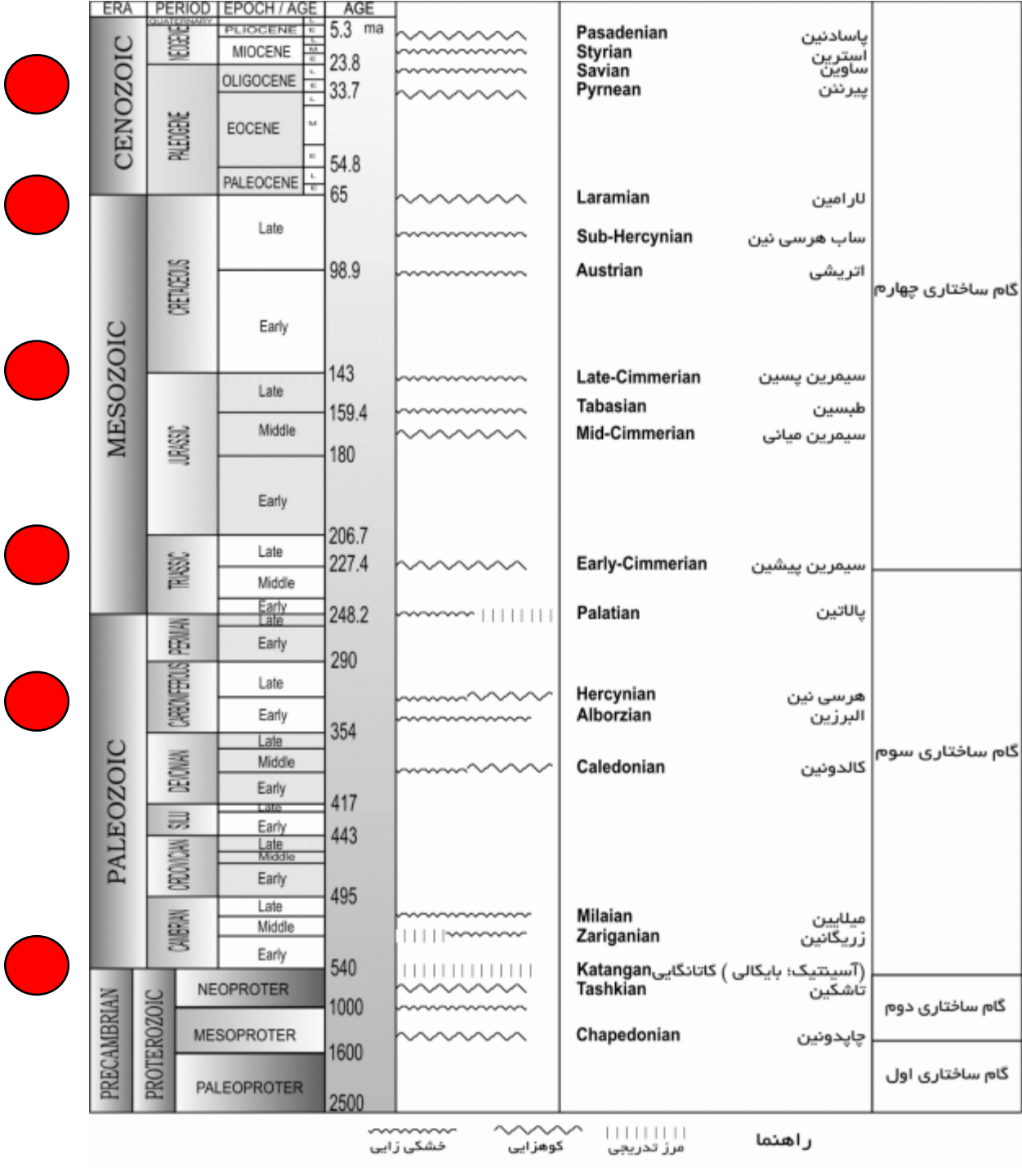
Zagros

It is in fact the northeastern edge of the Arabian plate. Some important features of Zagros include
– Absence of magmatic and metamorphic events after Triassic
– Low abundance of the outcrops of Paleozoic rocks
– Structurally consisting of large anticlines and small synclines
– Continuous sedimentation from Triassic to Miocene with negligible hiatuses





Structural and Orogenic Events in Iran

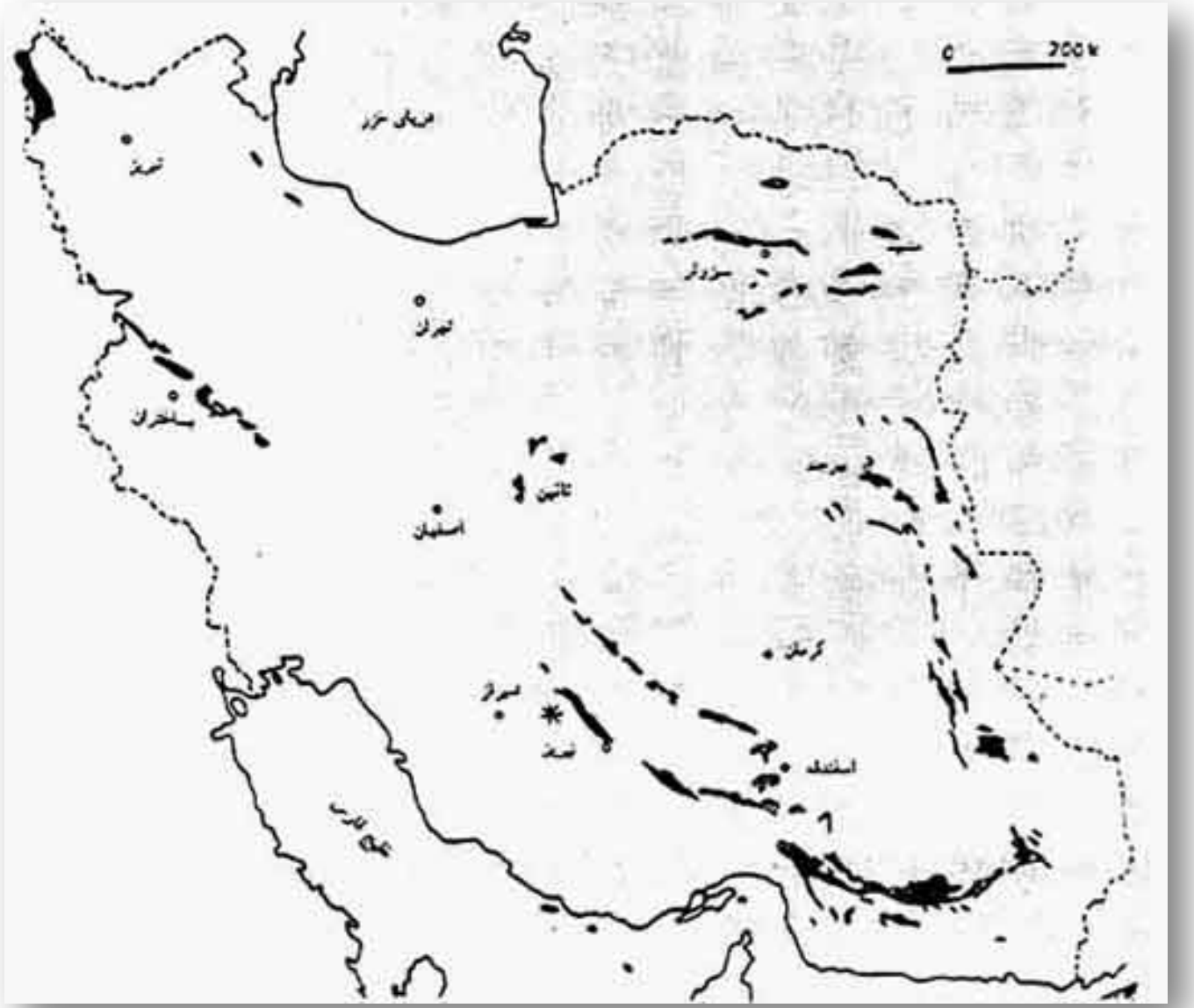


Ophiolite Series and Ultramafic Rocks of Iran

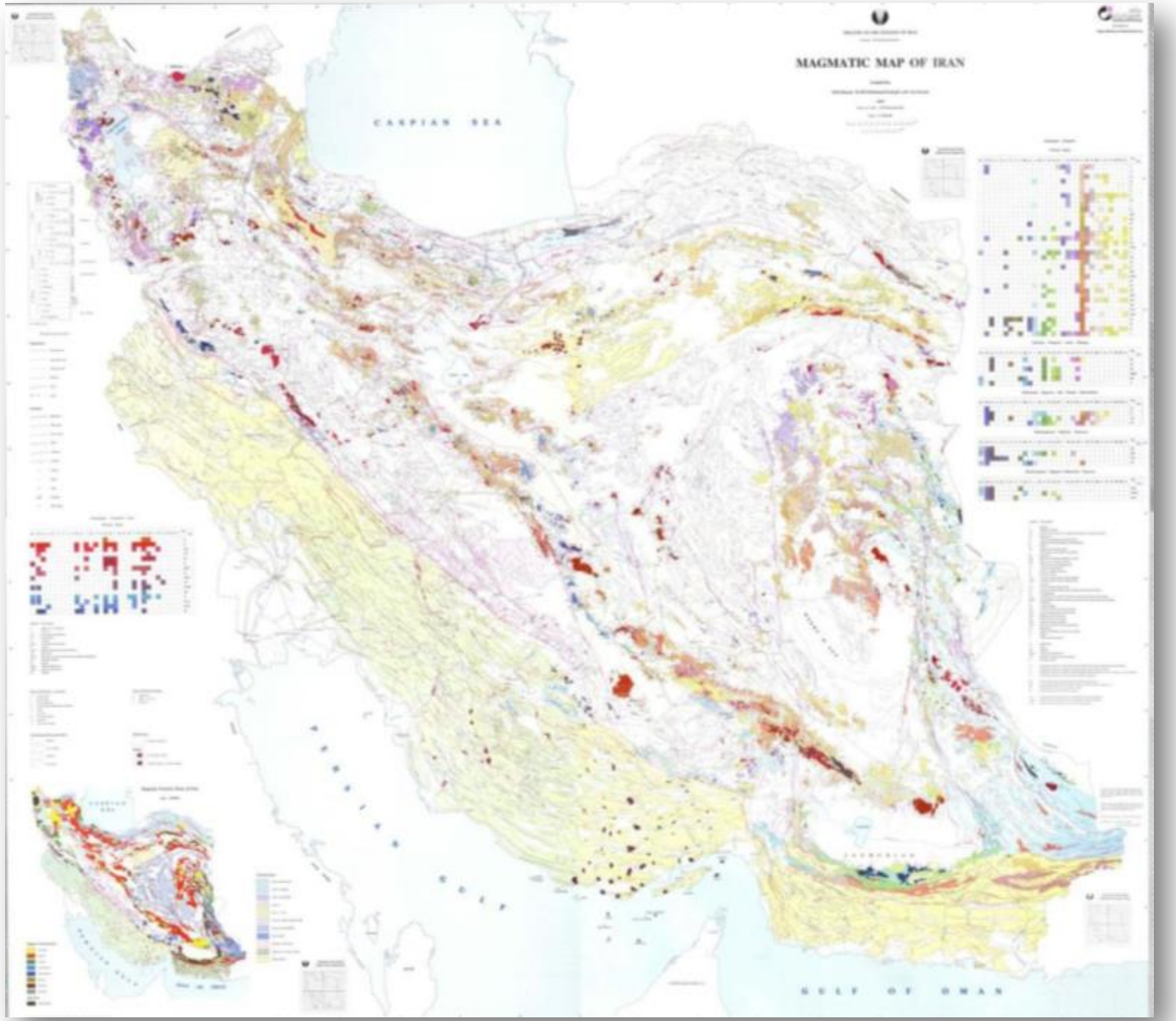
– Ultramafic and mafic units of Late Precambrian–Early Cambrian: Although comparable to modern ophiolites, these rocks do not display all typical features of an oceanic crust. These rocks are widespread in Takab and Anarak Regions. They might be representing a protorift.

– Ultramafic and mafic rocks of Upper Paleozoic: These rocks occur as metamorphosed as well as non-metamorphosed bodies in some areas like Fariman, Shanderman, and Asalam. These rocks display many typical features of modern ophiolites.

- Ophiolite series of Early Cretaceous–Paleogene age: These rocks show typical features of ophiolitic sequences and are thought to be associated with the closure of Neotethys.



- **Magmatic rocks of all ages, from the Precambrian to the Quaternary, are widespread in Iran (e.g., Doran granite, Zarigan–Narigan granite, Torghabeh granite, Ghaen granite, Chaghand gabbro, Alvand granite, Natanz granite).**
- **A correlation exists between the distribution of magmatic rocks and certain types of ore deposits (e.g., iron deposits in Bafgh related to Zarigan–Narigan-type granites, Mazraeh copper deposit related to Sheyvar–Daghi granite, Sarcheshmeh porphyry deposit related to Sarcheshmeh porphyry body) .**
- **Several episodes of magmatic activities have been identified in Iran.**



Major episode of Magmatism in IRAN

Upper Precambrian–Lower Cambrian

Lower Paleozoic

Upper Paleozoic

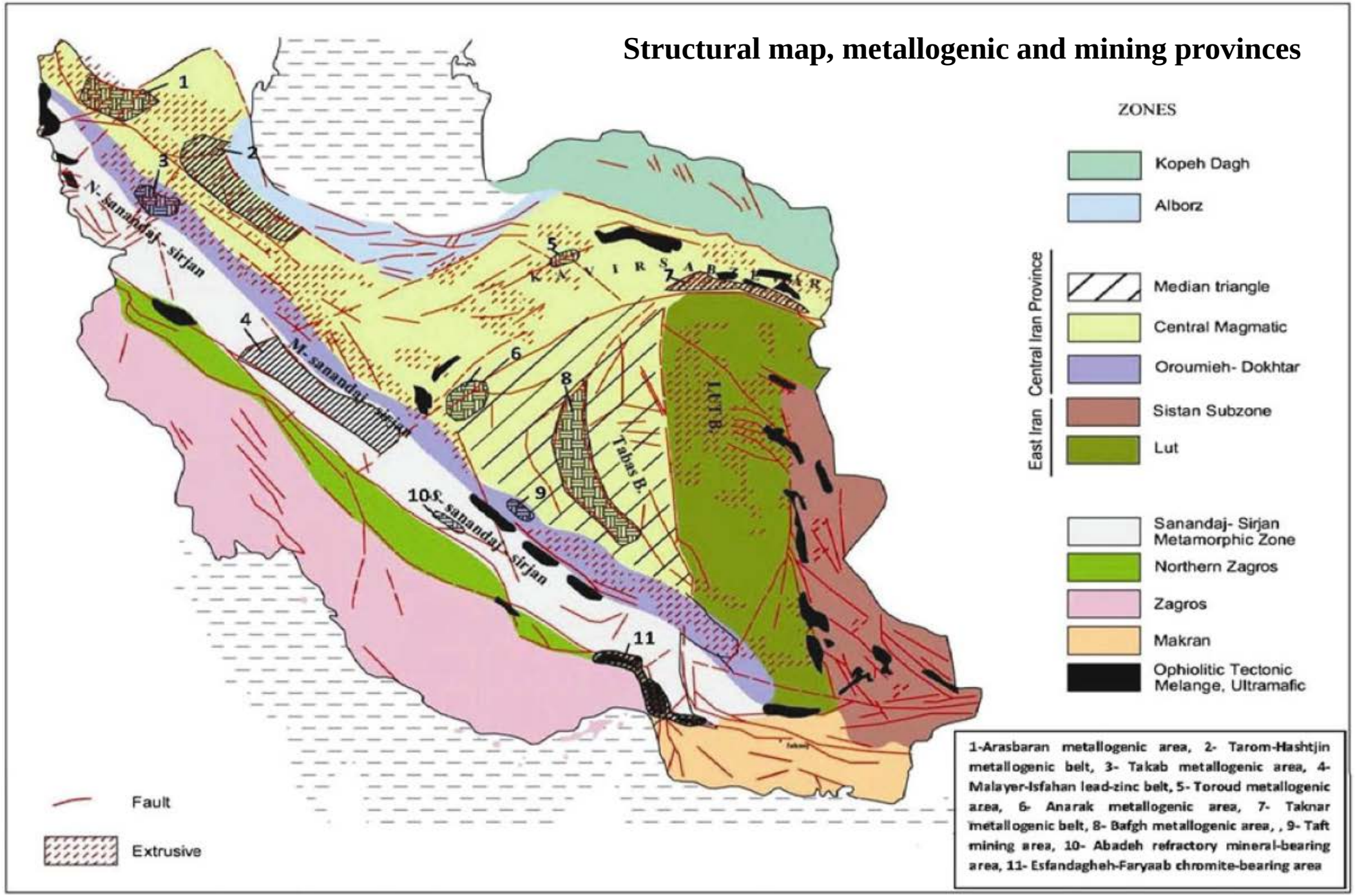
Mesozoic

Tertiary

Metallogenic and Mineralization Phases of Iran

1. **Late Proterozoic–Early Cambrian (coinciding with the Pan-African tectono-magmatic event)**
2. **Lower Paleozoic (corresponding to the Caledonian tectono-magmatic event)**
3. **Upper Paleozoic–Triassic (corresponding to Hercynian and Early Cimmerian)**
4. **Jurassic–Early Cretaceous (Middle Cimmerian tectono-magmatic event)**
5. **Late Cretaceous–Lower Paleozoic (Laramide tectono-magmatic event)**
6. **Tertiary–Quaternary (Late Alpine tectono-magmatic event)**

Structural map, metallogenic and mining provinces



Metallogenic provinces of Iran are as follows

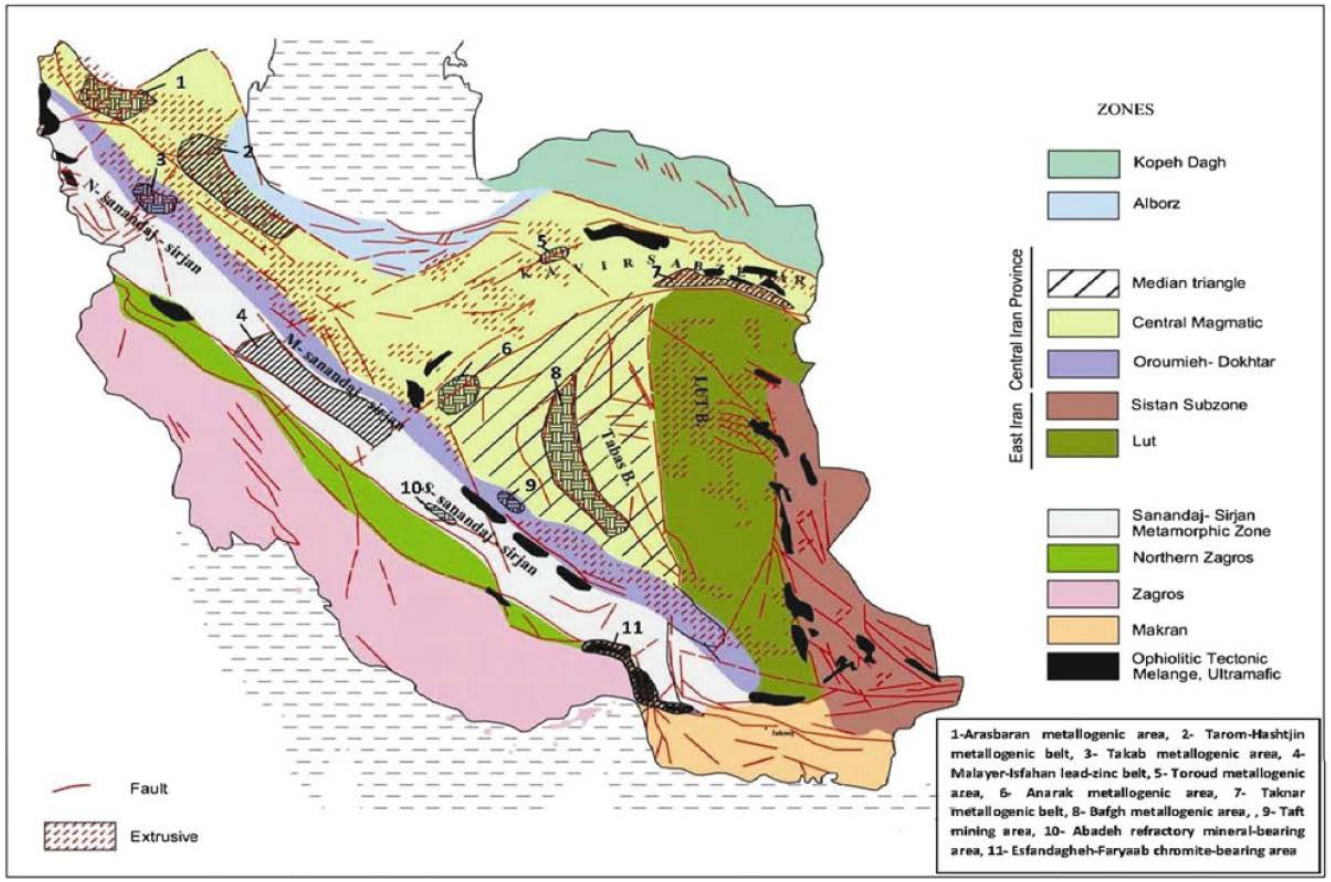
– Central Iran
– Urumiyeh–Dokhtar metallogenic province
– Sanandaj–Sirjan metallogenic province
– Northeast metallogenic province (Taknar, Kavir, Sabzevar Belts)
– Alborz metallogenic province
– Southeast and east of Iran metallogenic province
– Zagros oil and gas province
– Kopet–Dagh oil and gas province

Metallogenic (mining) belts of Iran are as follows:

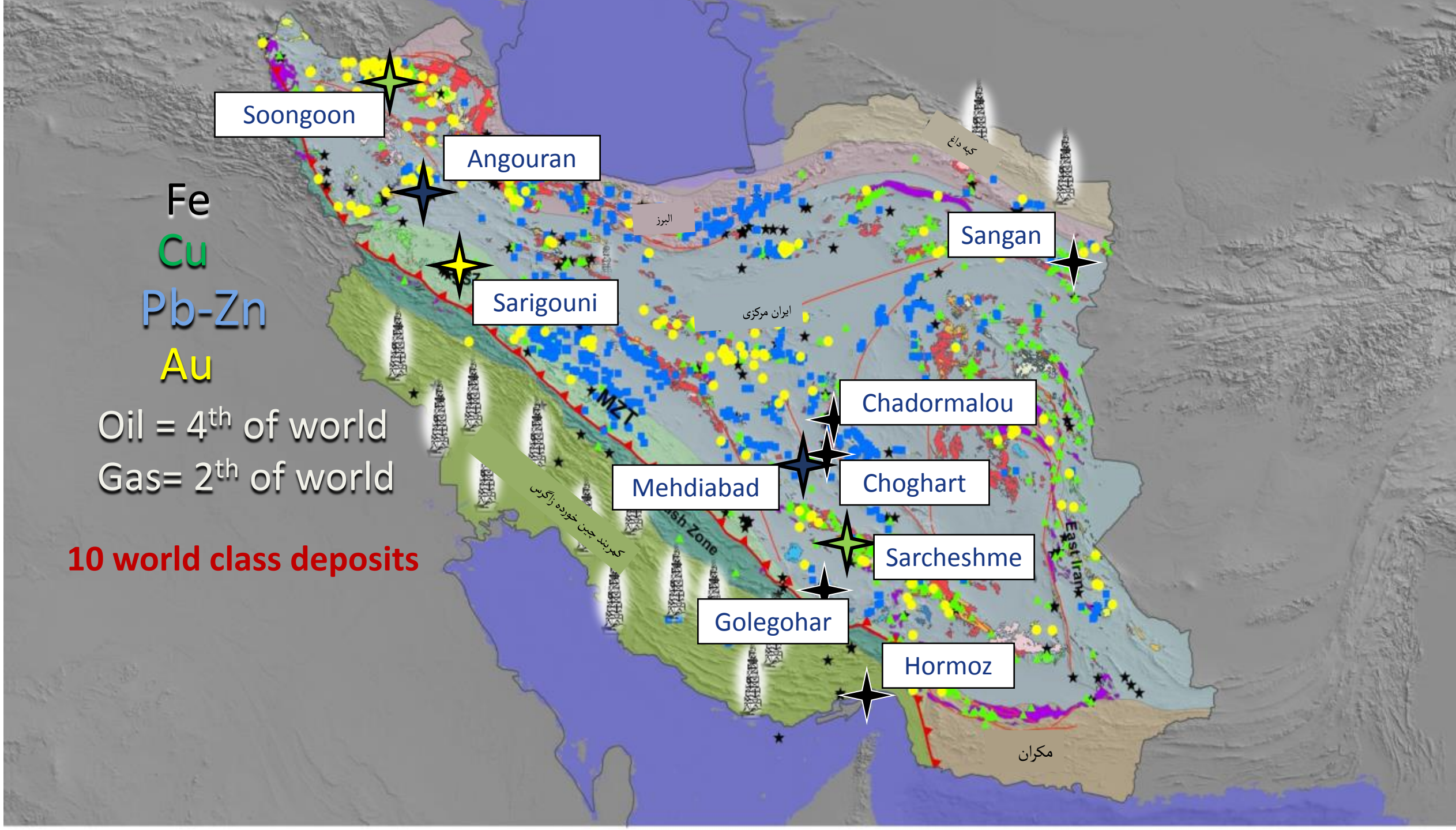
– Malayer–Isfahan lead and zinc belt
– Kerman copper belt
– Esfandagheh–Faryab chromite ophiolitic belt
– Khash–Nehbandan Belt (with chromium, copper, and magnesium deposits)
– Qom–Naein Belt (manganese, barite, copper deposits)
– Kavir–Sabzevar Belt (copper, chromium, gold, iron deposits)
– Taknar Belt (copper, gold, arsenic deposits)
– Tarom–Hashtjin Belt (copper, iron, lead, zinc, gold deposits)
– Maku–Khoy–Urumiyeh Belt (gold, mercury, copper, chromium, iron deposits)

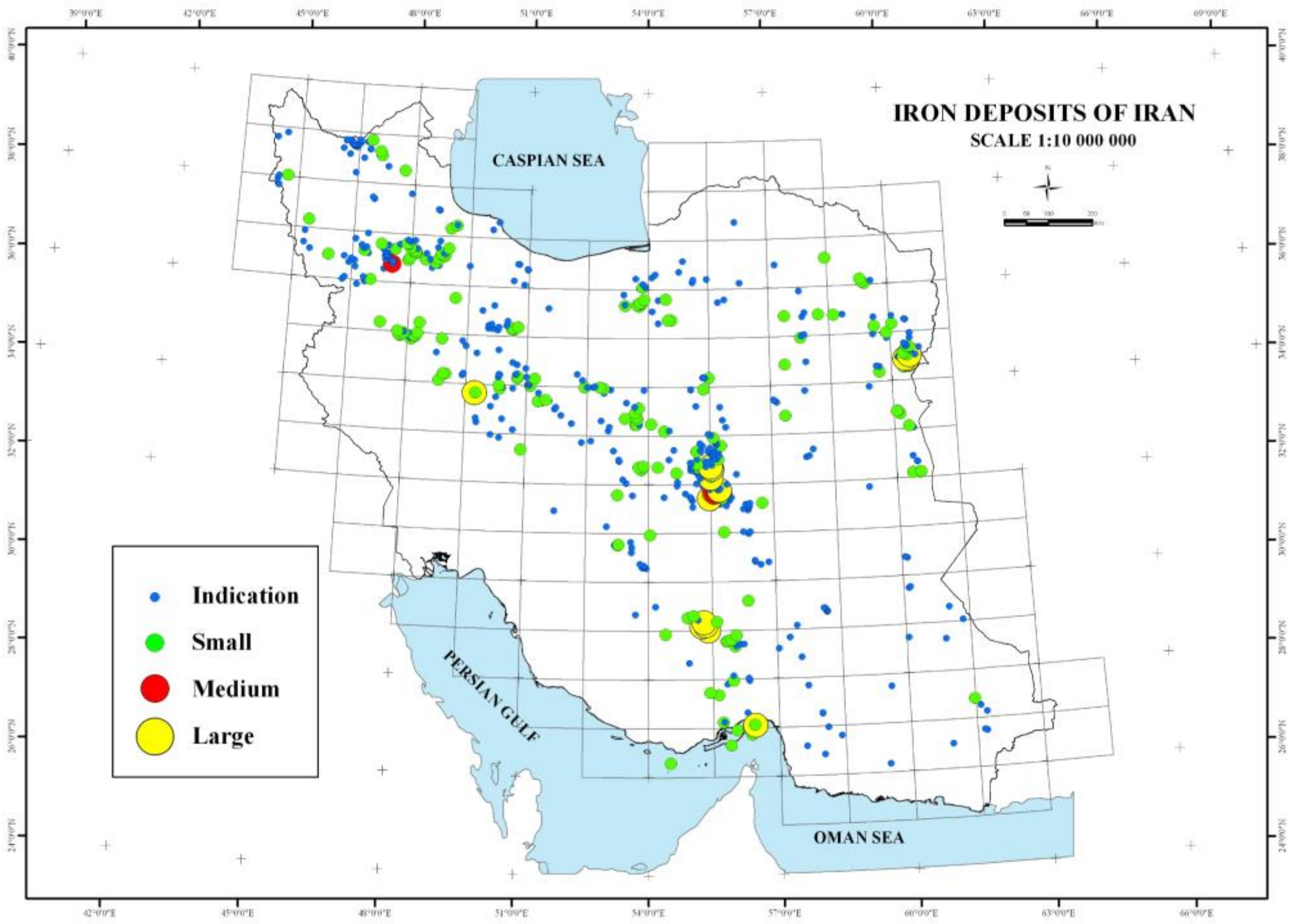
Metallogenic areas are as follows:

– Takab area (gold, arsenic, antimony, mercury, lead, zinc, poly-metal deposits)
– Bafgh area (iron, lead, zinc, apatite, REE deposits)
– Anarak area (copper, lead, zinc, gold, iron, antimony, arsenic deposits)
– Arasbaran area
– Tabas area (refractory, fl uorite, manganese, lead, zinc deposits)
– Abadeh refractory material-bearing area
– Kuhbanan–Ravar– Behabad triangle (lead and zinc deposits)
– Qorveh–Asadabad area (antimony, gold, iron deposits)
– Taft area (lead, zinc, copper deposits)



1-Arasbaran metallogenic area, 2- Tarom-Hashtjin metallogenic belt, 3- Takab metallogenic area, 4- Malayer-Isfahan lead-zinc belt, 5- Toroud metallogenic area, 6- Anarak metallogenic area, 7- Taknar metallogenic belt, 8- Bafgh metallogenic area, , 9- Taft mining area, 10- Abadeh refractory mineral-bearing area, 11- Esfandagheh-Faryaab chromite-bearing area


Soongoon
Angouran
Sarigouni
Sangan
Chadormalou
Mehdiabad
Choghart
Sarcheshme
Golegohar
Hormoz
Fe
Cu
Pb-Zn
Au
Oil = 4th of world
Gas= 2th of world
10 world class deposits
MZT
البرز
ایران مرکزی
کپه داغ
مکران
East Iran


IRON DEPOSITS OF IRAN
SCALE 1:10 000 000
CASPIAN SEA
PERSIAN GULF
OMAN SEA
Indication
Small
Medium
Large

Iron (Fe-Content)

Rank 2012	Rank 2011	Country	Production 2012 metr. t	Share in %
1	(1)	China	419 200 000	29,77
2	(2)	Australia	327 600 000	23,27
3	(3)	Brazil	232 477 000	16,51
4	(4)	India	91 132 730	6,47
5	(6)	Russia, Europe	47 476 000	3,37
6	(7)	South Africa	43 615 310	3,10
7	(5)	Ukraine	42 975 400	3,05
8	(8)	United States	33 516 000	2,38
9	(10)	Canada	24 050 470	1,71
10	(11)	Venezuela	18 000 000	1,28
11	(12)	Sweden	16 985 600	1,21
12	(13)	Kazakhstan	16 827 530	1,20
13	(9)	Iran	15 635 000	1,11
14	(14)	Russia, Asia	9 724 000	0,69
15	(15)	Chile	9 429 000	0,67

Metallogenic Phases of Iron

It must be noted that the deposits of Late Proterozoic–Early Cambrian are more abundant than those of other time periods.

~4 billion tons of iron ore of:

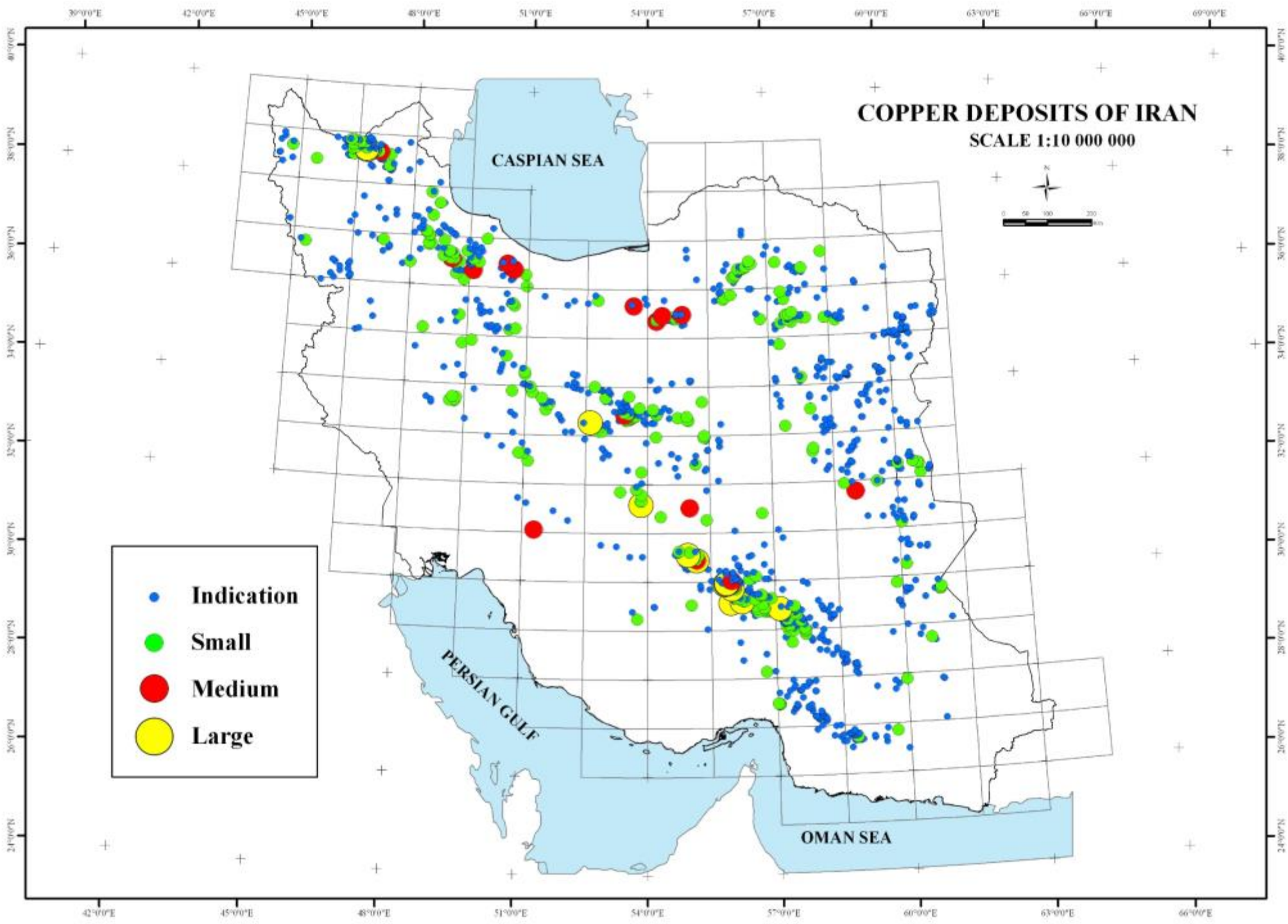
Igneous (Sangan, Bafgh, Zanjan, Morvariyeh,Sorkhe-Dizaj)

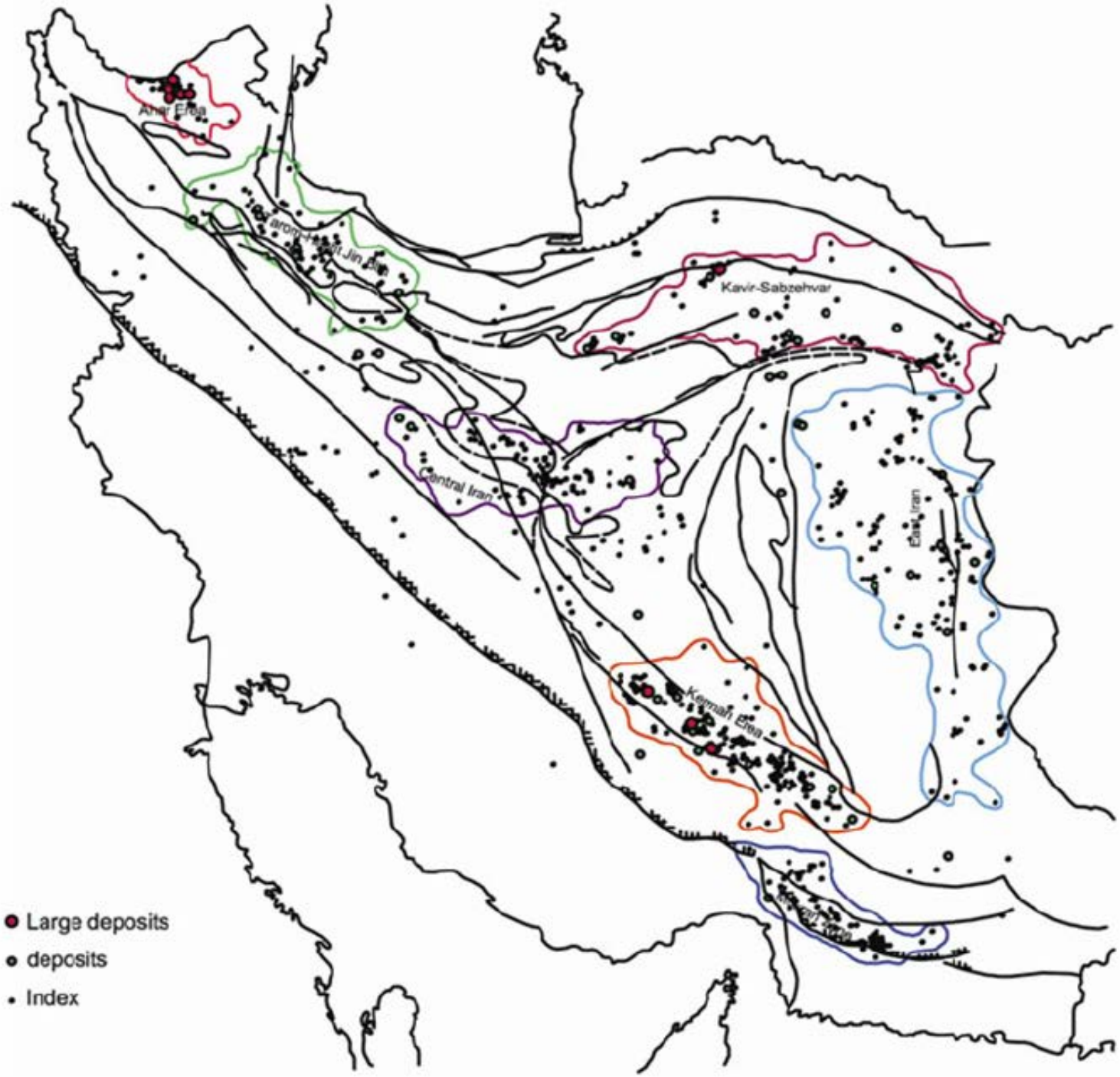
Sedimentary volcanic (Bandar Abbas, Shams Abad)

Volcanosedimentary (Soltanieh-Mahabad Belt, Hamekasi Complex origins)

have been discovered till date

Age	Paragenesis		Location	Deposits and indication
Tertiary Late Eocene–Quaternary	Magmatic	Concurrent with Oligocene volcanic and plutonic activity	Urumiyeh–Dokhtar zone	Niasar (Kashan), Daran, Shahrak, and Kuh Baba
		Associated with Oligo-Miocene igneous activity	Alborz zone	Semnan, Sorkhe Dizaj, Morvariyeh (north of Khoram Dareh), Damirchi
		Metasomatic and volcanic; orthomagmatic	East of Iran	Sangan
Mesozoic Cretaceous	Magmatic skarn, volcanogenic	Magmatic skarn	Hamedan region	Baba Ali, Chenar Bala, Golali
		Magmatic skarn	Northeast of Khoy	Eskandian (Late Cretaceous–Early Paleocene)
		Volcano sedimentary	Southwest of Arak	Shams Abad (lower Cretaceous)
Triassic–Early Jurassic	Associated with plutonic bodies		Northern regions of Sanandaj–Sirjan zone	Hezar Khani, Khosro Abad, Charmale (Songhor), Zafarabad, Hamekasi Complex
	Sedimentary		Central Iran	Kharanagh Oligist, Rebat, Posht Badam
Late Paleozoic–Early Triassic	Volcanosedimentary		East of Iran	Kalat Naser (east of Ghaen), Ahangaran region
			Southern Sanandaj–Sirjan	Honeshk Iron and Manganese (Dehbid, Fars)
			Hamedan–Kordestan Region	Zafarabad (Kordestan)
			Alborz zone	Masooleh (Gilan)
Late Proterozoic–Early Cambrian	Magmatic	Zarigan–Narigan type granitic magmas	Central Iran	Choghart, Chadormalu, Sechahoon, Mishdavan, Esfordi, and most of the deposits at Bafgh area
		Mafic and Ultramafic Magmas	South of Sanandaj–Sirjan zone	Gol Gohar
	Directly or indirectly associated with plutonic or volcano sedimentary rocks	Volcanosedimentary, intermingled with Rizoo and Dezoo Formations	Central Iran	Manganiferous iron deposit at Mishdavan and Ghar Dareh Dahoo
		Volcanosedimentary, associated with Qareh Dash Volcanics and lower parts of Soltanieh Formation — Intermingled with Qareh Dash Volcanics	Azerbaijan	Bordeh Rash Kuh, Bichaghchi and Hamam (Shahin Dezh)
		Volcanosedimentary, associated with Qareh Dash Volcanics and lower parts of Soltanieh Formation — Stratiform with Upper Kahar and Lower Soltanieh as host	Azerbaijan	Arjin, Shah Bolagh, Mirjan, Ghaliche Bolagh, Char Tagh, Balestan
		Volcanosedimentary, along with Hormoz Series and its associated volcanic rocks	Bandar Abbas and islands towards the south	Tange Zagh, Hormoz, Larak and Qeshm

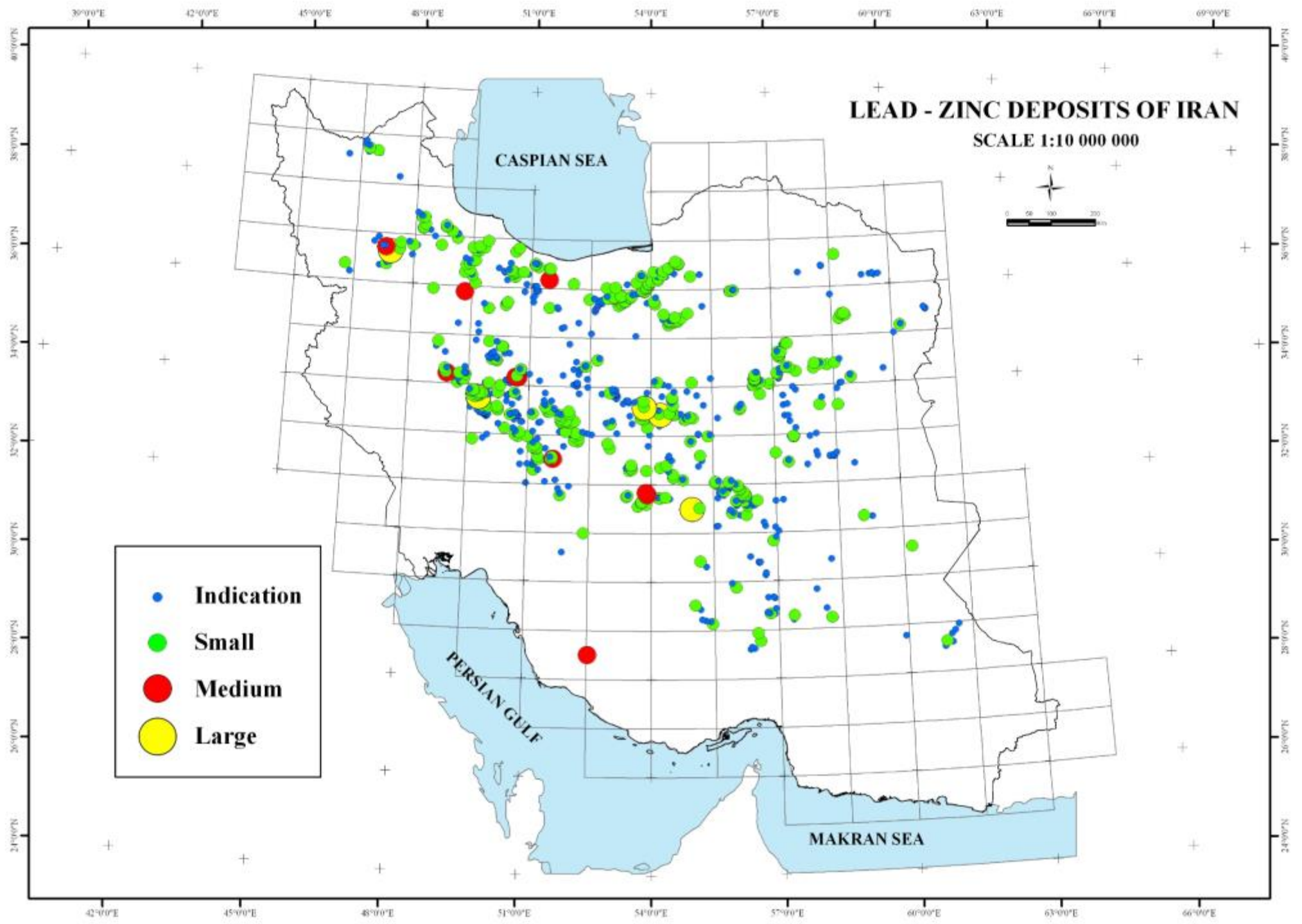

COPPER DEPOSITS OF IRAN
SCALE 1:10 000 000
CASPIAN SEA
PERSIAN GULF
OMAN SEA
Indication
Small
Medium
Large

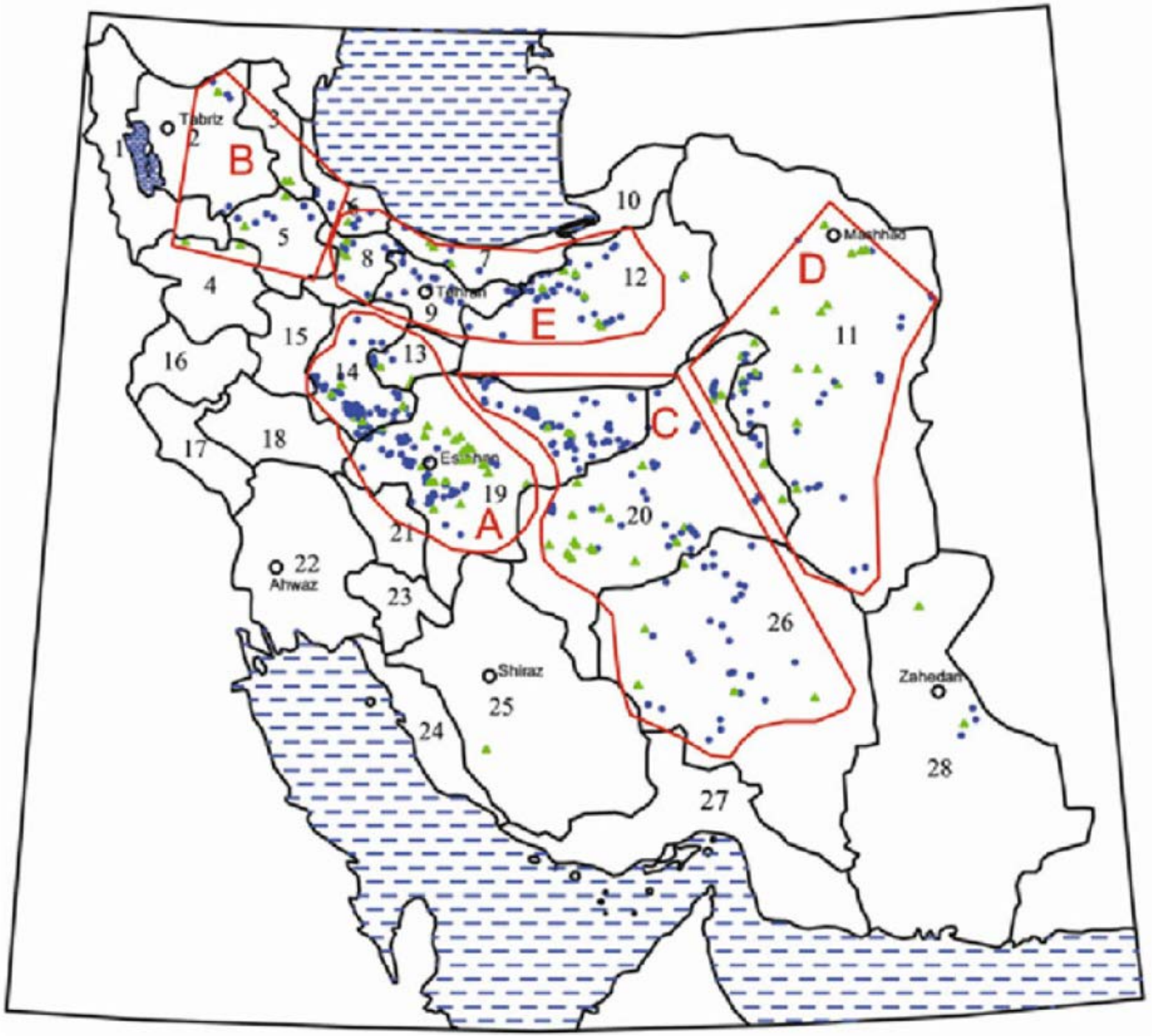


Name of deposit	Location	Reserves and grade	Details
Sarcheshmeh	Kerman	1.2 billion tons with an average grade of 0.68% of copper	Molybdenum (300 ppm), gold (270 ppm), and silver (309 ppm) are associated with this deposit
Meydouk	Kerman	Exploitable deposit is estimated at around 140 million tons with an average grade of 0.85%; comprising of 70 million tons of hypogene reserves having 0.70% grade and 70 million tons of supergene reserves having 1% grade	The results of drilling in the area reveal that the probable reserve of Meydouk is around 500 million tons and the copper grade increases with depth
Darre Zar	Kerman	1.1 million tons oxide reserve with 0.95% grade. 41 million tons of 0.70% proved reserves and 100 million tons of probable reserves	In spite of the absence of supergene deposit, the stripping volume is not great. Molybdenum grade reaches around 500 ppm
Songoon	Ahar	Proved and probable reserves estimated at about one and two billion tons, respectively, with an approximate grade of 0.70%	The supergene reserve is limited, and most copper is situated in hypogene level. Molybdenum grade is around 200 ppm
Mazra'e	Ahar	Total reserved measures at 431,062 tons with 1.7% copper grade. Exploitable reserve is around 387,900 while probable reserves is 860,000 tons	–
Anjard	Ahar	–	–
Darre Zereshk	Taft	Proved reserve is 29 million tons with 0.68% copper	The reserves are estimated for 3,079 m level using 21 boreholes
Kale Kafi	Anarak	Proved reserve is 13.5 million tons with 0.90% copper	Mineralization is in supergene region with very poor hypogene. Total drilling in the area 15 boreholes measuring 2,200 m
Aliabad	Taft	–	–
Taknar	Kashmar	–	–
Abbasabad	Shahrood	–	–
Ghal'e Zari	Eastern Iran	Proved reserve is 360 thousand tons with 0.30–0.50% copper	The deposit is of vein-type with high gold content of about 10 ppm
Lar	Zahedan	40 million tons of probable reserves with a grade of around 0.40–0.45%	–

Details of important copper mines in Iran

		Production			Details						
Name of the mine	Geographic coordinates	2000	2001	2002	Status	Main product	Type of mining	Proved reserve (million tons)	Probable reserve (million tons)	Annual production	Average grade
Sarcheshmeh	55°50′ 29°58′	0.1–0.12	0.1–0.12	0.1–0.12	Active	Cu	Open pit	826.5	1,200	0.14	Cu = 0.68
Meydouk	55°10′ 30°10′				Being equipped	Cu	Open pit	180	500	0.05	Cu = 0.85
Ghal'e Zari	58°55′ 31°49′	0.06	0.06	0.06	Active	Cu	Underground	0.36	1.315	0.1	Cu = 0.5–3.0 Au = 6 ppb
Mazra'e	47°04′ 38°39′	0.03 27–30% con-cen-trate	0.03 27–30% concen-trate	0.03 27–30% concen-trate	Active	Cu	Underground	0.2	0.431	0.04 concentrate	Cu = 1.70
Songoon	46°43 38°42				Being equipped	Cu	Open pit	1,000	2,000	0.6 copper	Cu = 0.70
Taknar	57°46′ 35°22′				Being equipped	Cu, Pb, Zn	Underground	–	79	0.125 ore	Cu = 1.50


LEAD - ZINC DEPOSITS OF IRAN
SCALE 1:10 000 000
CASPIAN SEA
PERSIAN GULF
MAKRAN SEA
Indication
Small
Medium
Large



A : Malayer - Esfahan Belt

B : Azarbaijan

C : Central Iran

D : Eastern Iran

E : Alborz

▲ Ore Deposit

● Indication

Provinces:

1 - West Azerbayjan
2 - East Azerbayjan
3 - Ardebil
4 - Kordestan
5 - Zanjan
6 - Gilan
7 - Mazandaran
8 - Ghazvin
9 - Tehran
10 - Golestan
11 - Khorasan
12 - Semnan
13 - Ghorn
14 - Markazi
15 - Hamedan
16 - Kermanshah
17 - Ilam
18 - Lorestan
19 - Esfahan
20 - Yazd
21 - Chaharmahal & Bakhtiyari
22 - Khuzestan
23 - Kohkiluyeh & Boyerahamad
24 - Bushehr
25 - Fars
26 - Kerman
27 - Hormozgan
28 - Sistan & Baluchestan

Metallogenic Phases of Lead and Zinc

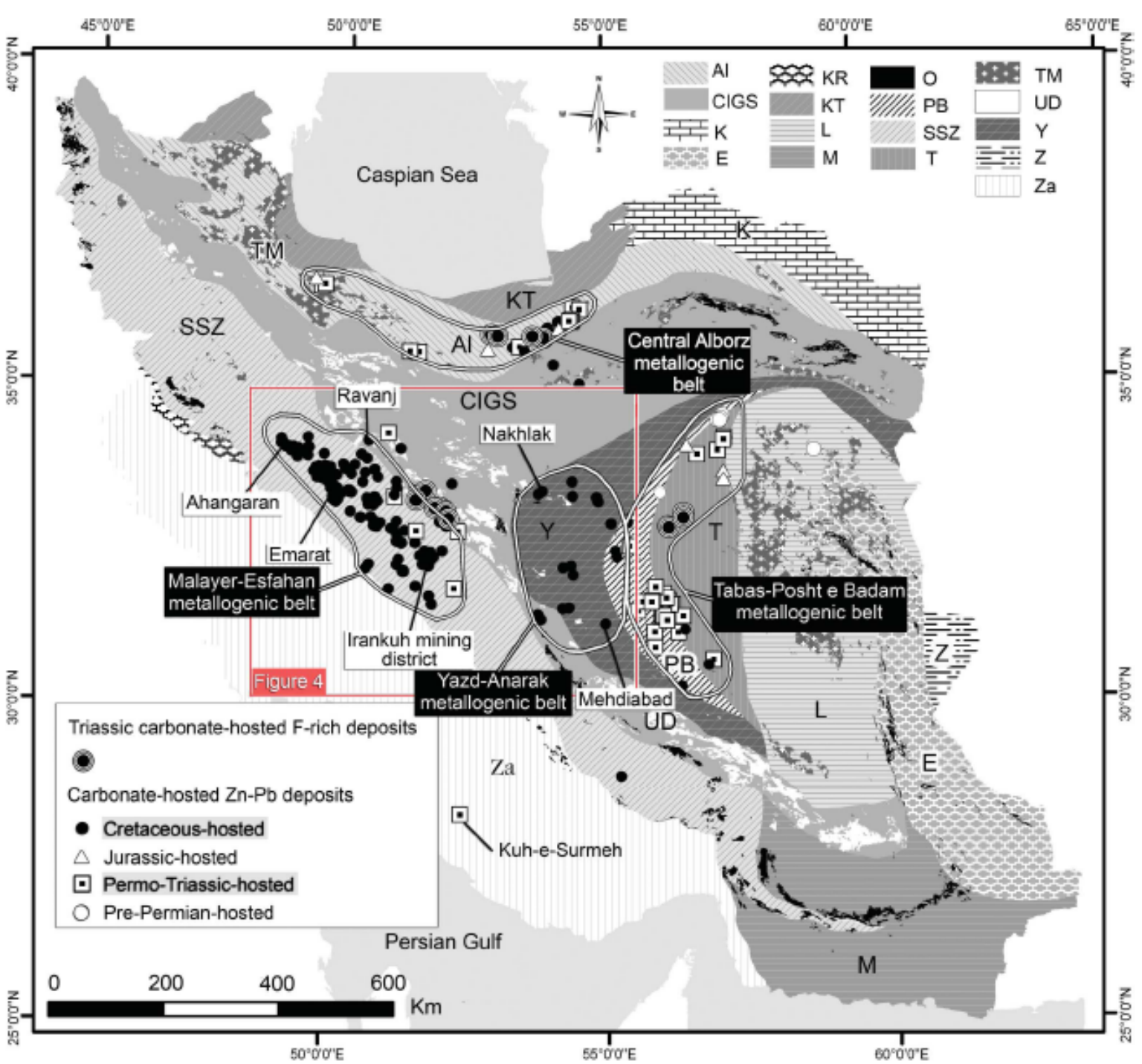
Late Proterozoic - Early Cambrian

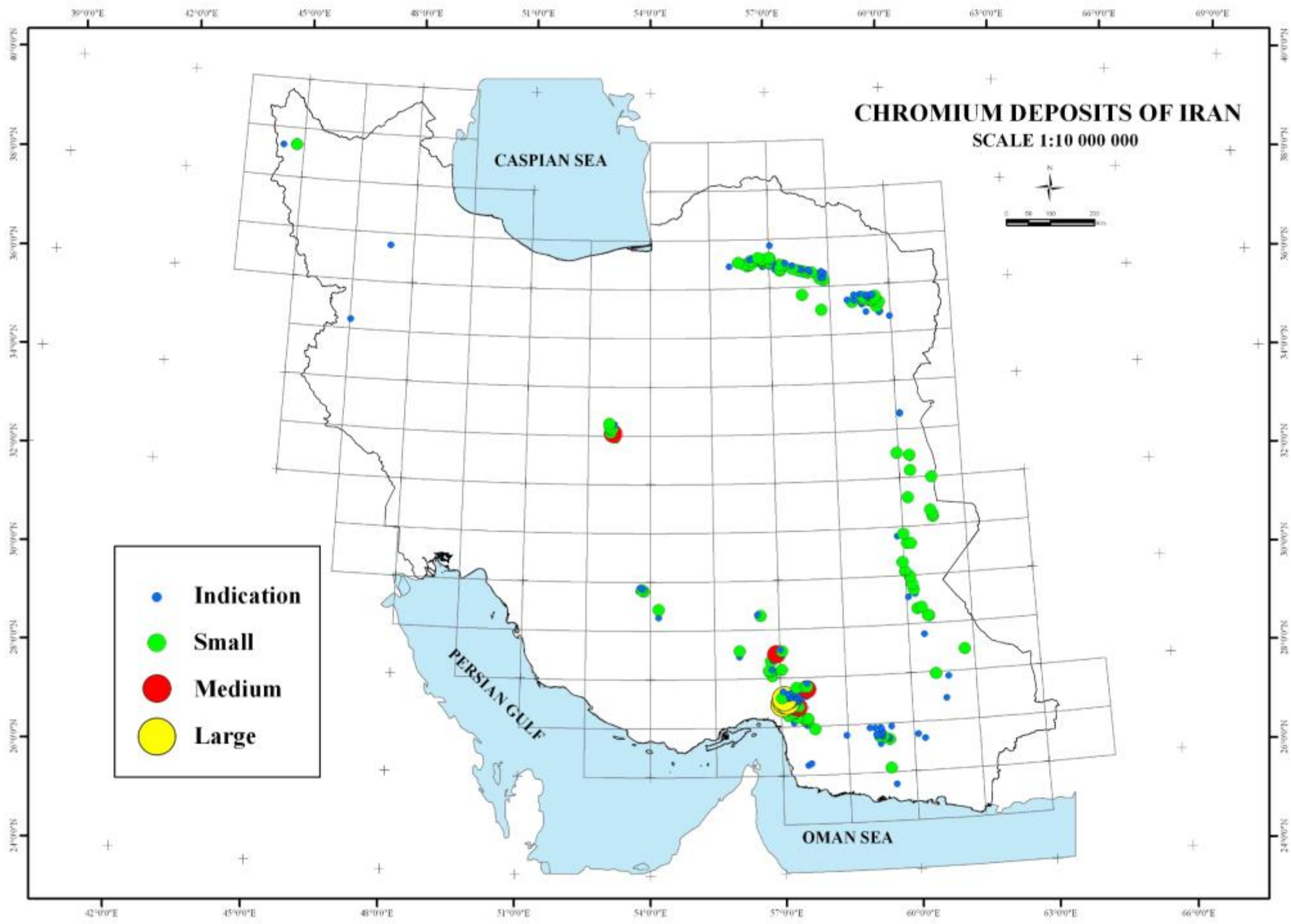
Late Paleozoic

Triassic

Cretaceous

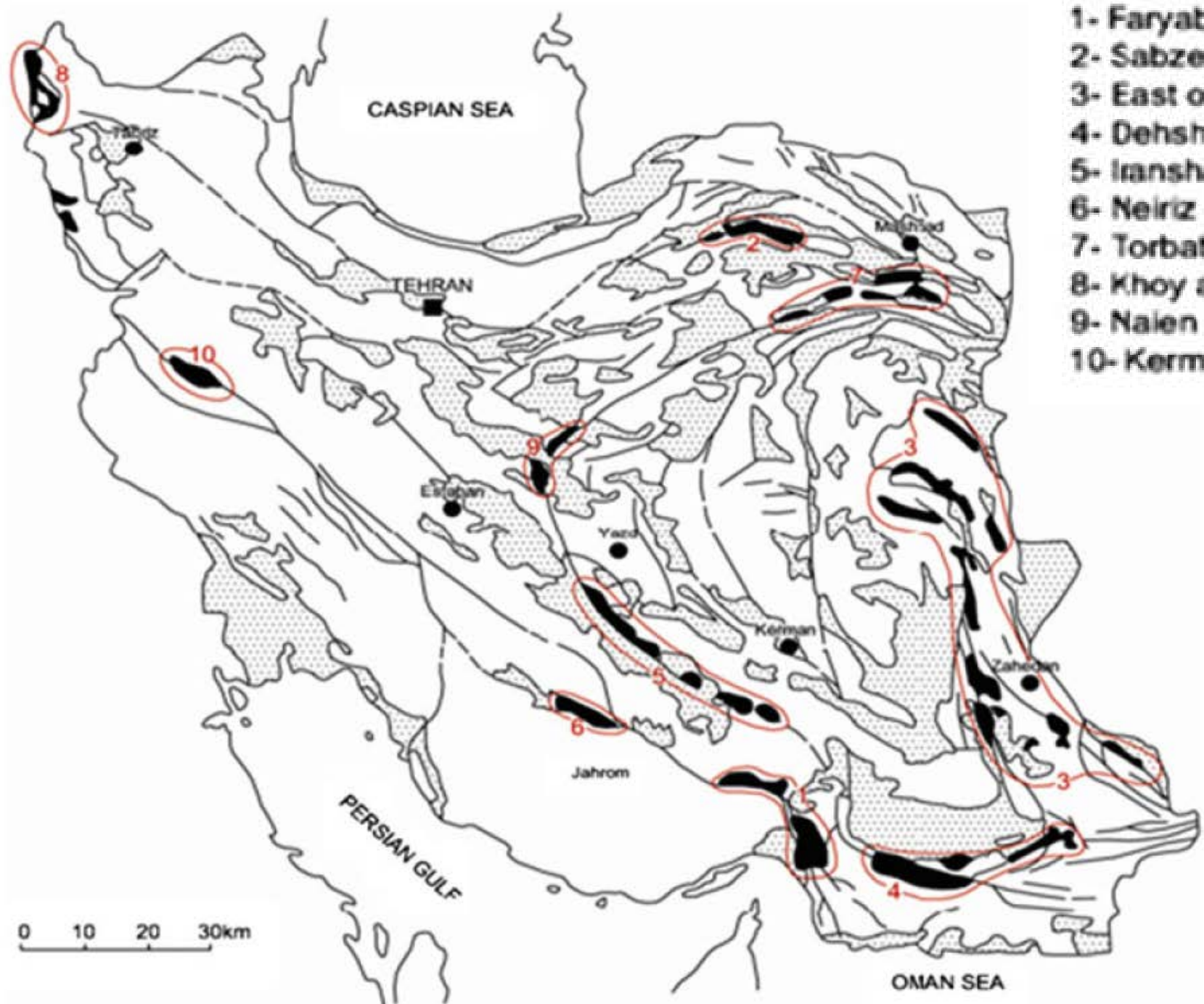
Tertiary




CHROMIUM DEPOSITS OF IRAN
SCALE 1:10 000 000
CASPIAN SEA
PERSIAN GULF
OMAN SEA
Indication
Small
Medium
Large

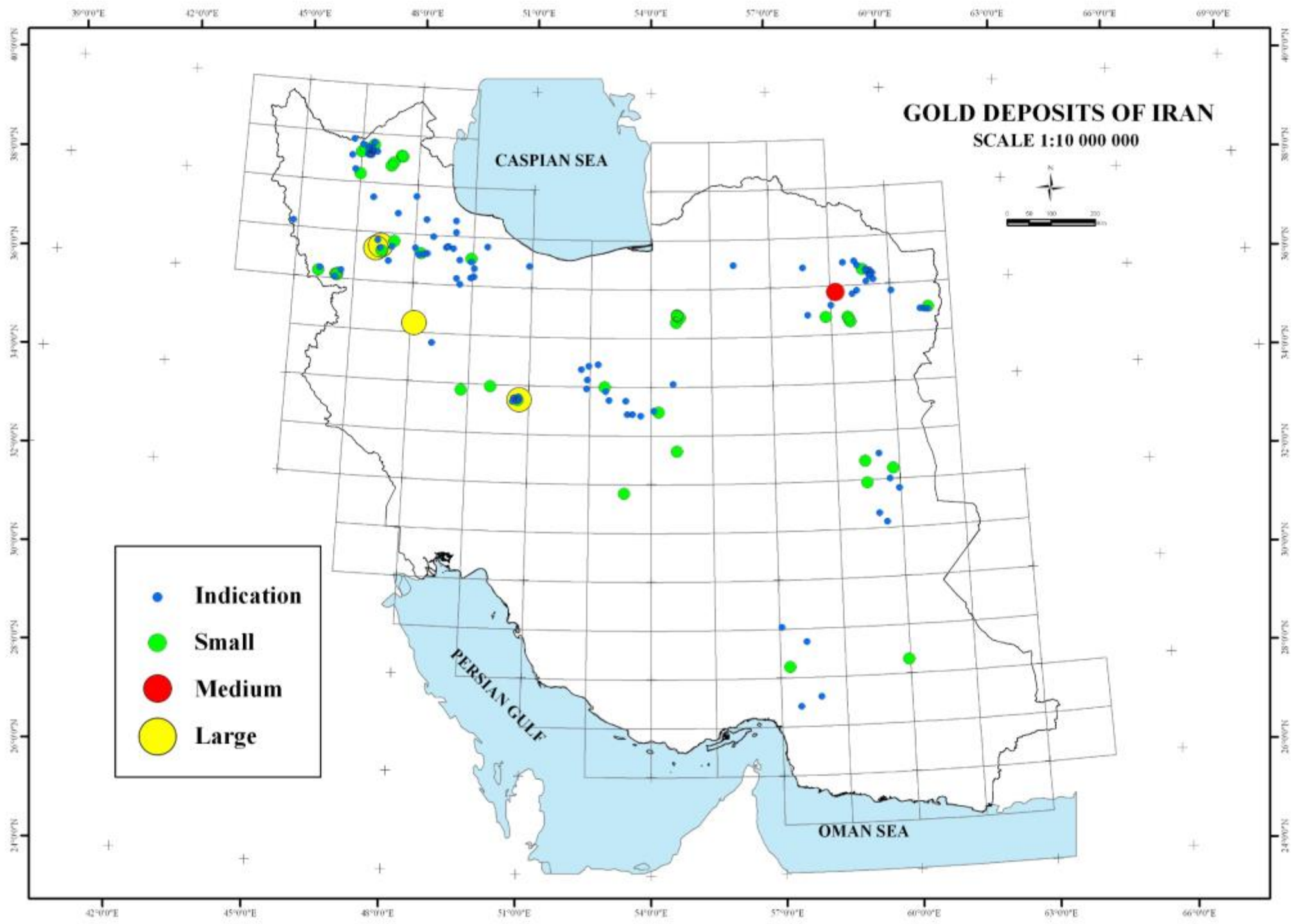
Chromium (Cr_2O_3 - Content)

Rank 2012	Rank 2011	Country	Production 2012 metr. t	Share in %
1	(1)	South Africa	4 976 500	39,81
2	(2)	Kazakhstan	2 250 230	18,00
3	(4)	Turkey	2 083 900	16,67
4	(3)	India	1 357 100	10,86
5	(9)	Russia, Europe	270 000	2,16
6	(7)	Oman	241 280	1,93
7	(5)	Finland	212 610	1,70
8	(11)	Iran	192 210	1,54
9	(8)	Brazil	184 275	1,47
10	(6)	Zimbabwe	183 814	1,47
11	(10)	Albania	158 400	1,27
12	(12)	Australia	127 700	1,02
13	(13)	China	85 800	0,69
14	(14)	Pakistan	71 680	0,57
15	(15)	Madagascar	65 905	0,53

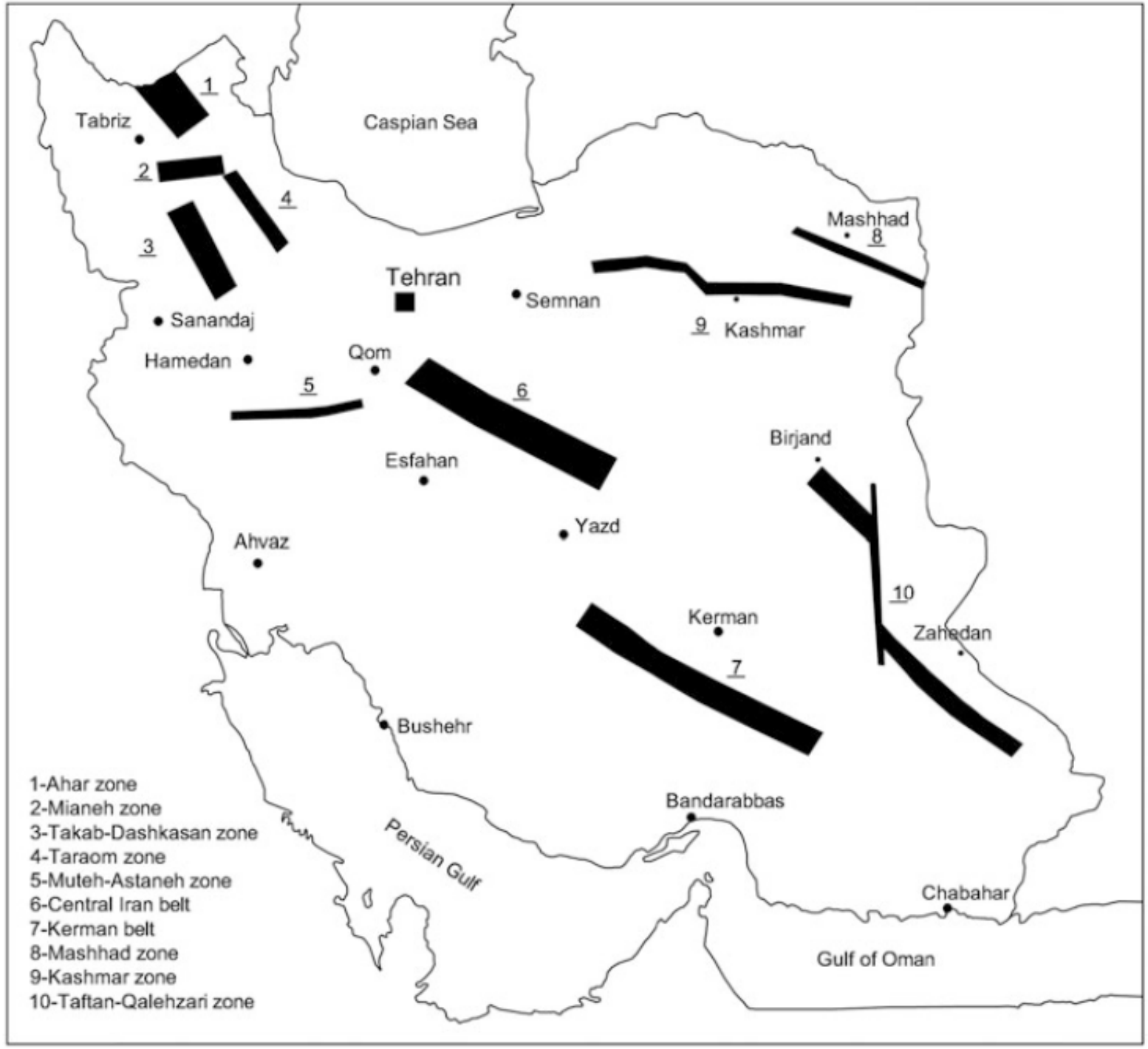


1- Faryab - Esfandaqeh area
2- Sabzevar area
3- East of Iran
4- Dehshir - Baft axis
5- Ianshahr - Fahnuj axis (south of Jazmurian)
6- Neiriz area
7- Torbat e heidarieh - Fariman area
8- Khoy area
9- Nalen - Anarak area
10- Kermanshah area

Fault
Inferred fault
Area of ophiolite outcrops
Region with chromite resources
Quaternary


GOLD DEPOSITS OF IRAN
SCALE 1:10 000 000
CASPIAN SEA
PERSIAN GULF
OMAN SEA
Indication
Small
Medium
Large

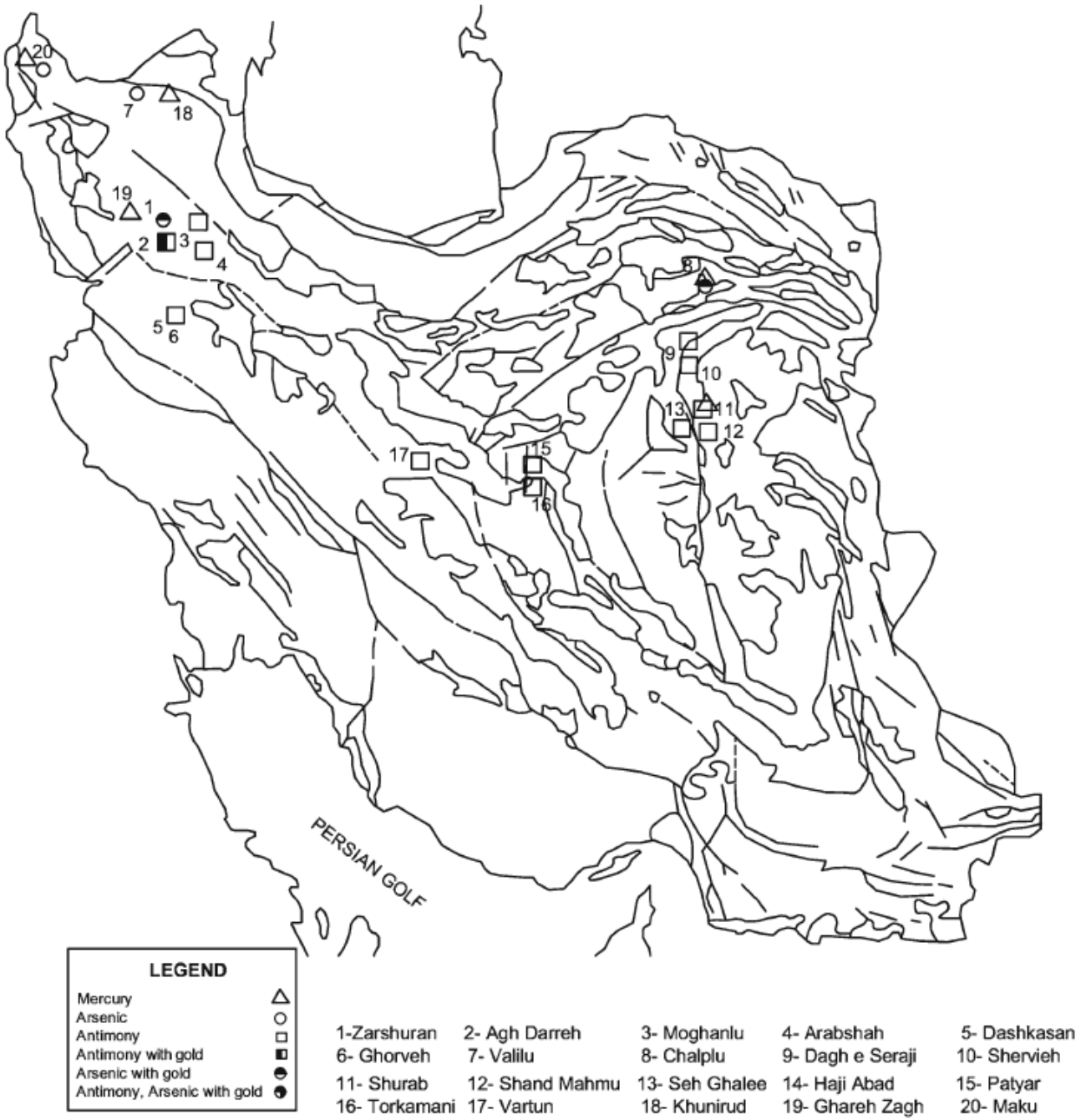
The gold-bearing provinces and areas of Iran (Maghsoudi et al. 2005)



Distribution of antimony, arsenic, and mercury deposits of Iran (Ghorbani 1995)

General characteristics and type of deposit	Associated elements
Hydrothermal deposits having old mafic and ultramafic basement	Sb+As±Hg along with gold
Hydrothermal deposits having old volcanosedimentary basement	Sb+Hg±As along with gold
Hydrothermal deposits having Mesozoic continental basement	Sb+Hg±As±(Pb±Zn)
Hydrothermal deposits having Cretaceous ophiolitic basement	Sb+Hg+As±Au
Hydrothermal deposits having volcanic basement	As

Host rock	Explored areas and name of deposits
Old carbonates and metamorphic rocks	Takab area (Zarshooran, Arabshah, Agh Dareh), Anarak area (Patyar, Torkamani)
Young carbonates and old metamorphic rocks	Takab area (Moghanloo-Agh Dareh, Qizghapan, Qareh Dagh)
Mesozoic clastic rocks and/or younger igneous rocks	Ferdows area (Shoorab, Hesamieh, Se Qal'e, etc.), Qorveh area (Dashkesan)
Rocks of ophiolitic suites and/or their associated igneous rocks	Khoy area (Khan Geli), East of Qa'en (Haji Abad)
Sedimentary rocks	Ahar area (Valiloo)



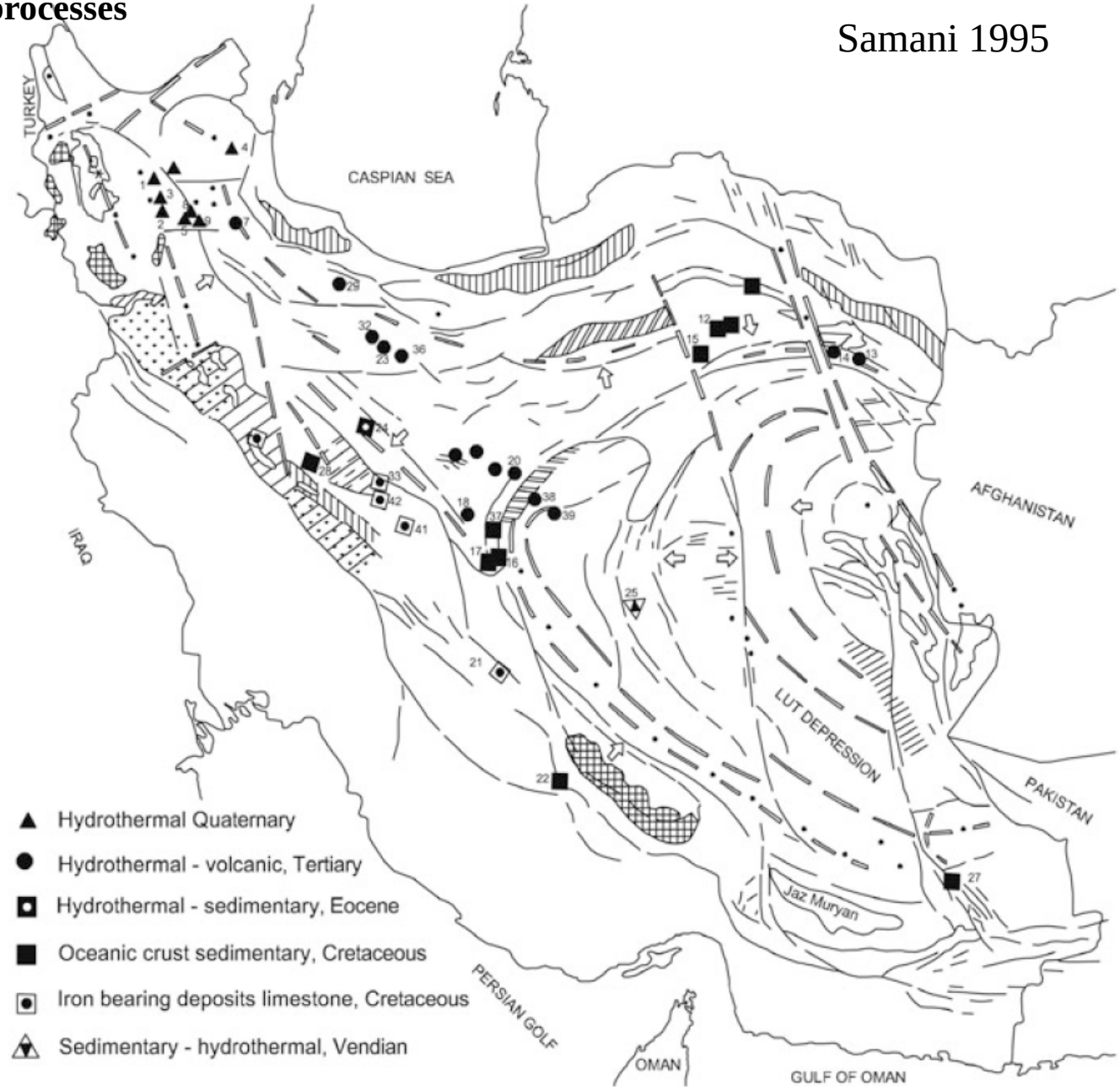
The manganese deposits of Iran are classified into three types (NISCO 1977):

(a) Hydrothermal vein deposits associated with volcano-plutonic processes

(b) Volcanosedimentary deposits

(c) Polygenetic deposits associated with limestone formations

Samani 1995



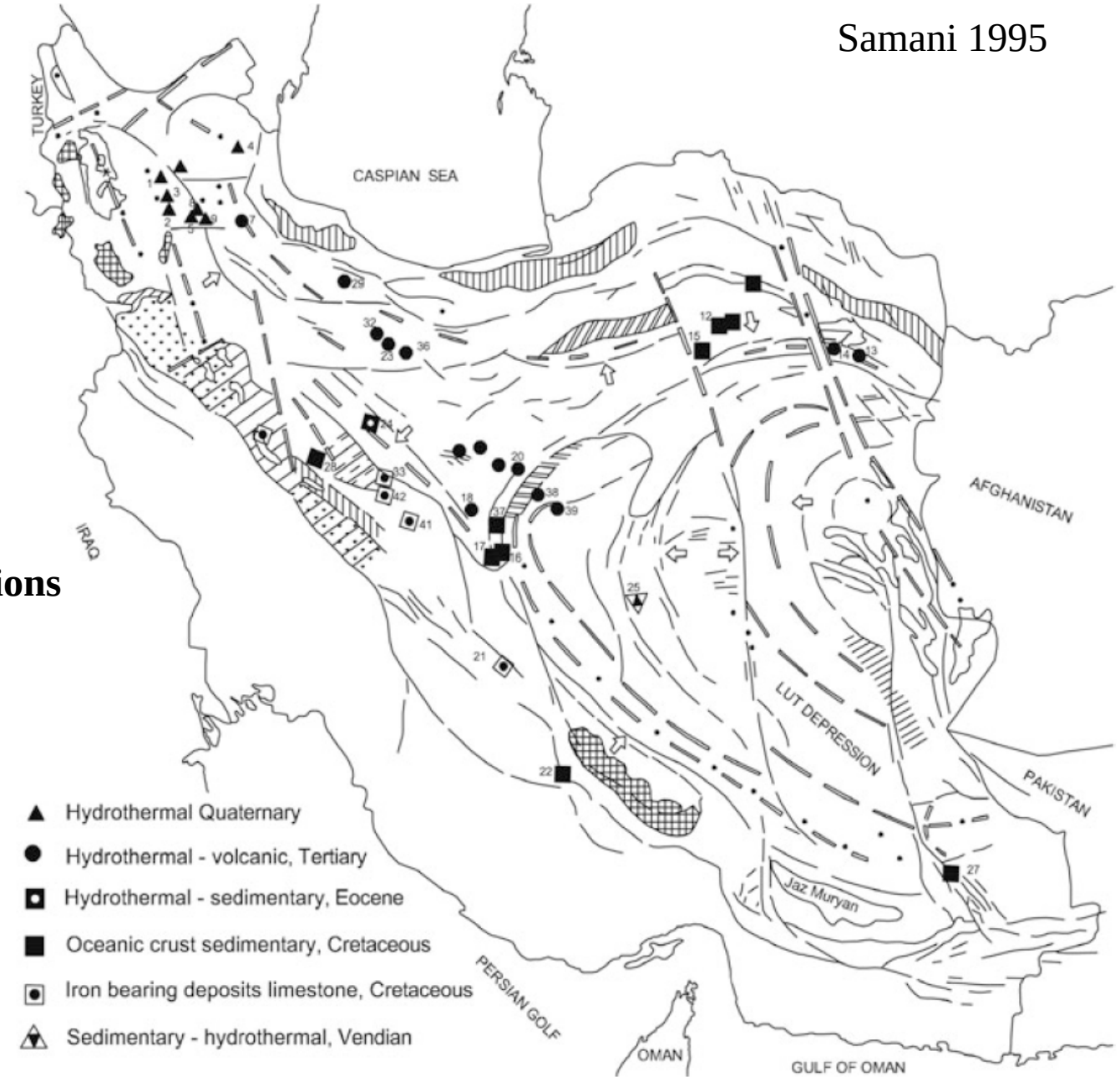
General characteristics of some manganese deposits of Iran

Age	Name of deposit or mineral indication	General characteristic
Neogene and Quaternary	Debakloo, Eideh Koochoo Ghani, Ghoopooz, Vila Dareh, Manamin, Zarshloo, Khalifeh Kamal, Galoojeh, Chai Talvar	Hot spring deposits (terrestrial)
Tertiary (volcanic-plutonic)	Chah Sefid, Sargaz, Robat Karim, Bozni, Sorkhshad, Abdol Abad, Noogh	Hydrothermal–vein (terrestrial)
Late Cretaceous–Paleogene	Venarch, Asad, Bensport, Bagh Qareh, Ab Band, Gonij, Benvid, Salam Rud, Zaboli	Sedimentary–hydrothermal (marine) Volcanosedimentary (marine)
Early Cretaceous	Shams Abad, Chah Basheh	Sedimentary associated with iron (marine)
Paleozoic	Kalat Naser, Heneshk	Associated with iron
Late Precambrian	Narigan, Amir Abad (east of Angooran)	Volcanosedimentary (marine)

Provincial distribution of manganese deposits and indications

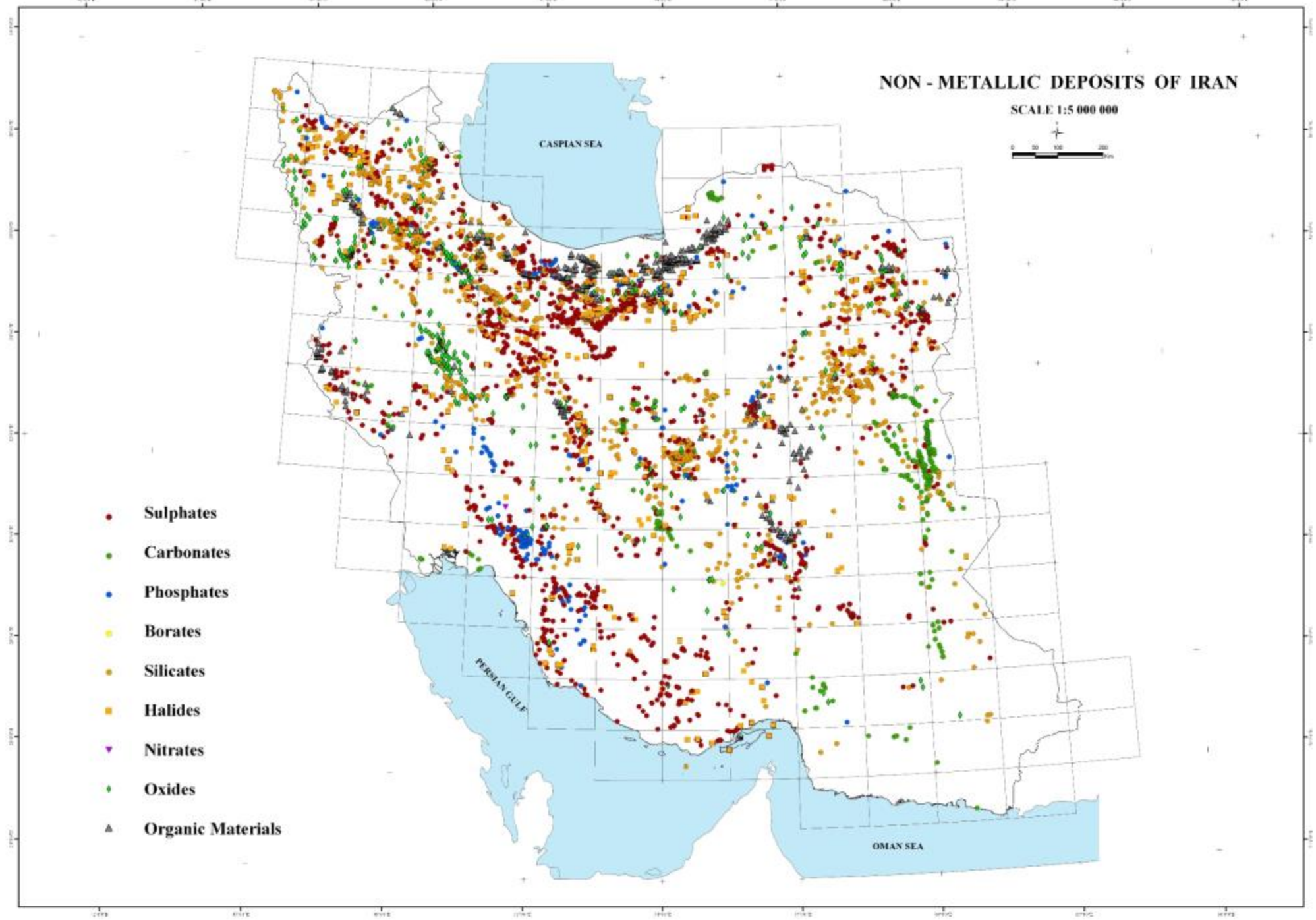
Sr. no.	Name of deposit or indication	Province	Sr. no.	Name of deposit or indication	Province
1	Debalkoo	East Azerbaijan	13	Bozni	Esfahan
2	Eideh Koochoo Ghani	East Azerbaijan	14	Sorkh Shad	Esfahan
3	Ghoopooz	East Azerbaijan	15	Chah Sefid	Esfahan
4	Vila Dareh	East Azerbaijan	16	Robat Karim	Tehran
5	Zarshloo	East Azerbaijan	17	Venarch	Tehran
6	Khalifeh Kamal	East Azerbaijan	18	Bensport	Khorasan
7	Manamin Khalkhal	East Azerbaijan	19	Asad	Khorasan
8	Koloocheh	East Azerbaijan	20	Nogh	Khorasan
9	Chai Talvar	East Azerbaijan	21	Bagh Qareh	Khorasan
10	Janbehan	East Azerbaijan	22	Salam Rud	Khorasan
11	Chahbashi	Esfahan	23	Honeshk	Fars
12	Benvid	Esfahan	24	Ab Band	Fars

