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STATUS OF URANIUM EXPLORATION IN TURKEY

by

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CONTENTS

ILLUSTRATIONS

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ABSTRACT

During the period July 8 to August 6, 1961 field evaluations were made of uranium deposits located in and near the Menderes massif in southwestern Turkey. The most important uranium deposit visited was located near Demirtepe, along a schist-gneiss contact. