

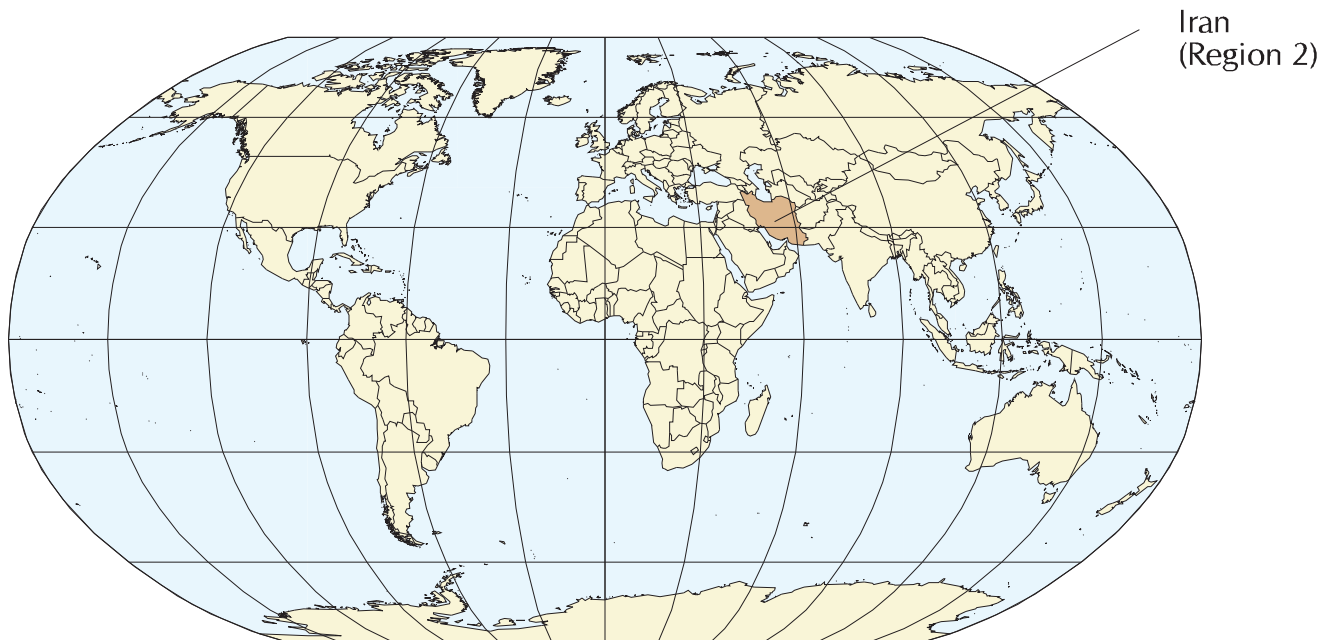
U.S. Department of the Interior
U.S. Geological Survey

MAP SHOWING GEOLOGY, OIL AND GAS FIELDS, AND GEOLOGIC PROVINCES OF IRAN

by R. M. Pollastro¹, F. M. Persits², and D. W. Steinshouer²

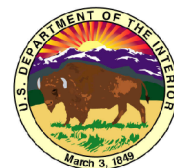
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² Contractor to the U.S. Geological Survey, Denver, CO



Open-File Report 97-470G, ver.1.0

This report is preliminary and has not been reviewed for conformity with U. S. Geological Survey editorial standards and stratigraphic nomenclature. Any use of trade names is for descriptive purposes only and does not imply endorsement by the U. S. government.



U.S. Geological Survey Open File Report 97-470G, ver.1.0

**MAP SHOWING GEOLOGY, OIL AND GAS FIELDS,
AND GEOLOGIC PROVINCES OF IRAN**

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Map showing geology, oil and gas fields and geologic provinces of Iran



INTRODUCTION

This digitally compiled map includes geology, oil and gas field centerpoints, geologic provinces, and major faults of Iran with some of these components extended into geographically adjacent areas. This digital compilation is an interim product of the U.S. Geological Survey's World Energy Project (WEP) and part of a series on CD-ROM. The goal of the WEP is to assess the undiscovered, technically recoverable oil and gas resources of the world and report the result of this assessment in the year 2000. For data management purposes, the world was divided into eight energy regions corresponding approximately to the economic regions of the world as defined by the U.S. Department of State.

Each world energy region was then further divided into geologic provinces on the basis of natural geologic entities and may include a dominant geologic structural element or a number of contiguous elements. Some provinces contain multiple, genetically-related basins. Geologic province boundaries for Iran were delineated using data from different geologic maps, publications, and other tectonic and geographic data. Each province was assigned a unique number; the first digit is the region number. An attempt was made to number the provinces in geographical order or groups with numbering starting at the Arabian Shield (see Pollastro and others, 1998). The list of provinces sorted by number is shown to the right of the map.

Centerpoints of oil and gas fields are shown and were plotted with permission from Petroconsultants International Data Corporation, 1996 worldwide oil and gas field database. Allocation of field data to geologic provinces provided a ranking of the provinces by total known petroleum volume (see Klett and others, 1997). The WEP further characterizes the geologic provinces by petroleum system and assessment units in order to assess the undiscovered petroleum volume.

Specific details of map and data sources, and the procedure used in the compilation of this geologic map of Iran are given in the metadata file and described briefly in the text below. Stratigraphic subdivisions of Phanerozoic rocks were combined to simplify the geology and maintain consistency with other maps in this series. Precambrian rocks are undivided. This map was compiled using Environmental Systems Research Institute, Inc.(ESRI) ARC/INFO software. Political boundaries and cartographic representations are used, with permission, from ESRI's ArcWorld 1:3M digital coverages, have no political significance, and are displayed for general reference only.

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DATA PROCESSING STEPS

This map has been digitally compiled and abstracted from The Geological Map of Iran, (1985) Compiled by **A. Haghypour and A. Aghanabati, Ministry of Mines and Metals, Geological Survey of Iran, Scale 1:2,500,000.**

The projection information written on the original map is ".. adjusted from Polyconic Projection of International 1:1000000 Map of the Earth". Because such projection is not directly supported by **ESRI's ARC/INFO software**, it was necessary to georeference the map to the one of known projections. This was done as follows:

1. The latitude/longitude grid with cell size $2 * 2$ degrees was projected to Lambert Conformal Conic projection and then used to create ARC/INFO point coverage. That point coverage was used to create "to - from" links by ARC/INFO CONTROLPOINTS program.
2. A gray-scale scanned image of the original paper map was transformed to Lambert Conformal Conic projection by ARC/INFO GRIDWARP program (polynomial of the second order) using the "to - from" links created by CONTROLPOINTS program.
3. Geologic polygon boundaries from the source map were initially transferred to mylar and then scanned to produce a binary image.
4. The binary image from step 3 with geologic boundaries was vectorized by ARC/INFO GRIDLINE utility and then supplemented by hands-on digitization.
5. Polygon boundaries and geologic attributing of the ARC/INFO coverage from step 4 were verified and corrected by using gray-scale image from step 2 as a background guide.
6. A series of piecewise "rubbersheet" transformations was applied to the final ARC/INFO coverage. The ARC/INFO coverages that were used for transformation were **ESRI's ArcWorld 1:3M GIS cartographic layers (RIV3M, CTRY3M)**. Overall RMS error of that transformation is equal to 1,500 meters (0.6 mm on original paper map).

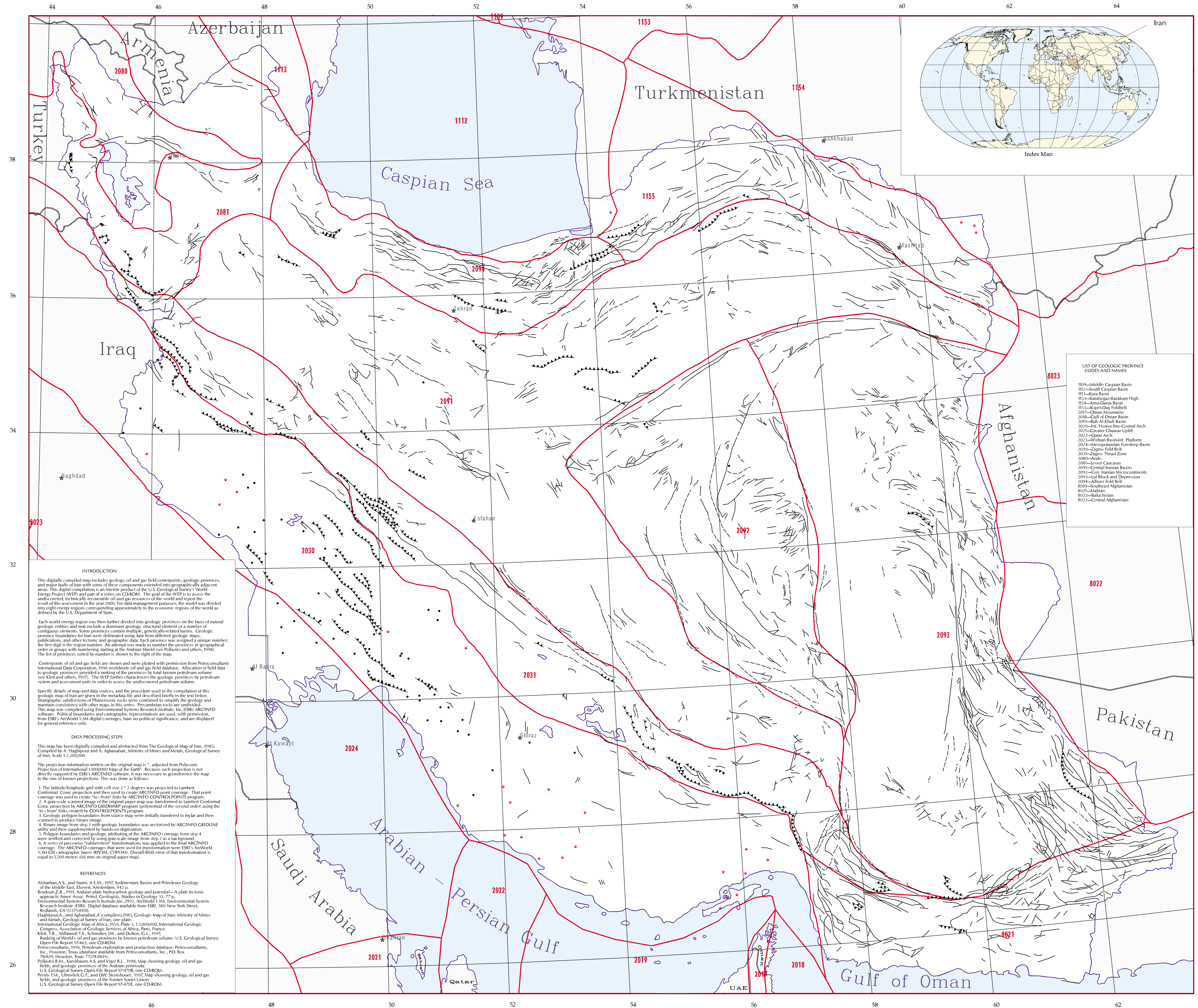
LIST OF GEOLOGIC PROVINCE CODES AND NAMES
(SORTED BY CODE)



1109---Middle Caspian Basin
1112---South Caspian Basin
1113---Kura Basin
1153---Karabogaz-Karakum High
1154---Amu-Darya Basin
1155---Kopet-Dag Foldbelt
2017---Oman Mountains
2018---Gulf of Oman Basin
2019---Rub Al Khali Basin
2020---Int. Homocline-Central Arch
2021---Greater Ghawar Uplift
2022---Qatar Arch
2023---Widyan Basin-Int. Platform
2024---Mesopotamian Foredeep Basin
2030---Zagros Fold Belt
2031---Zagros Thrust Zone
2080---Araks
2081---Lesser Caucasus
2091---Central Iranian Basins
2092---Cen. Iranian Microcontinents
2093---Lut Block and Depression
2094---Alborz Fold Belt
8001---Southeast Afghanistan
8021---Makran
8022---Baluchistan
8023---Central Afghanistan

LIST OF GEOLOGIC PROVINCE CODES AND NAMES
(SORTED BY NAME)

2094---Alborz Fold Belt
1154---Amu-Darya Basin
2080---Araks
8022---Baluchistan
8023---Central Afghanistan
2091---Central Iranian Basins
2092---Cen. Iranian Microcontinents
2021---Greater Ghawar Uplift
2018---Gulf of Oman Basin
2020---Int. Homocline-Central Arch
1153---Karabogaz-Karakum High
1155---Kopet-Dag Foldbelt
1113---Kura Basin
2081---Lesser Caucasus
2093---Lut Block and Depression
8021---Makran
2024---Mesopotamian Foredeep Basin
1109---Middle Caspian Basin
2017---Oman Mountains
2022---Qatar Arch
2019---Rub Al Khali Basin
1112---South Caspian Basin
8001---Southeast Afghanistan
2023---Widyan Basin-Int. Platform
2030---Zagros Fold Belt
2031---Zagros Thrust Zone



LIST OF GEOLOGIC PROVINCE CODES AND NAMES

1109	Al-Bahri-Caspian Basin
1112	South-Caspian Basin
1113	Kura Basin
1114	Karadaglar-Karakum High
1115	Amu-Darya Basin
1117	Kopet-Dag Fold Belt
2007	Amu-Darya Basin
2008	Gulf of Oman Basin
2009	Kuh-e Alborz Basin
2010	Iran-Hormuz-Central Arch
2011	Greater Chahmahal-Lillir
2012	Qatar Arch
2013	Salween Basin-Hat Platform
2014	Mesopotamian Foredeep Basin
2015	Zagros Fold Belt
2016	Zagros Thrust Zone
2018	Lesser Caucasus
2019	Central Iranian Basin
2020	Iranian Microcontinents
2021	Lesser Caucasus and Depression
2024	Alborz Fold Belt
8001	Southeastern Afghanistan
8011	Andran
8012	Sabahistan
8023	Central Afghanistan

INTRODUCTION

This digitally compiled map includes geology, oil and gas field centerpoints, geologic provinces, and major faults of Iran with some of these components extended into geographically adjacent areas. This digital compilation is an interim product of the U.S. Geological Survey's World Energy Project (WEP) and part of a series on CD-ROM. The goal of the WEP is to assess the undiscovered, technically recoverable oil and gas resources of the world and report the result of this assessment in the year 2001. For data management purposes, the world was divided into eight energy regions corresponding approximately to the economic regions of the world as defined by the U.S. Department of State.

Each world energy region was further divided into geologic provinces on the basis of natural geologic entities and may include a dominant geologic structural element or a number of contiguous elements. Some provinces contain multiple, geographically related basins. Geologic province boundaries for Iran were delineated using data from different geologic maps, publications, and other sources and geographic data. Each province was assigned a unique number, the first digit is the region number. An attempt was made to number the provinces in geographical order or groups with numbering starting at the Arabian Shield (see Pollastro and others, 1998). The list of provinces sorted by number is shown to the right of the map.

Centerpoints of oil and gas fields are shown and were plotted with permission from Petroconsultants International Data Corporation, 1996 worldwide oil and gas field database. Allocation of field data to geologic provinces provided a ranking of the provinces by total known petroleum volume (see Klitz and others, 1997). The WEP further characterizes the geologic provinces by petroleum system and assessment units in order to assess the undiscovered petroleum volume.

Specific details of map and data sources, and the procedure used in the compilation of this geologic map of Iran are given in the metadata file and described briefly in the text below. Stratigraphic subdivisions of Phanerozoic rocks were combined to simplify the geology and maintain consistency with other maps in this series. Precambrian rocks are omitted.

This map was compiled using Environmental Systems Research Institute, Inc. (ESRI) ARC/INFO software. Political boundaries and cartographic representations are used, with permission, from ESRI's ArcWorld 1.0M digital coverage, have no political significance, and are displayed for general reference only.

DATA PROCESSING STEPS

This map has been digitally compiled and distributed from The Geological Map of Iran, 1983, Compiled by A. Haghighat and A. Aghashahi, Ministry of Mines and Metals, Geological Survey of Iran, Scale 1:2,500,000.

The projection information written on the original map is: adjusted from Polyconic Projection of International 1:500,000 Map of the Earth. Because such projection is not directly supported by ESRI's ARC/INFO software, it was necessary to georeference the map to the one of known projection. This was done as follows:

1. The latitude-longitude grid with cell size 2° x 2° degrees was projected to Lambert Conformal Conic projection and then used to create ARC/INFO control points.
2. A georeferenced scanned image of the original paper map was transformed to Lambert Conformal Conic projection by ARC/INFO GRIDWARP program (a/normal of the second entry) using the 10-control points created by CONTROLPOINTS program.
3. Geologic polygon boundaries from source maps were initially transferred to x,y,z and then scanned to produce binary image.
4. Binary image from step 3 and geologic boundaries were vectorized by ARC/INFO GRIDLINE utility and then supplemented by hand-drawn digitization.
5. Polygon features and grid attributes of the ARC/INFO coverage from step 4 were verified and corrected by using georeferenced image from step 2 as a background.
6. A series of successive "rubber-sheet" transformations was applied to the final ARC/INFO coverage. The ARC/INFO coverage that were used for transformation were ESRI's ArcWorld 1.0M GIS cartographic layers: RIVRS, CTRYNA, Overall 1:500,000 cover of that transformation is equal to 1:500 meters (0.6 mm on original paper map).

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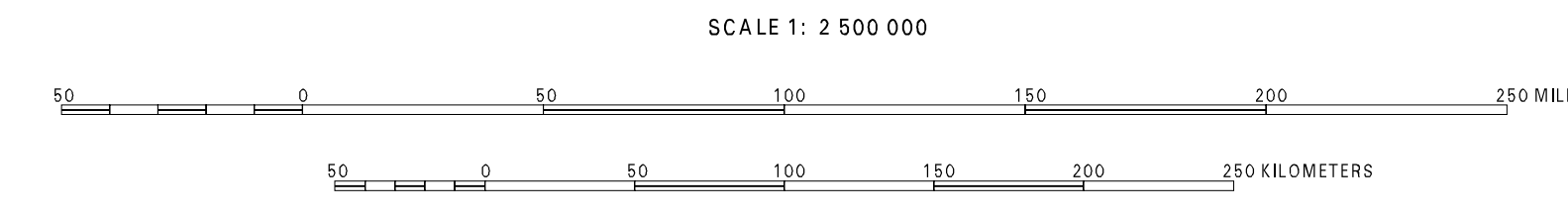
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- EXPLANATION**
- MAP SYMBOLS**
- Geologic province outline
 - Geologic province code
 - Geologic contact
 - Thrust/Reverse fault
 - Thrust/Reverse fault (inferred)
 - Other faults (undifferentiated)
 - Other faults inferred (undifferentiated)
 - Center of oil field
 - Center of gas field
 - International boundary
 - * Major cities
- OTHER MAP UNITS**
- Areas outside of Iran
 - Sea
 - Lakes and wide rivers

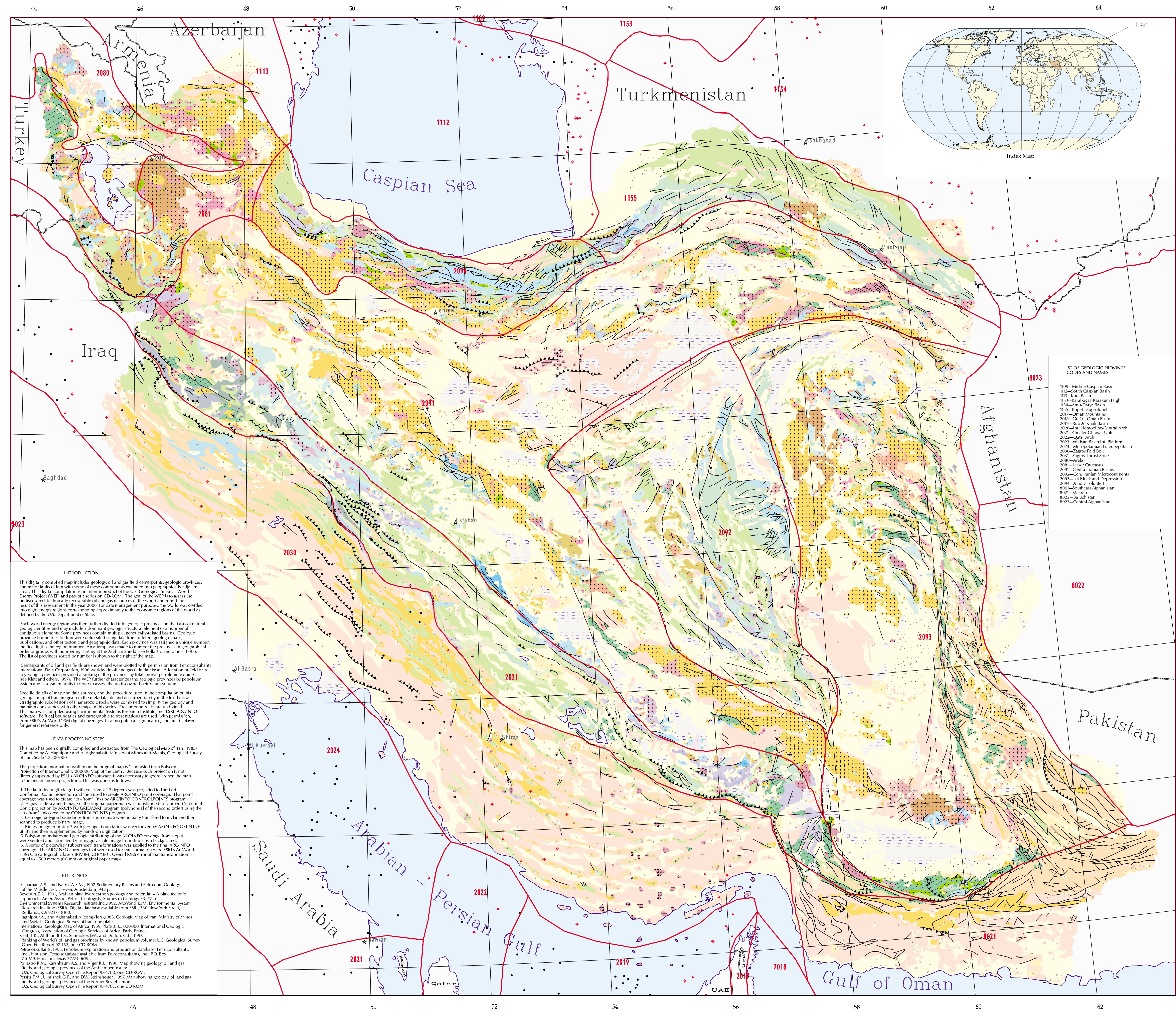
Projection - LAMBERT CONFORMAL CONIC
Spheroid - CLARKE 1866
First standard parallel - 17°
Second standard parallel - 33°
Central Meridian - 47°
Latitude of projection origin - 22°



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MAP SHOWING FAULTS, OIL AND GAS FIELDS, AND GEOLOGIC PROVINCES OF IRAN
Digitally compiled by R. M. Pollastro, F. M. Persits, and D.W. Steinsouer

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EXPLANATION

SEDIMENTARY ROCKS

- Q Quaternary
- Qe Quaternary eolian
- Qsk Quaternary sabkha/marsh
- QN Quaternary-Neogene
- N Neogene
- Pg Paleogene
- T Tertiary
- TK Tertiary-Cretaceous
- K Cretaceous
- KJ Cretaceous-Jurassic
- J Jurassic
- JTr Jurassic-Triassic
- Tr Triassic
- Mz Mesozoic
- TrP Triassic-Permian
- MzPz Mesozoic-Paleozoic
- P Permian
- PC Permian-Carboniferous
- C Carboniferous
- CD Carboniferous-Devonian
- D Devonian
- S Silurian
- SO Silurian-Ordovician
- O Ordovician
- Cm Cambrian
- Pz Paleozoic
- CmpCm Cambrian-Precambrian
- PzPzCm Precambrian-Paleozoic
- pCm Precambrian
- Salt
- Salt Undifferentiated

IGNEOUS ROCKS

- Qi Quaternary Intrusives
- Qv Quaternary Volcanics
- Ti Tertiary Intrusives
- Tv Tertiary Volcanics
- To Tertiary Ophiolites
- Czi Cenozoic Intrusives
- Czv Cenozoic Volcanics
- CzMzi Cenozoic-Mesozoic Intrusives
- CzMzv Cenozoic-Mesozoic Volcanics
- Mzi Mesozoic Intrusives
- Mzv Mesozoic Volcanics
- Mzo Mesozoic Ophiolites
- MzPi Mesozoic-Paleozoic Intrusives
- MzPzv Mesozoic-Paleozoic Volcanics
- Pzv Paleozoic Volcanics
- pCmi Precambrian Intrusives
- pCmv Precambrian Volcanics
- ac Acid Extrusives unknown age
- ai Acid Intrusives unknown age
- acid Acid igneous unknown age and type
- ie Basic Extrusives unknown age
- ib Basic Intrusives unknown age
- ieic Basic igneous unknown age and type
- ie Intermediate Extrusives unknown age
- ii Intermediate Intrusives unknown age
- inter Intermediate igneous unknown age and type
- io Ophiolites (undifferentiated)
- vs Volcanics and Sedimentary deposits undifferentiated

MAP SYMBOLS

- 7203 Geologic province outline
- 7204 Geologic province code
- Geologic contact
- Thrust/Reverse fault
- Thrust/Reverse fault (inferred)
- Other faults (undifferentiated)
- Other faults inferred (undifferentiated)
- Center of oil field
- Center of gas field
- International boundary
- Major cities

OTHER MAP UNITS

- Areas outside of Iran
- Sea
- Lakes and wide rivers

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1. The latitude/longitude grid with cell size 2° x 2° degrees was projected to Lambert Conformal Conic projection and then used to create ARC/INFO CONTROLPOINTS program.
2. A gray-scale scanned map of the original paper map was transferred to Lambert Conformal Conic projection by ARC/INFO GRIDWARP program (polynomial of the second order) using the "to-from" links created by CONTROLPOINTS program.
3. Geologic polygon boundaries from source map were initially transferred to mylar and then scanned to produce binary image.
4. Binary image from step 3 with geologic boundaries was vectorized by ARC/INFO GRIDLINE utility and then supplemented by hand-on digitization.
5. Polygon boundaries and geologic attributing of the ARC/INFO coverage from step 4 were verified and corrected by using gray-scale image from step 2 as a background.
6. A series of province "sub-coverage" transformations was applied to the final ARC/INFO coverage. The ARC/INFO coverages that were used for transformation were ESRI's ArcWorld 1.3M GIS cartographic layers: ARABIAN, CRYVAL. Overall RMS error of that transformation is equal to 1,500 meters (0.6 mm on original paper map).

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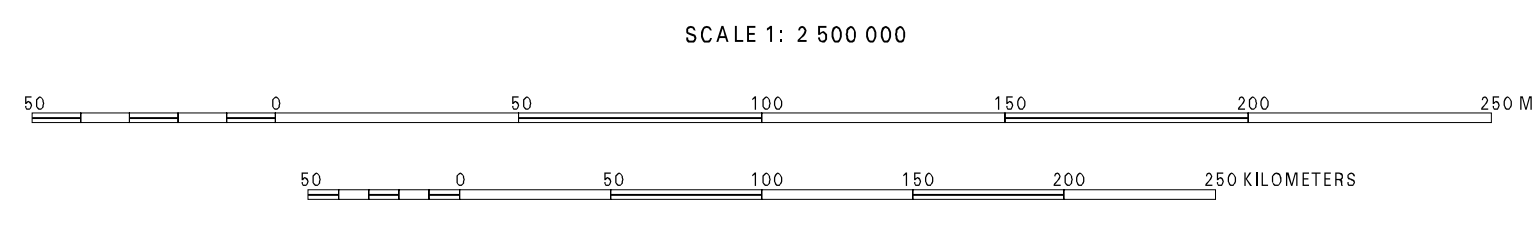
Pollastro, R.M., Kar-Huam, A.S., and Viger, R.L., 1998. Map showing geology, oil and gas fields, and geologic provinces of the Arabian peninsula. U.S. Geological Survey Open File Report 97-478, one CD-ROM.

Peris, F.A., Ullrich, G.F., and DW, Stinson, 1997. Map showing geology, oil and gas fields, and geologic provinces of the former Soviet Union. U.S. Geological Survey Open File Report 97-476, one CD-ROM.