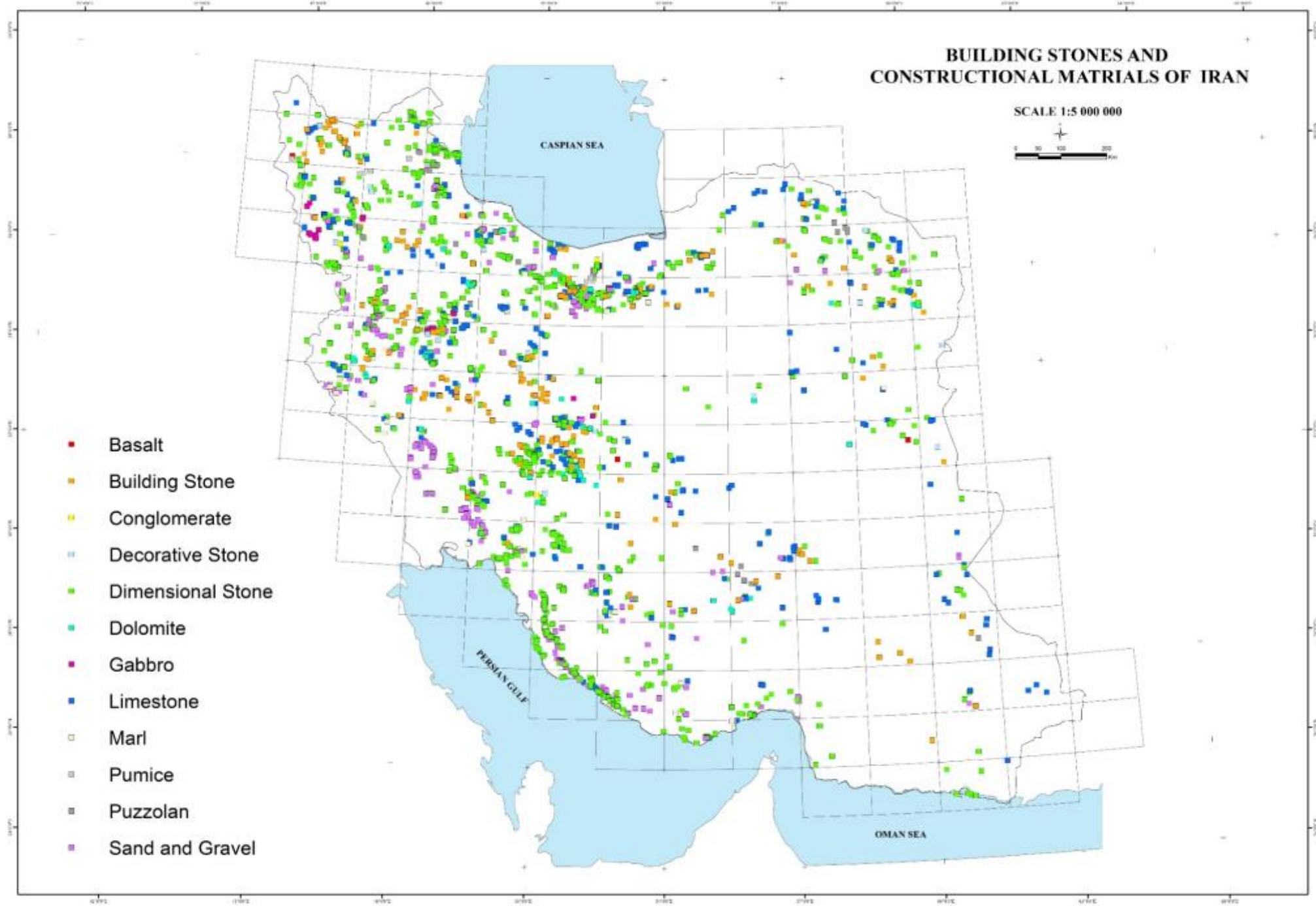
Samani 1995

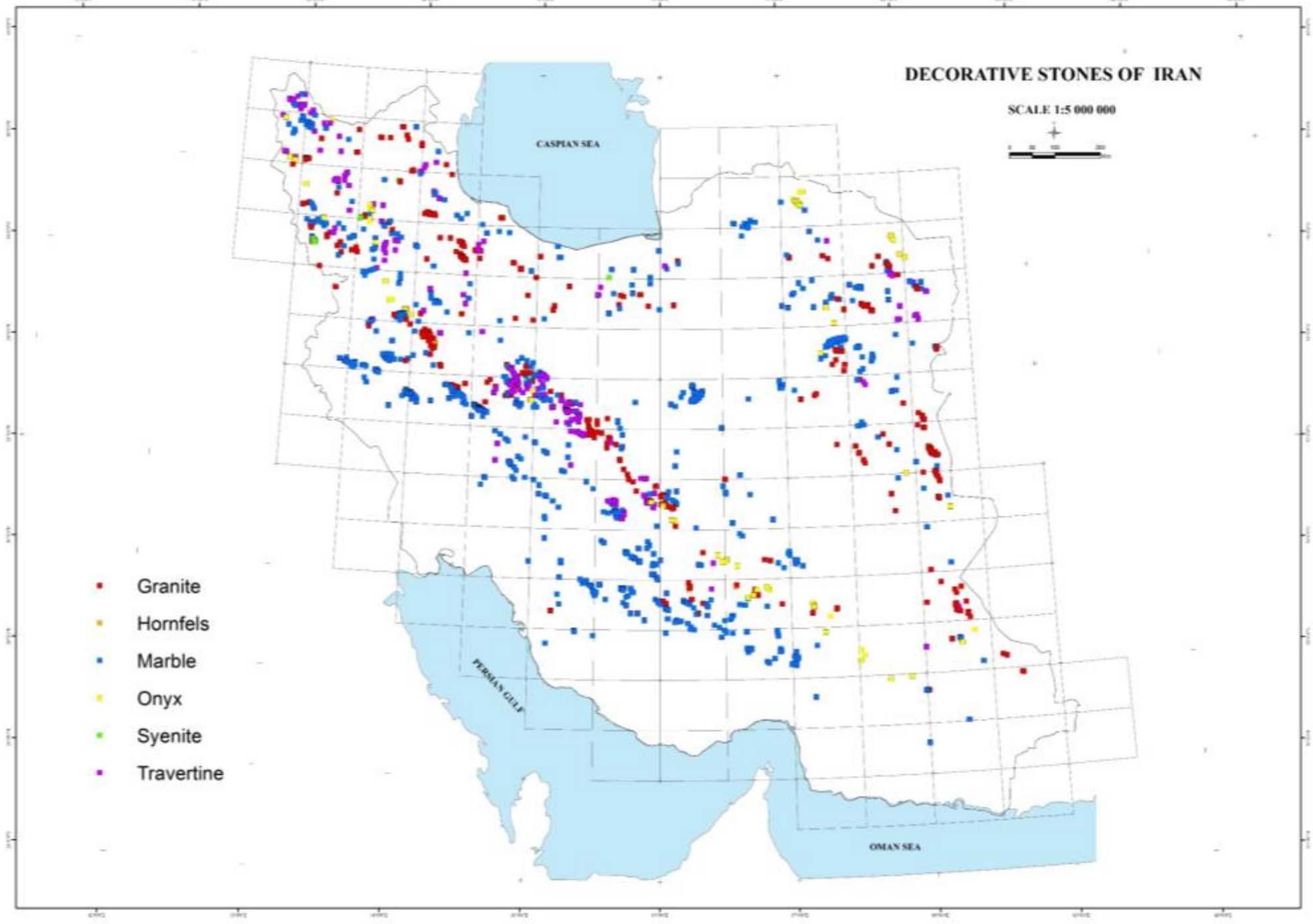


Manganese

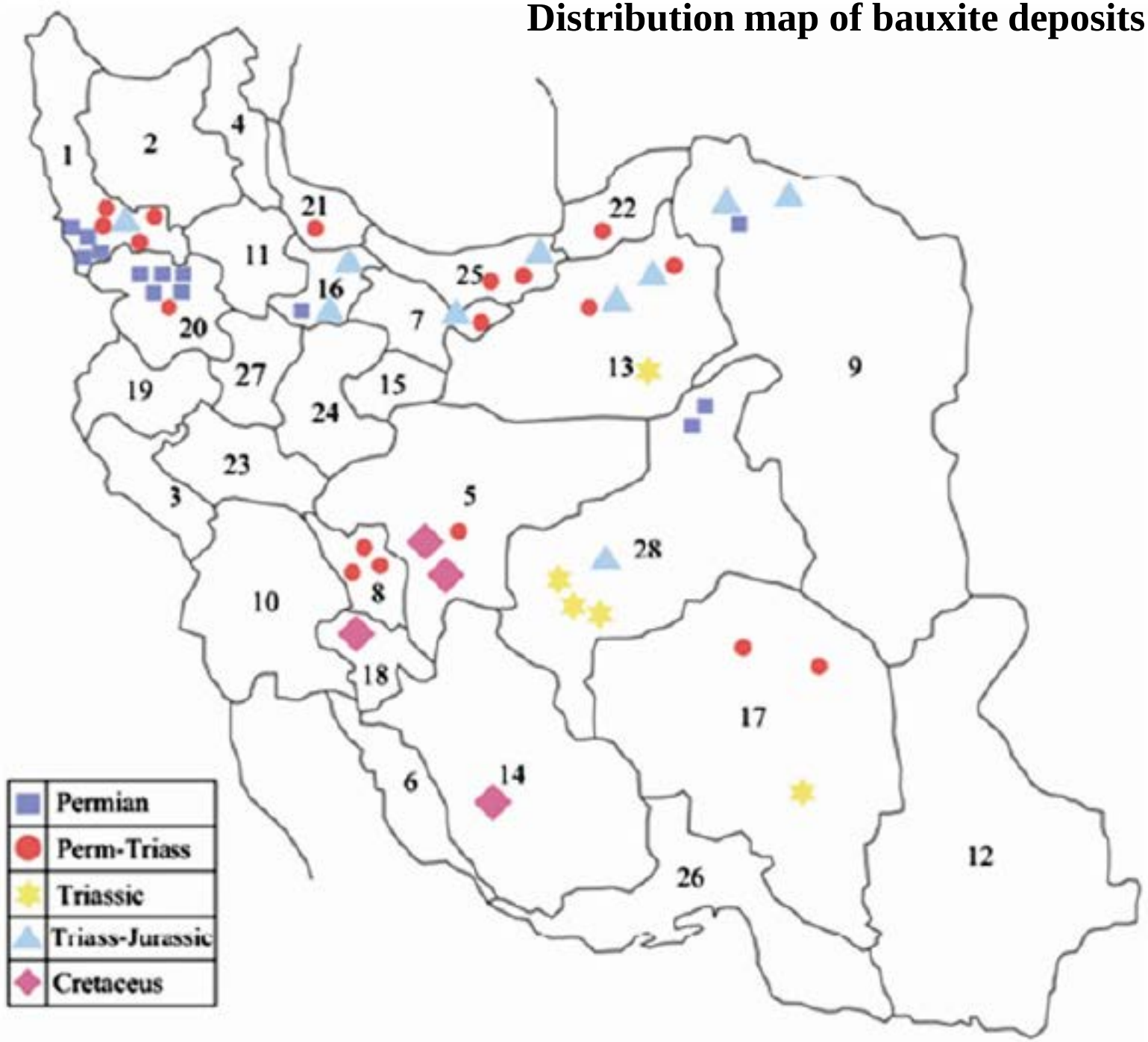
Rank 2012	Rank 2011	Country	Production 2012 metr. t	Share in %
1	(2)	South Africa	3 935 100	20,81
2	(1)	China	3 700 000	19,57
3	(3)	Australia	3 459 840	18,30
4	(4)	Gabon	2 262 000	11,96
5	(5)	Kazakhstan	1 428 000	7,55
6	(6)	Brazil	1 118 000	5,91
7	(7)	India	882 400	4,67
8	(10)	Malaysia	527 800	2,79
9	(8)	Ghana	521 720	2,76
10	(9)	Ukraine	456 600	2,41
11	(11)	Mexico	188 294	1,00
12	(20)	Cote d'Ivoire	112 500	0,59
13	(13)	Georgia	90 000	0,48
14	(15)	Iran	46 000	0,24
15	(17)	Morocco	45 100	0,24


NON - METALLIC DEPOSITS OF IRAN
SCALE 1:5 000 000
CASPIAN SEA
PERSIAN GULF
OMAN SEA
Sulphates
Carbonates
Phosphates
Borates
Silicates
Halides
Nitrates
Oxides
Organic Materials

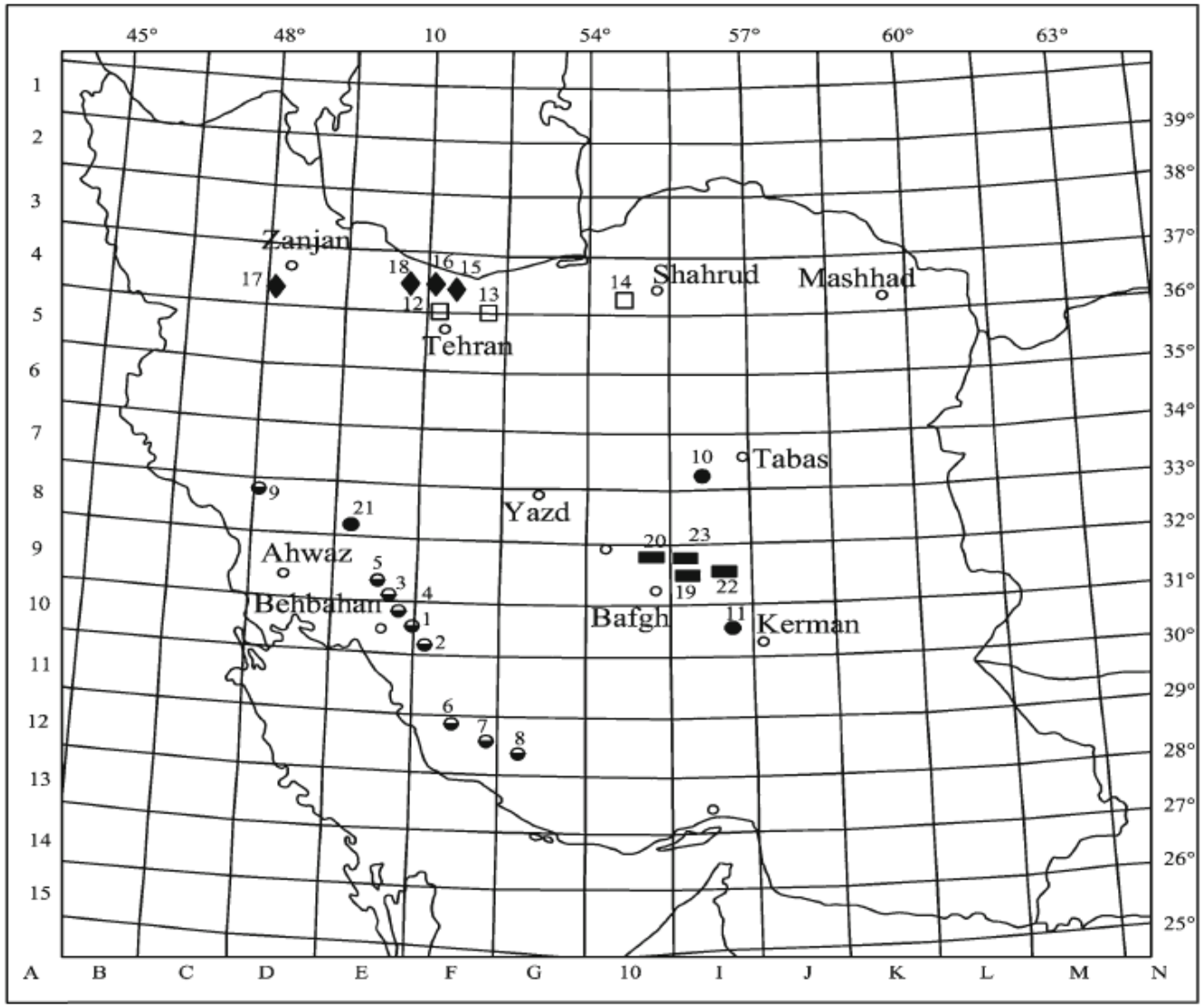

BUILDING STONES AND
CONSTRUCTIONAL MATRIALS OF IRAN
SCALE 1:5 000 000
CASPIAN SEA
PERSIAN GULF
OMAN SEA
Basalt
Building Stone
Conglomerate
Decorative Stone
Dimensional Stone
Dolomite
Gabbro
Limestone
Marl
Pumice
Puzzolan
Sand and Gravel


DECORATIVE STONES OF IRAN
SCALE 1:5 000 000
CASPIAN SEA
PERSIAN GULF
OMAN SEA
Granite
Hornfels
Marble
Onyx
Syenite
Travertine

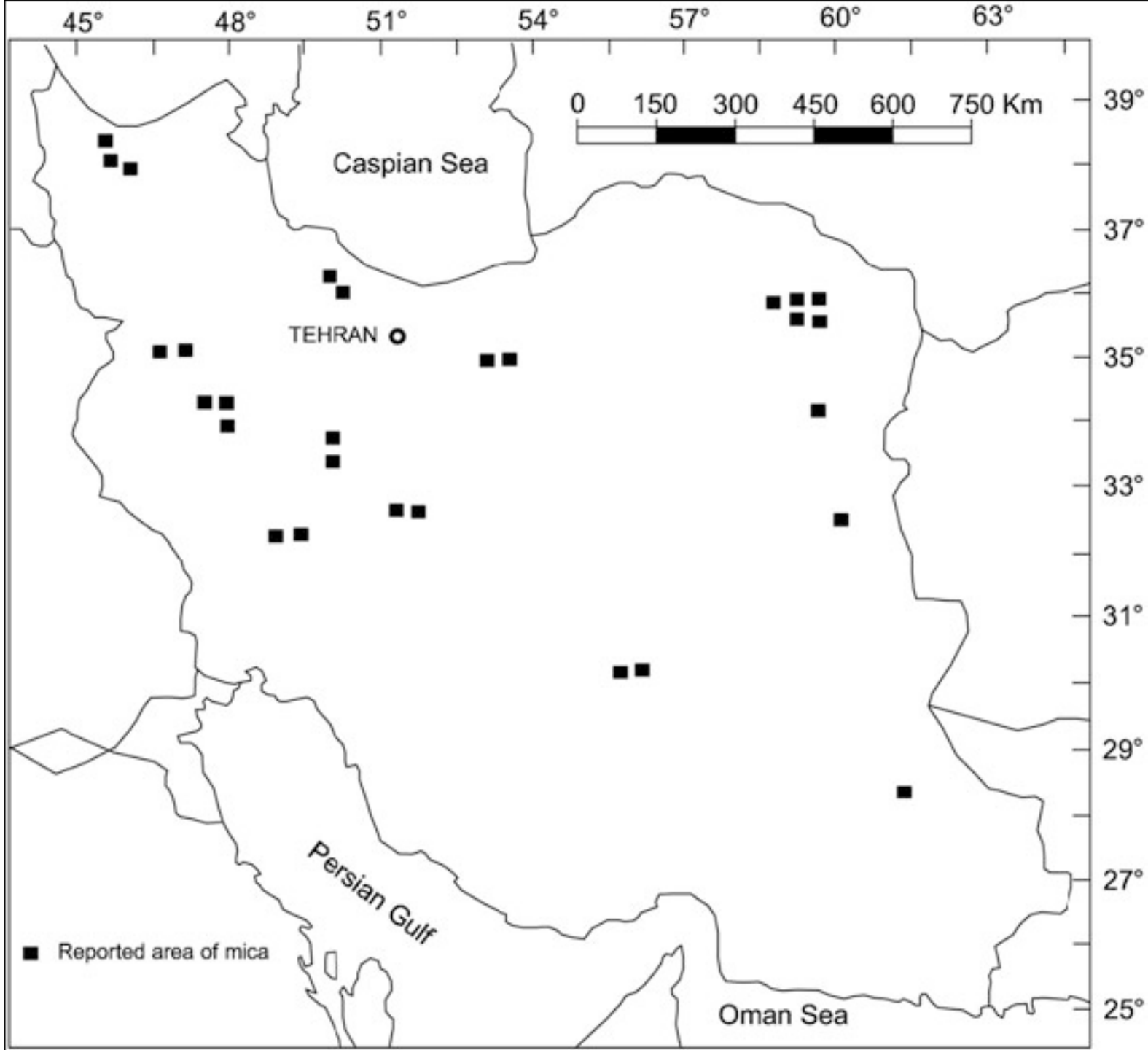
Distribution map of bauxite deposits and indications of Iran (Soheili 2004)



