International Atomic Energy Agency

IUREP N.F.S. No. 94
October 1977
Distr. LIMITED
Original: ENGLISH

INTERNATIONAL URANIUM RESOURCES EVALUATION PROJECT

I U R E P

NATIONAL FAVOURABILITY STUDIES

ITALY

77-8847

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C O N T E N T S

A - INTRODUCTION AND GENERAL GEOGRAPHY

The Italian Republic comprises a 1200 - Km - long peninsula extending from southern Europe into the Mediterranean Sea, and a number of adjacent islands, among which the principals are Sicily and Sardinia. The total area is in excess of 300,000 Sq.Km, the islands account for some 50,000 Sq.Km.

From a physiographic and morphologic point of view, Italy mainly consists of the Alpine region and the Po valley to the North and of the Appennine range and small Coastal plains to the Centre and South. Plains occupie only 20% of the total area, hills and mountains, up to 4,810 m of elevation, contribute almost equally to the remaining 80%.

The wide distribution of mountain areas generates different climates ranging from that of maritime-mediterranean type of the Centre and South, to that of transition type of the Po Valley and of the Alps. In these two regions, rain and snow fall in winter are abundants and the excursion of temperature is substantial.

The communications network is well developed and comprises some 20,000 Km of rail roads and 285,000 Km of motorways. In the Alpine region however, access to localities at altitude in excess of 2,000 m is generally by mountain tracks and/or by helicopter.

B - GEOLOGY IN RELATION TO POTENTIALLY FAVOURABLE URANIUM BEARING AREAS

The structural setting of Italy results from very recent tectonic activity, largely of miocene age, which affected, in both the Alpine and Appennine chains, geological units of different origin and age. Locally, the tectonic style was of compression but in general the tension mouvements prevailed leading to the formation and development of quickly subsidising basins where both marine and continental sediments were deposited during pliocene and quaternary times. The compression mouvements are still active today.

In the Alpine chain, a number of cristalline complexes of palaeozoic age are known to occur imbricated within carbonatic and clastic rocks of mesozoic and tertiary age. These complexes consist of gneiss, micaschists, granites and migmatites which were also affected by the hercynian and, in part, by the caledonian orogeny. In the Appennines, the oldest rocks are of Palaeozoic age but, the mesozoic carbonatic rocks, the mesozoic-tertiary flysch and the pliocene-quaternary clay-silty sediments are largely prevailing

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In the Alps, particularly favourable for uranium mineralizations are the continental, lagoonal, littoral and deltaic formations laying uncorformably over the eroded crystalline complexes of the hercynian basement. These formations often include volcanics, of lower-permian age, consisting of latite-andesites, rhyodacites and rhyolites. Both the continental sediments and the volcanics are known to occur in numerous separate areas over the entire Alpine Arc. The distribution of the areas of occurrence is due not only to the palaeogeographic conditions existing at the time of deposition but also to the action of the overthrust tectonics which affected the region during tertiary times. The tectonic activity was also responsible for the low-grade metamorphism (epizonal) of some of these formations.

The volcanics, part of a late hercynian magmatic cycle, consist of ignimbrites, tuffs and lavas with their maximum thickness exceeding 1,000 m. The volcanics are overlain by a sedimentary unit largely consisting of sandstones of alluvial and deltaic environment of deposition. In parts, the volcanics and the sandstones are also intercalated and form a typical volcanic and sedimentary complex.

The palaeogeographic setting of the Alpine region before the deposition of the continental sediments of permian age was that of a sector of the front area of the hercynian basement complex. This complex was largely eroded and a tectonic of tension style had led to the formation of small intracratonic basins still subsidising during sedimentation. Associated to the tension mouvements were also the intrusion of granites (ca. 280 M.Y.) and the effusion of acid volcanics (ca. 265 M.Y.). The period of sedimentation under continental conditions was of about 30 M.Y., ending between the Upper Permian and Lower Trias. Sedimentation followed then under lagoonal and of shallow water conditions with frequent recurrences and active reworking of sediments (quartzites of triassic age). This marine transgression was a forerunner of the development of the Alpine trough where the sediments were subsequently subjected to the overthrust tectonics of the Alpine orogeny and would finally emerge during neogenic and quaternary times.

The hercynian granite massifs and associated metamorphic aureoles are also regarded as promising targets for uranium exploration. They occur, as tectonic blocks, in the Alps, in Sardinia and in Calabria.

In the Appennines, favourable characteristics are shown by the volcanic and sedimentary complexes associated with the recent alkaline volcanism of Central Italy, rich in radioactive minerals.

The lignite basins of tertiary age in peninsular Italy and in Sardinia may also be considered for uranium exploration.

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C - PAST EXPLORATION

Prospecting for uranium in Italy began in 1954 and a first cycle of exploratory work was completed in 1962. Activities were initiated by private companies soon flanked by two State organisations, CNRN (now CNEN) and ENI (through its subsidiary SOMIREN), which entered the search for uranium with increased impetus.

During this first period of exploration, radiometric and hydrogeochemical prospecting was mainly carried out over the Alpine arc (hercynian massifs, volcanic and sedimentary basins of permian and triassic age). In addition, however, exploration was also carried out in Calabria (hercynian massifs), in Sardinia (hercynian massifs, permian volcanics, alkaline and calc-alkaline volcanics of tertiary age) and in Latium (quaternary basins with continental sediments and alkaline volcanics).

Areas of first priority were prospected mainly by both ground and aerial radiometric surveys. A total of approx. 15,000 Sq.Km were investigated in detail including some 4,400 Sq.Km of aerial surveys. Other areas of secondary priority were largely covered by regional hydrogeochemical surveying. Total areas investigated by both regional and detailed exploration techniques amount to some 75,000 Sq.Km.

In addition, underground exploration comprised some 13,300 m of tunnelling and 18,100 m of drilling.

D - URANIUM OCCURRENCES AND RESOURCES (Fig. 1)

The most promising uranium mineralizations have been found in the Bergamasc Alps, near the small town of Novazza. Pitchblende and minor sphalerite (formation temperature, 80°-100°C) occur disseminated in volcanics of permian age.

The host rocks at the Novazza uranium deposit, consist of an acid ignimbrite with cineritic texture. The rocks have been affected by metasomatism which brought abundant neo-formation minerals such as silica, sericite, carbonates and minor adularia, albite and muscovite.

The reasonably assured resources of the Novazza deposit have been estimated to be 1,200 ton of U having a grade of 900 p.p.m. U. Estimated additional resources are 1,000 ton U. Production is scheduled to start in 1980.

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Mineralizàtions of possible commercial interest are also found in continental sandstones of middle-upper permian age. Uranium, where present, is mostly located at the base of the formation, near the contact between a grey-coarse sandstones unit and the overlying red sandstones unit. These mineralizations, which appear stratabound and often lenticular in shape, consist of microcrystalline uraninite and associated pitchblende. Pitchblende occurs as aggregate of spherulites with rare pyrite and remains of organic matter. These occurrences have been investigated in some detail only in the area of Val Rendena - Val Daone (Trentino) where they appear more substantial.

Numerous uranium mineralizations have also been found in the Western Alps where they occur as stratabound, lenticular ore bodies in continental sandstones of permian and triassic age. The host rocks have undergone, during cainozoic times, low-grade metamorphism and shearing which have remobilized the uranium mineralizations forming veins and lenses. Limited underground exploration has shown the continuity of the ore bodies whose uranium content is in the order of a few tens of tons of U.

Small veinlets of pitchblende have been found filling mylonitic zones of the hercynian massif of Mt. Blanc. These mineralizations do not appear of commercial interest.

Limited concentrations of autunite of supergene origin have been located in the fracture zones of the hercynian granites of Calabria. They are interpreted as due to recent tectonic and present hydrologic conditions.

In the southern part of Sardinia, supergene uraninite is found in small veinlets within metamorphic rocks, close to the contact with hercynian granites. Minor occurrences of secondary uranium minerals are also found in volcanics of permian age.

Widespread, stratabound mineralizations are located in the alkaline-volcanic and sedimentary complex of the Upper-Latium region. Mineralization, which is supergene in origin, occurs in thin layers over large areas. It consists of uranium oxydes disseminated in volcanics intensively kaolinized and rich in Iron sulphides. Total content of uranium is difficult to determine. In addition, the low grade and the impact on the environment which would result from mining, affect greatly the commercial prospectiveness of such mineralizations.

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E - PRESENT STATUS OF EXPLORATION

Beginning in 1975 the ENI Group, through its subsidiary Agip Mineraria, started a second cycle of exploration with the purpose of reassessing the country's uranium potential on the basis of new concepts of ore deposition and of exploration techniques.

Prospecting is now very active in the Bergamasc Alps and particularly in Val Seriana, in the area surrounding the Novazza deposit. The Val Seriana has already been prospected by helicopterborne spectrometric survey over an area of some 1,200 Sq.Km. In addition, a campaign of both systematic and reconnaissance drilling is in progress (8,600 m already drilled) and geochemical and radon emanation techniques are also being employed. On the southern flank of the Valtellina, a broad, regional exploration programme is being implemented. Helicopterborne gamma ray spectrometry and ground prospecting have located new radioactive anomalies.

In Trentino (Val Rendena), a programme of diamond drilling has been undertaken to explore the down dip extension of mineralization.

In Central Italy (Latium), a drilling campaign is in progress in order to assess the commercial interest of the low grade mineralizations in the quaternary volcanics.

In Sardinia, helicopter borne spectrometric survey and ground follow up is in progress.

Finally, regional aerial and ground prospecting programmes have been started in numerous areas of the Western and Eastern Alps.

In summary, in 1975 and 1976, the aerial radiometric surveys have covered some 3,670 Sq.Km and 287 drill holes have been completed for a total of 26,124 m.

In 1977, the exploration programme will continue.

Compiled by F Pantanetti
CNEN
October 1977

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F - AREAS FAVOURABLE FOR URANIUM MINERALIZATION AND POTENTIAL FOR NEW DISCOVERIES

The geology of the areas favourable for uranium mineralization has been discussed in detail under point D.

In summary, the more promising areas are:

- the Central-Bergamasc Alps (Lombardy region)
  where the target is represented by pitchblende mineralization occurring in a volcanic and sedimentary complex of permian age.

- the Val Rendena area (Trentino region)
  where the target is represented by pitchblende-coffinite mineralization in continental sandstones of middle-upper permian age.

- the Western Alps (Piedmont and Liguria regions)
  where the target in represented by pitchblende mineralization in quartz-sericitic schists of permian age.

Favourable geological environment occur over large areas of the Country but in consideration of the intense exploration already carried out, the potential for new discoveries of resources economi - cally recoverable at present market price does not appear to be great.

Italy, with regard to its Speculative Reserves, could be listed with the countries of the class "1,000-10,000 tons U".

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Abbreviazioni:

C.N.E.N. - Comitato Nazionale per l'Energia Nucleare
C.N.R.N. - Comitato Nazionale per le Ricerche Nucleari
S.I.G.M.A. - Symposium Internazionale
S.I.M.P. - Società Italiana di Mineralogia e Petrologia (già SMI fino al 1967)
S.M.I. - Società Mineralogica Italiana (SIMP dal 1968)

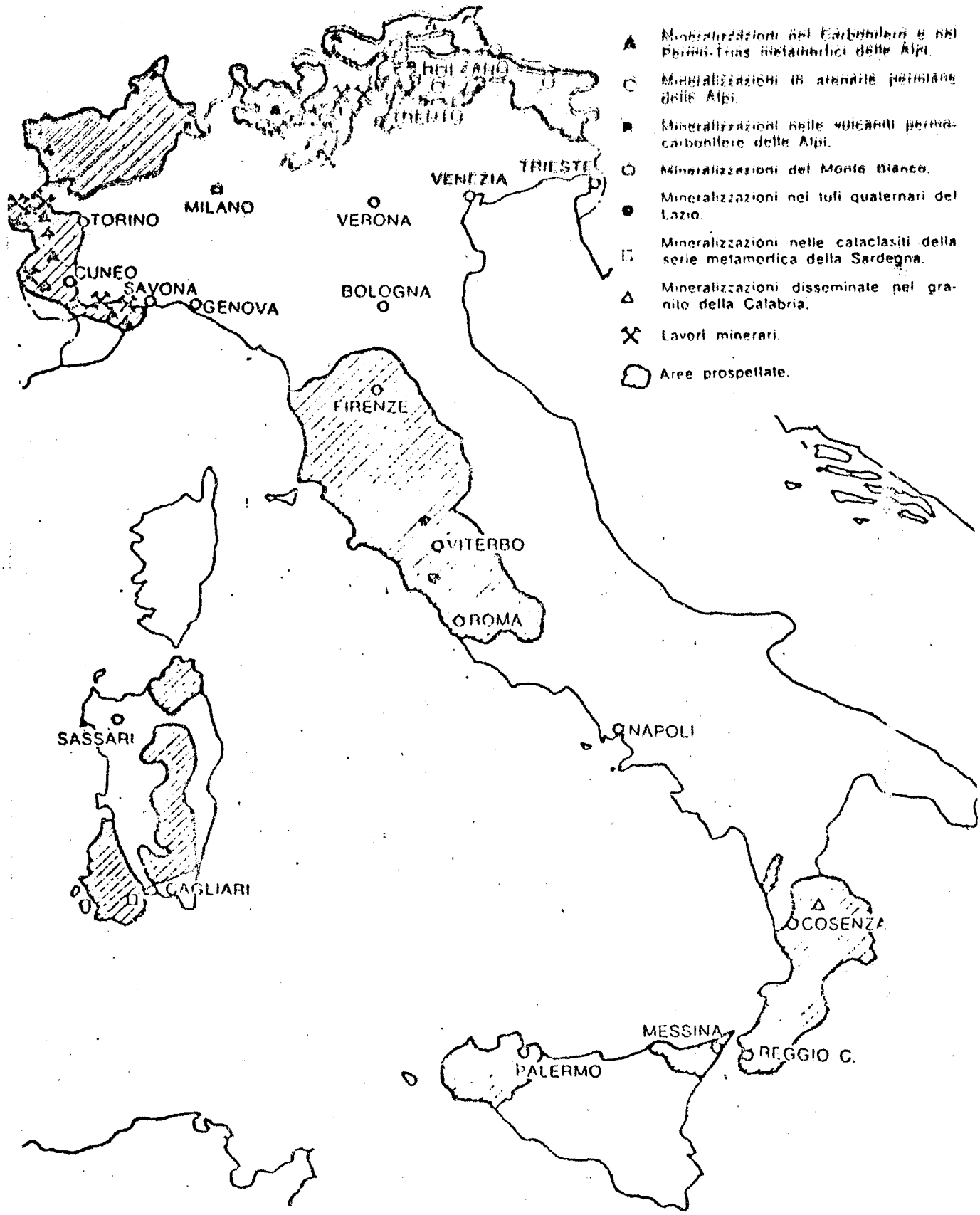

Fig. 1 : Main areas of uranium occurrences.

94. ITALY ERDA (DF)

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