LIST OF GEOLOGIC PROVINCE CODES AND NAMES

- 1109—Middle Caspian Basin
- 1112—South Caspian Basin
- 1113—Kura Basin
- 1115—Aralguz-Akardam High
- 1114—Arma-Darya Basin
- 1117—Kopet-Dag Foldbelt
- 1117—Doran Mountains
- 1118—Gulf of Oman Basin
- 1119—Balakhani Basin
- 1120—Int. Homocline-Central Arch
- 1121—Greater Chahair Uplift
- 1122—Qatar Arch
- 1123—Wilson Basin-Ind. Platform
- 1124—Mesopotamian Foredeep Basin
- 1125—Zagros Fold Belt
- 1131—Zagros Thrust Zone
- 2008—Araks
- 2081—Lower Caucasus
- 2099—Central Iranian Basins
- 2092—Cent. Iranian Microcontinents
- 2093—Lut Block and Depression
- 2094—Mozur Fold Belt
- 8001—Southeast Afghanistan
- 8012—Kabul
- 8022—Baluchistan
- 8023—Central Afghanistan

Projection - LAMBERT CONFORMAL CONIC
Spheroid - CLARKE 1866
First standard parallel - 17°
Second standard parallel - 33°
Central Meridian - 47°
Latitude of projection origin - 22°



MAP SHOWING GEOLOGY, OIL AND GAS FIELDS, AND GEOLOGIC PROVINCES OF IRAN

Digitally compiled by R. M. Pollastro, F. M. Persits, and D.W. Steinshouer

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EXPLANATION

SEDIMENTARY ROCKS

	Q Quaternary
	Qe Quaternary eolian
	Qsk Quaternary sabkha/marsh
	QN Quaternary-Neogene
	N Neogene
	Pg Paleogene
	T Tertiary
	TK Tertiary-Cretaceous
	K Cretaceous
	KJ Cretaceous-Jurassic
	J Jurassic
	JTr Jurassic-Triassic
	Tr Triassic
	Mz Mesozoic
	TrP Triassic-Permian
	MzPz Mesozoic-Paleozoic
	P Permian
	PC Permian-Carboniferous
	C Carboniferous
	CD Carboniferous-Devonian
	D Devonian
	S Silurian
	SO Silurian-Ordovician
	O Ordovician
	Cm Cambrian
	Pz Paleozoic
	CmpCm Cambrian-Precambrian
	PzpCm Precambrian-Paleozoic
	pCm Precambrian
	Salt Salt Undifferentiated

OTHER MAP UNITS

	Areas outside of Iran
	Sea
	Lakes and wide rivers

IGNEOUS ROCKS

	Qi Quaternary Intrusives
	Qv Quaternary Volcanics
	Ti Tertiary Intrusives
	Tv Tertiary Volcanics
	To Tertiary Ophiolites
	Czi Cenozoic Intrusives
	Czv Cenozoic Volcanics
	CzMzi Cenozoic-Mesozoic Intrusives
	CzMzv Mesozoic-Cenozoic Volcanics
	Mzi Mesozoic Intrusives
	Mzv Mesozoic Volcanics
	Mzo Mesozoic Ophiolites
	MzPzi Mesozoic-Paleozoic Intrusives
	MzPzv Mesozoic-Paleozoic Volcanics
	Pzv Paleozoic Volcanics
	pCmi Precambrian Intrusives
	pCmv Precambrian Volcanics
	ae Acid Extrusives unknown age
	ai Acid Intrusives unknown age
	acid Acid igneous unknown age and type
	be Basic Extrusives unknown age
	bi Basic Intrusives unknown age
	basic Basic igneous unknown age and type
	ie Intermediate Extrusives unknown age
	ii Intermediate Intrusives unknown age
	inter Intermediate igneous unknown age and type
	Io Ophiolites (undifferentiated)
	vs Volcanics and Sedimentary deposits undifferentiated

MAP SYMBOLS

	Geologic province outline
	Geologic province code
	Geologic contact
	Thrust/Reverse fault
	Thrust/Reverse fault (inferred)
	Other faults (undifferentiated)
	Other faults inferred (undifferentiated)
	Center of oil field
	Center of gas field
	International boundary
	Major cities