Distribution of Iran phosphate deposits through different geologic periods

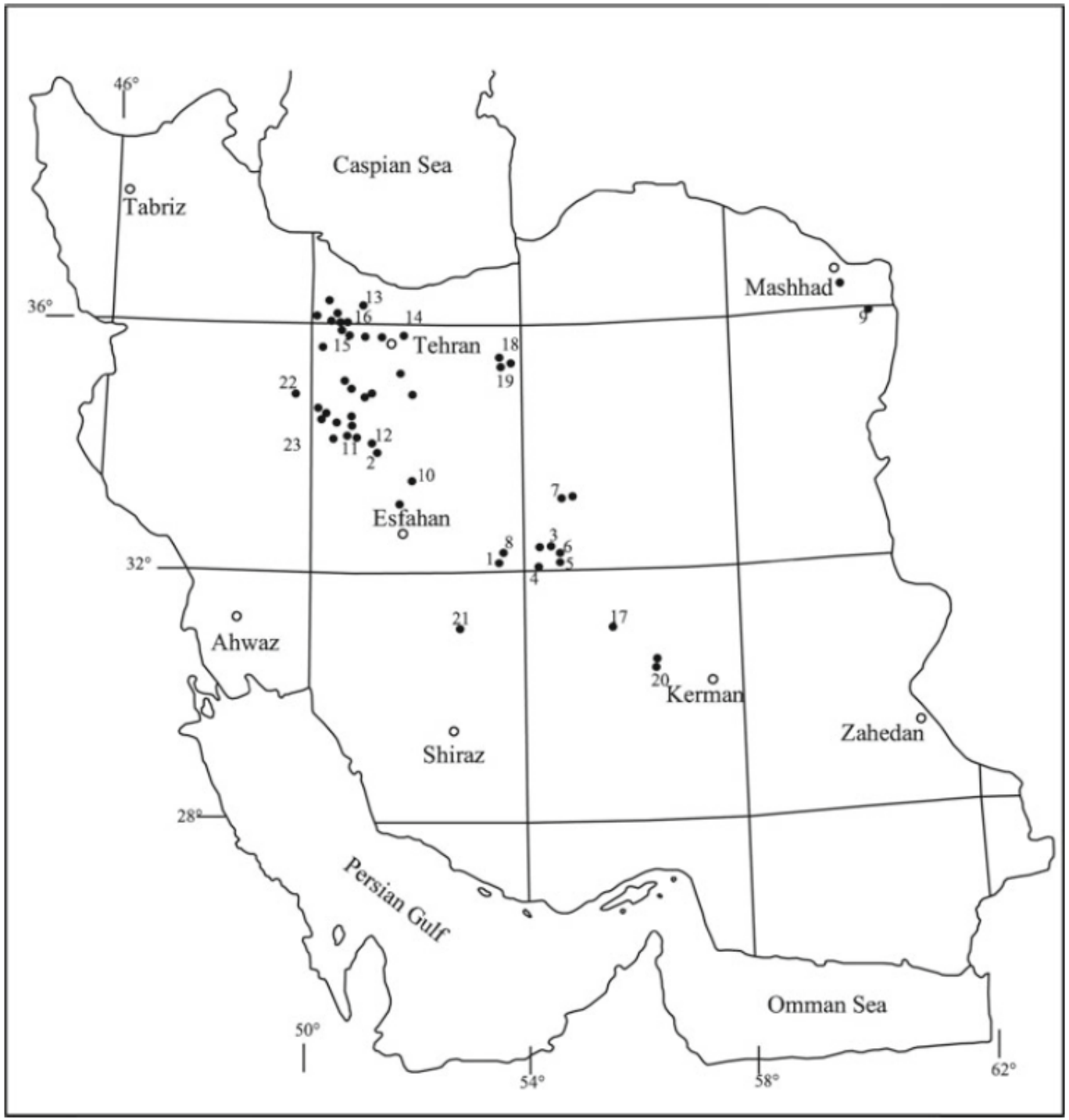


Distribution map of mica deposits of Iran (Ghorbani 2011)

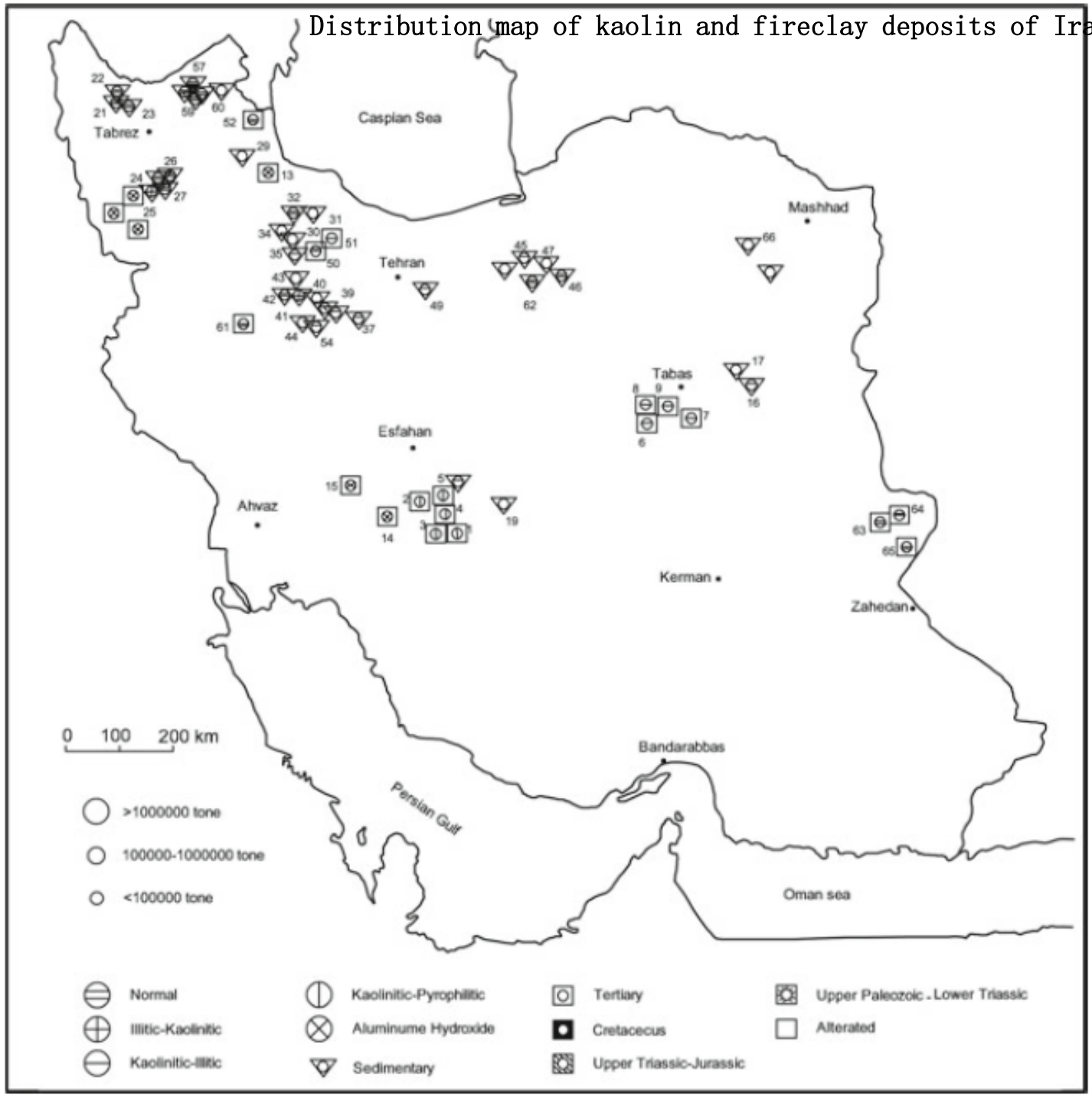


Distribution map of **barite** deposits of Iran (Khoshjou 1999)

(1 Haft-har, 2 Darreh Kashan, 3 Ardekan, 4 Dorbid, 5 Niyook, 6 Dasht-e Deh, 7 Haji Abad, 8 Hoodeh, 9 Ghara Gheytan, 10 Kamshacheh, 11 Tappeh-sorkh Bichegan, 12 Vavan, 13 Elite, 14 Lar, 15 Ahoorak Taleghen, 16 Seplark, 17 Chari-Abtorsh, 18 Garmab, 19 Chah Shirin, 20 Baghin, 21 Khaneh Hozeh-abad, 22 Tang-abad, 23 Jasb)



1- Esteghlal
2- Kavir 5
3- Kavir 16
4- Kavir 17
5- Vijeh
6- Cheshmeh Shotoran
7- Robat-khan
8- Tabas ball clay
9- Chah-bid clay-like deposit
10- Chelpo Shahin-dezh
11- Shahin-dezh
12- Norooz-abad
13- Sang-rud
14- Poshteh-Samirom
15- Dooplan refractory
16- Baghe-siyah Gonabad
17- Kabootar-kuh kaolin
18- Makki Kashmar
19- Abdullah Shahbaz
20- Robat Shah-abbasi
21- Zonooz
22- Blootlook Zonooz
23- Zonooz green clay
24- Issti-soo
25- Maneshakeh
26- Azar-goyooni kaolin
27- Abak
28- Gavazn
29- Zajekan Qazvin
30- Qazvin
31- Abdol-abad
32- Ab-torsh kaolin
33- Kaolin deposit near Alan Ghaya
34- Nikooiyeh
35- Ghazan-daghi
36- Shabolagh
37- Kooshk-e Nosrat
38- Parandak
39- Tavakol-abad kaolin
40- Hajib kaolin
41- Kooshk clay
42- Shirin-goo
43- Shoorjehbolagh-bidloo
44- Deposit near ghezeljeh
45- Ghooshe kaolin-alunite
46- Gandi
47- Komboloo refractory
48- Darreh-jazin
49- Kritoneh clay
50- Soorojin clay
51- Niyagh clay
52- Bibi-janloo clay
53- Ab-garm Mahalt clay
54- Kondaj kaolin-clay
55- Gray clay
56- Issti-soo yellow clay
57- Ghalandari ziling clay
58- Ahar mixed clay
59- Ahar white clay
60- Ghalandari-Ahar ziling clay
61- Lalehjin clay
62- Dasht-e Kalat
63- Brick clay Shileh
64- Shahr-e Sookhteh clay
65- Varmal clay
66- Ghasem-abad



Kaolin

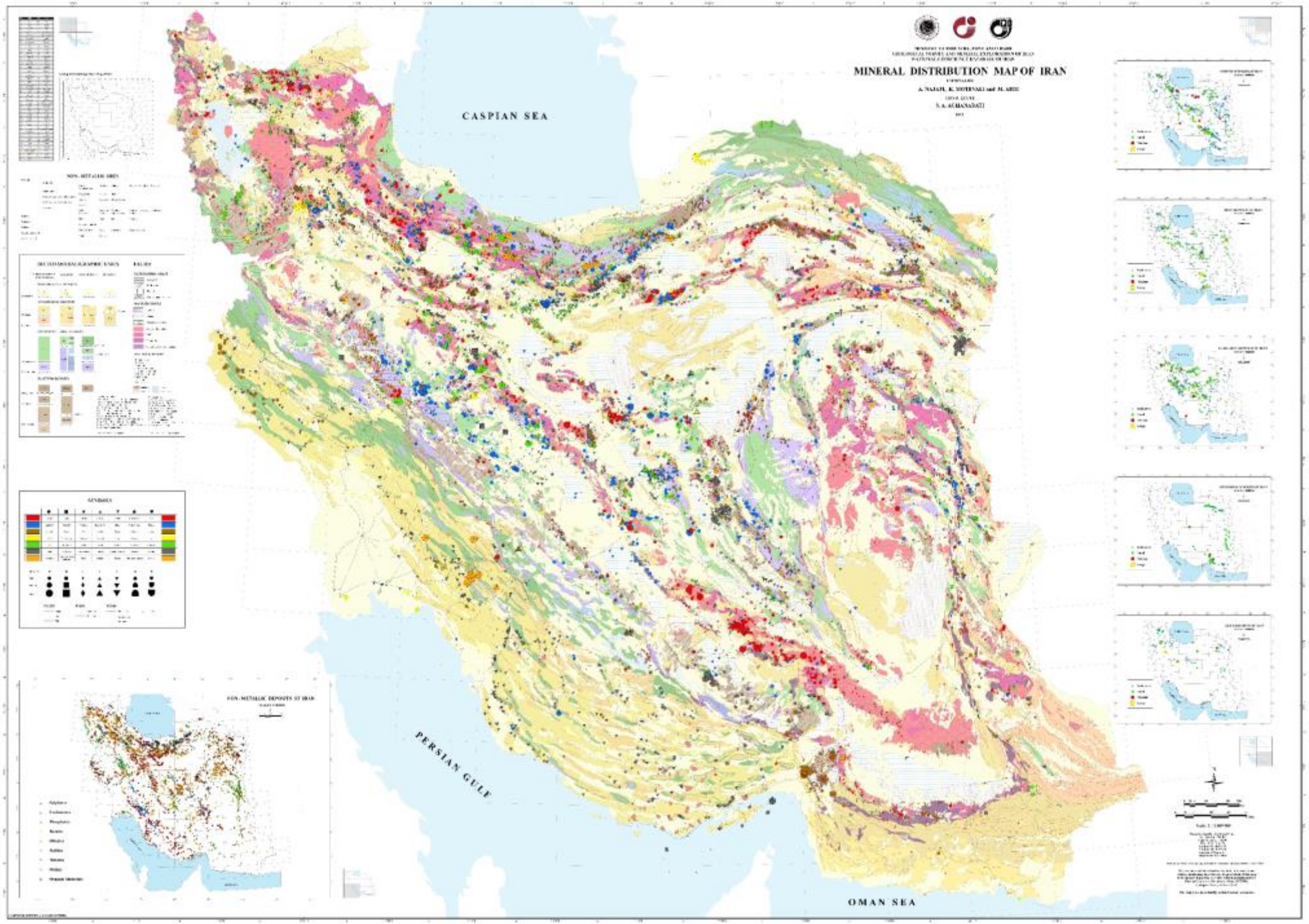
Rank 2012	Rank 2011	Country	Production 2012 metr. t	Share in %
1	(1)	United States	5 900 000	17,18
2	(2)	Germany	4 347 591	12,66
3	(5)	India	3 678 930	10,71
4	(3)	Czech Republic	3 318 000	9,66
5	(4)	China	3 300 000	9,61
6	(6)	Brazil	2 189 000	6,37
7	(8)	Korea, South	1 910 947	5,56
8	(7)	Ukraine	1 736 000	5,05
9	(10)	United Kingdom	1 150 000	3,35
10	(9)	Turkey	980 924	2,86
11	(11)	Iran	800 000	2,33
12	(12)	Vietnam	650 000	1,89
13	(24)	Mexico	514 730	1,50
14	(13)	Malaysia	438 923	1,28
15	(16)	Spain	332 000	0,97

Distribution map of bentonite deposits of Iran

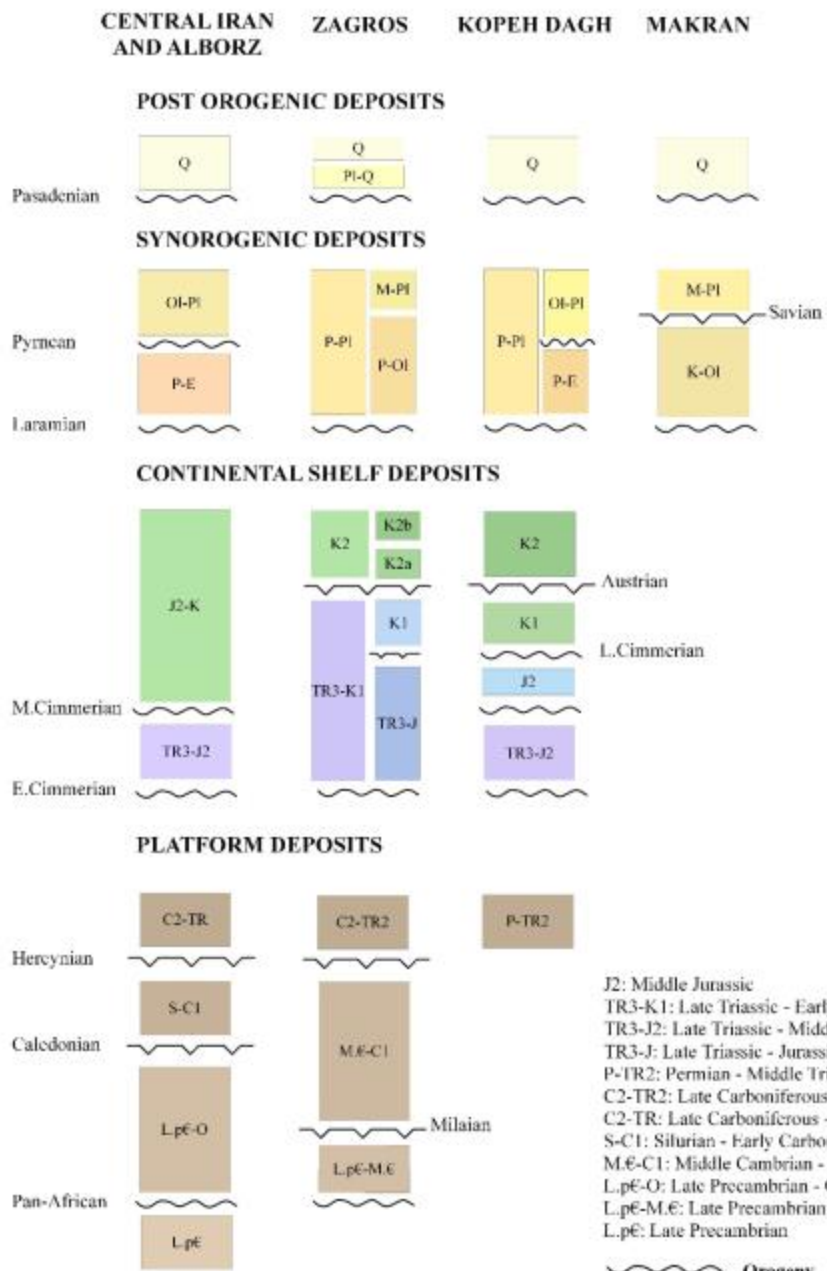
The primary mineral of all bentonites in Iran is montmorillonite. In most of these, bentonites minerals like cristobalite, quartz, and calcite are found as secondary minerals. It is interesting to note that in the bentonite deposits of Iran, montmorillonite and kaolinite minerals are not paragenetic. Evidences from mineralogical studies and fi eld observations indicate that wherever these two minerals are seen together, the minerals and the host rocks show stratiform structure, and the minerals are the result of erosion and sedimentation (they are not in situ) and do not form high-quality deposits.

Chemical composition of bentonite deposits of Iran

Deposit name	Total	H_2O-	H_2O+	MgO	CaO	Al_2O_3	SiO_2	$FeO^+ Fe_2O_3$	K_2O	Na_2O
Goosh-mir	100.51	6.06	6.52	2.02	6.8	12.43	63	0.59	0.44	2.65
Hessami-ye Ferdows	101.54	4.3	14.37	2.52	9.81	12.66	50	1.88	3.67	2.33
Jahrom	100.77	9.38	8.02	5.24	1.61	21.04	53.06	1.13	1.29	0
Kheyr-abad-e Kerman	98.43	8.03	11.3	2.9	1.94	14.4	56.49	1.24	0.62	1.51
Khoshab-e Kashmar	100.6	12.81	11.6	2.67	10.57	14.34	41.6	4.95	0.28	1.78
Kilan	99.67	7.68	5.56	4.36	2.66	17.11	54.38	4.3	1.3	2.32
Mehrjan	99.97	5.19	4.41	2.67	1.54	15.09	66.79	1.69	0.26	2.33
Rashm	99.46	5.49	4.99	1.92	0.77	16.65	62.07	2.16	1.14	4.27
Siah Kuh	99.21	4.91	4.03	1.92	1.33	13.37	68.6	1.37	0.91	2.77
Soosan-var	89.67	3.1	5	1.11	2.03	10.04	62.53	1.2	1.13	3.53
Tafresh	98.87	9.46	6.31	3.75	1.47	18.85	53.09	3.2	1.3	1.44
Zarrin	99.45	3.76	8	1.81	6.66	14.24	55.9	3.74	1.31	4.03


MINERAL DISTRIBUTION MAP OF IRAN
CASPIAN SEA
PERSIAN GULF
OMAN SEA

TECTONOSTRATIGRAPHIC UNITS



J2: Middle Jurassic
TR3-K1: Late Triassic - Early Cretaceous
TR3-J2: Late Triassic - Middle Jurassic
TR3-J: Late Triassic - Jurassic
P-TR2: Permian - Middle Triassic
C2-TR2: Late Carboniferous - Middle Triassic
C2-TR: Late Carboniferous - Triassic
S-C1: Silurian - Early Carboniferous
M.Є-C1: Middle Cambrian - Early Carboniferous
L.pЄ-O: Late Precambrian - Ordovician
L.pЄ-M.Є: Late Precambrian - Middle Cambrian
L.pЄ: Late Precambrian

Orogeny

Q: Quaternary
Pl-Q: Pliocene - Quaternary
M-Pl: Miocene - Pliocene
Ol-Pl: Oligocene - Pliocene
P-Pl: Paleocene - Pliocene
P-Ol: Paleocene - Oligocene
P-E: Paleocene - Eocene
K-Ol: Cretaceous - Oligocene
K2: Late Cretaceous
J2-K: Middle Jurassic - Cretaceous
K1: Early Cretaceous

Epeirogeny

FACIES

METAMORPHIC GRADE

- Low grade
- Medium grade
- High grade
- Contact metamorphism

MAGMATIC ROCKS

- Plutonic
- Volcanic
- Volcanosedimentary
- Acid & Intermediate
- Mafic
- Ultramafic
- Ophiolite & Colored melange

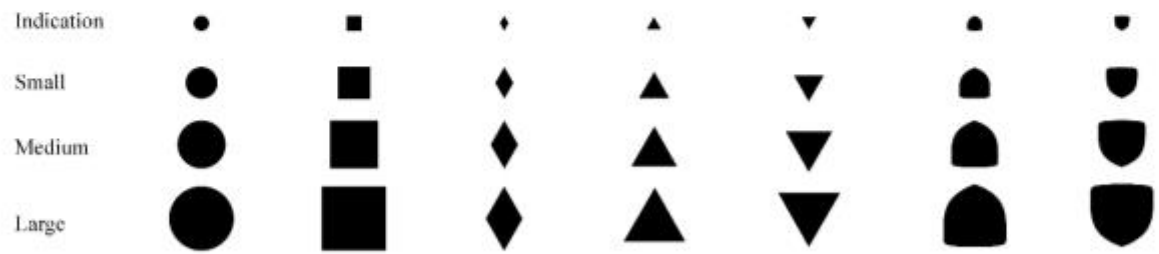
MAGMATIC EPISODS

PP:Post Pyrnean
Py:Pyrnean
L:Laramid
C3:Late Cimmerian
C2:Middle Cimmerian
C1:Early Cimmerian
H:Hercynian
C:Caledonian
Pa:Pan-African

- Salt Dome

SYMBOLS

	●	■	♦	▲	▼			
	Copper	Agate	Fluorite	Fire clay	Lithium	Tungsten-Tin	Mica	
	Lead-Zinc	Turquoise	Magnesite	Industrial clay	Halite	Nickel-Cobalt	Huntite	
	Chromium	Garnet	Coal	Kaolinite	Borate	Celestite	Bitumen	
	Gold	Molybdenum	Sulphur	Bentonite	Iodine	Uranium	Shell	
	Barite	Talc-Asbestos	Perlite	Zeolite	Sulphate	Andalusite	Diatomite	
	Iron	Manganese	Bauxite-Laterite	Alunite	Gypsum-Anhydrite	Mercury	Graphite	
	Phosphate	Realgar-Orpiment-Antimony	Silica	Feldspar	Potash	Titanium-Zirconium	Nitrate	



FAULTS

Major

Minor

Thrust

FOLDS

Anticline

Syncline

ROADS

First class

Second class

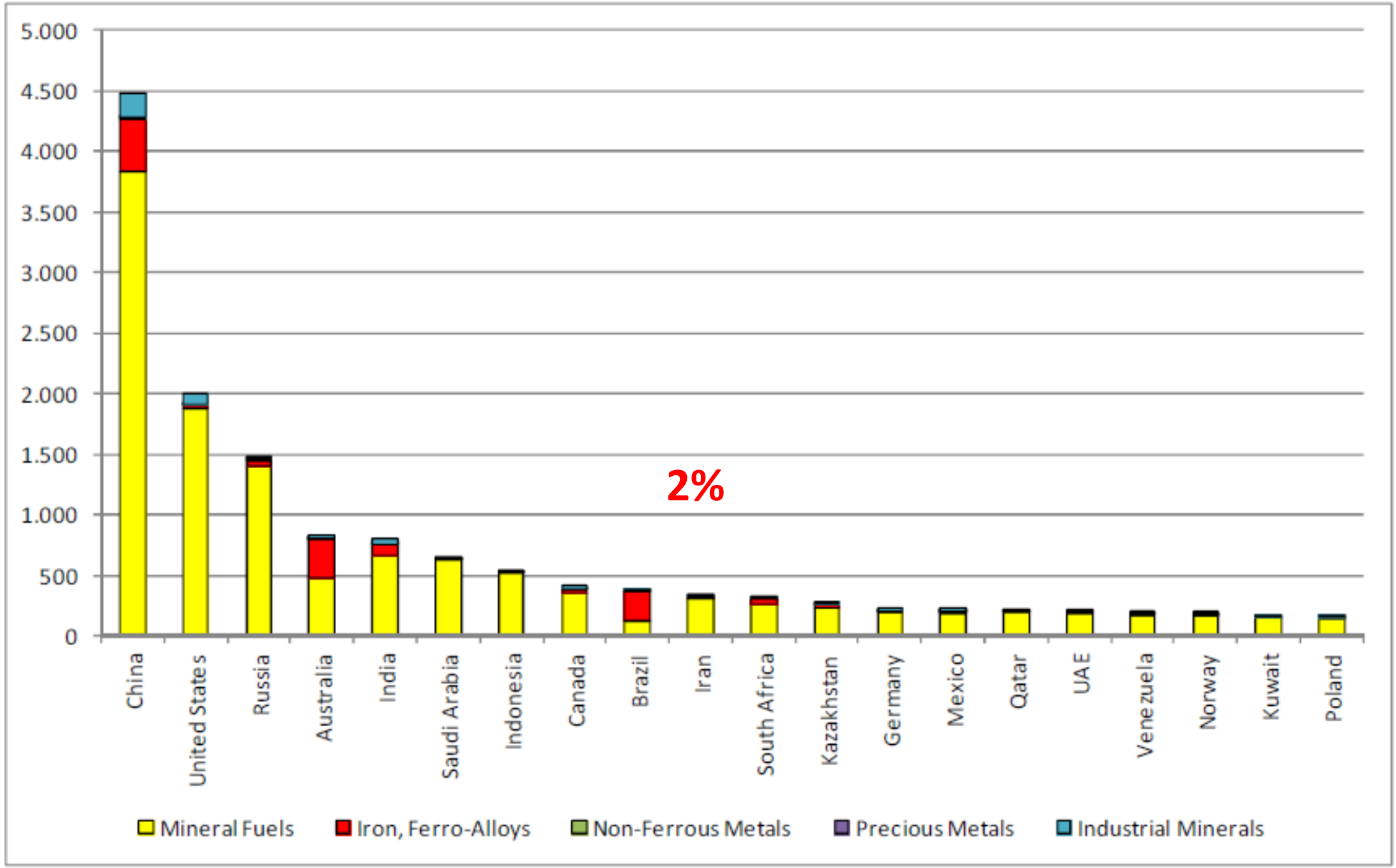
Railroad

City

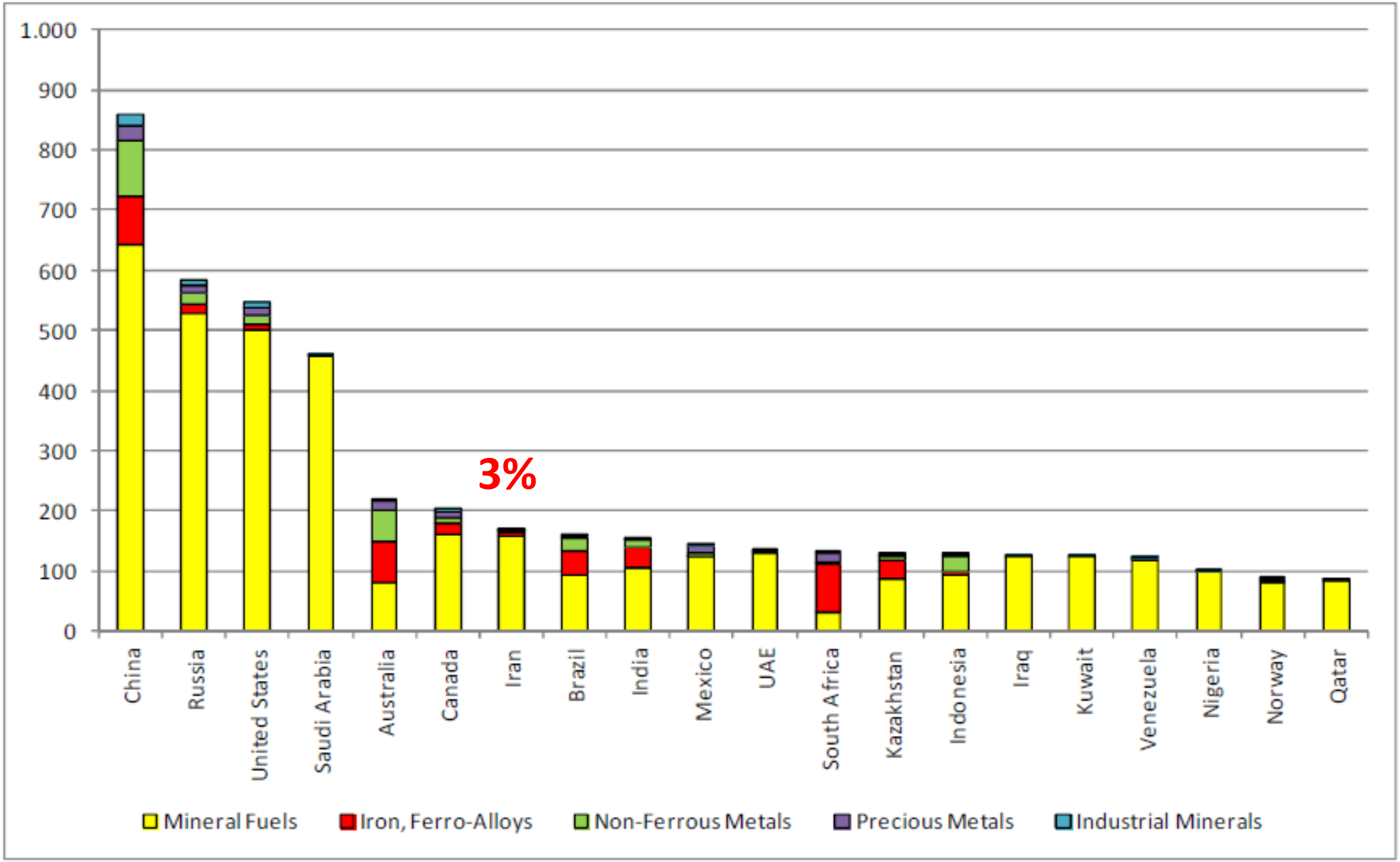
NON – METALLIC ORES

Oxysalts						
	Sulphates					
		Barite Sulphate (i.g.)	Celestite	Alunite	Gypsum-Anhydrite	Fireclay
	Carbonates					
		Magnesite	Huntite	Shell		
	Hydrous- Anhydrous **Phosphates**					
		Apatite	Turquoise	Phosphate (i.g.)		
	Hydrous- Anhydrous **Borates**					
		Borates				
	Silicates					
		Mica Feldspar	Bentonite Zeolite	Kaolinite Talc-Asbestos	Industrial clay (i.g.) Perlite	Andalusite
Halides						
		Halite	Potash	Iod	Fluorite	
Nitrates						
		Potassium nitrate				
Oxides						
		Quartz-Silica	Agate	Diatomite	Bauxite-Laterite	
Organic materials						
		Coal	Bitumen			

(i.g) : In general



20 largest producer countries 2012 (without construction minerals, in Million metr. t)



20 largest producer countries 2012 (without construction minerals, in Billion US$)

Types of mineral deposits of Iran

Metallic minerals	Nonmetallic minerals	Nonmetallic minerals	Building materials	Fossil fuel
Copper	Turquoise	Sepiolite	Building and decorative stone	Oil
Iron	Phosphate	Bitumen	Gypsum	Gas
Manganese	Salt	Orpiment	Rubble stone	Condensate
Chromite	Sulfur	Asbestos	Pumice	Coal
Gold	Sodium sulfate	Sylvite	Perlite	
Molybdenum	Kaolinite	Chalk	Pozzolan and pozzolanic tuff	
Lead	Bentonite	Vermiculite	Scoria	
Aluminum	Talc	Borax		
Antimony	Mica	Barite		
Arsenic	Feldspar	Magnesite		
Mercury	Silica	Celestite		
Silver	Fluorite	Garnet		
Polymetal	Alunite	Dolomite		
Pyrite	Nepheline syenite	Zeolite		
Uranium	Limestone	Diatomite		
Zinc	Ochre	Agate		
Tungsten	Fireclay	Bauxite		

Iran

		2007	2008	2009	2010	2011	Change 07/11	Change 10/11
Iron	(t)	16 640 000	15 091 200	16 956 300	18 841 000	25 511 100	53,31	35,40
Chromium	(t)	59 770	115 670	109 705	91 064	140 000	134,23	53,74
Manganese	(t)	35 020	41 293	42 500	44 540	45 900	31,07	3,05
Molybdenum	(t)	2 500	3 600	3 800	6 683	3 700	48,00	-44,64
Aluminium	(t)	203 600	241 300	281 300	303 000	321 900	58,10	6,24
Antimony	(t)	0	0	0	600	600	.	0,00
Arsenic	(t)	100	100	100	100	100	0,00	0,00
Bauxite	(t)	500 000	520 000	322 800	714 801	700 000	40,00	-2,07
Copper	(t)	244 200	248 100	262 599	210 000	259 100	6,10	23,38
Lead	(t)	31 864	26 905	27 000	25 000	30 000	-5,85	20,00
Mercury	(t)	0	0	0	1 800	1 800	.	0,00
Zinc	(t)	75 000	86 000	115 000	200 000	130 000	73,33	-35,00
Gold	(kg)	850	850	850	850	400	-52,94	-52,94
Silver	(kg)	40 000	40 000	40 000	40 000	40 000	0,00	0,00

Iran

		2007	2008	2009	2010	2011	Change 07/11	Change 10/11
Baryte	(t)	280 300	343 750	200 000	269 134	270 000	-3,67	0,32
Bentonite	(t)	180 000	356 989	376 000	542 935	545 000	202,78	0,38
Boron	(t)	1 603	1 150	1 000	1 060	1 000	-37,62	-5,66
Diatomite	(t)	1 500	9 600	2 000	3 000	3 000	100,00	0,00
Feldspar	(t)	512 261	501 821	502 000	533 117	540 000	5,42	1,29
Fluorspar	(t)	68 192	61 592	62 000	59 831	60 000	-12,01	0,28
Graphite	(t)	0	0	0	360	360	.	0,00
Gypsum	(t)	16 000 000	17 691 242	17 700 000	18 313 023	18 300 000	14,38	-0,07
Kaolin	(t)	700 000	945 758	907 487	761 530	762 000	8,86	0,06
Magnesite	(t)	112 229	115 087	130 575	173 530	170 000	51,48	-2,03
Perlite	(t)	30 000	40 307	47 000	19 168	20 000	-33,33	4,34
Phosphates	(t)	40 500	76 143	75 000	108 730	110 000	171,60	1,17
Salt	(t)	2 534 871	2 447 428	2 200 000	2 997 441	3 200 000	26,24	6,76
Sulfur	(t)	1 456 000	1 570 000	1 570 000	1 780 000	1 575 000	8,17	-11,52
Talc	(t)	91 000	90 000	66 383	62 672	63 000	-30,77	0,52
Vermiculite	(t)	0	0	0	1 200	1 200	.	0,00

Iran

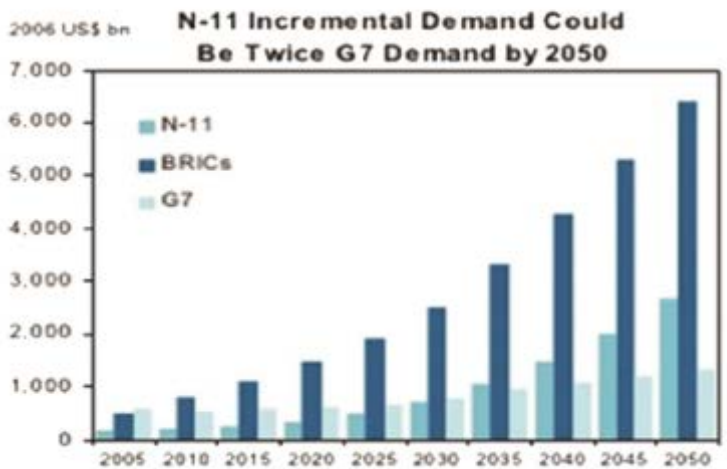
		2007	2008	2009	2010	2011	Change 07/11	Change 10/11
Steam Coal	(t)	324 000	324 000	104 000	99 000	113 000	-65,12	14,14
Coking Coal	(t)	1 039 000	1 266 000	1 048 000	926 000	1 061 000	2,12	14,58
Nat. Gas	(Mio m^3)	111 900	116 300	131 200	146 200	151 800	35,66	3,83
Petroleum	(t)	209 600 000	213 000 000	204 000 000	207 100 000	205 800 000	-1,81	-0,63
Total	(t)	340 283 551	348 255 076	352 072 590	371 150 360	381 178 800		

Some Highlights of Mineral reserve and production

- **10th largest Iron reserves**
- **First largest Gypsum reserves**
- **One of 10 countries with large copper, lead and zinc reserves**
- **4th largest producer of Cement**
- **10th largest producer of Steel**
- **One of 10 producers of Molybdenum, feldspar, Fluorspar, Lime, Dimensional stone, Barite**

- Iran ranks 2th in the world in natural gas reserve and 4th in oil reserve
- Iran has the largest and most diverse manufacturing base in the Middle East
- Young educated people
- Large domestic market
- Developed infrastructure, telecommunications and energy
- 10th rank in tourism industry and ecotourism potential

New studies by Economic research groups identified N11, 11 economies that can be surpass the G7 in share of global growth.
Iran was listed one of the N11 economies.



GDP prediction for 2050 (billions US$)

Position in 2050	Country	2050	2040	2030	2020	2015
1	China	70.710	45.022	25.610	12.630	8.133
2	USA	38.514	29.823	22.817	17.978	16.194
3	India	37.668	16.510	6.683	2.848	1.900
4	Brazil	11.366	6.631	3.720	2.194	1.720
5	Mexico	9.340	5.471	3.068	1.742	1.327
6	Russia	8.580	6.320	4.265	2.554	1.900
7	Indonesia	7.010	3.286	1.479	752	562
8	Japan	6.677	6.042	5.814	5.224	4.861
9	Iran	5.945	3.085	1.673	994	716
10	United Kingdom	5.133	4.344	3.595	3.101	2.835

Some commodities production

Mineral	Production (000ton)
Iron Ore	50,000
Steel	17,000
Copper (cathode)	200
Lead	40
Zinc	105
Sulfur	1,900
feldspar	600
Fluorspar	70
Gypsum	13,000
Barite	270
Cement	75,000
Aluminum	350
Chromite	400
Gold	3 (ton)
Manganese (Mn content)	70

Some commodities reserve

Mineral	Reserve (million ton)
Iron Ore	2500
Copper	3000
Lead and Zinc ore	90
Gypsum	900

Thanks for your attention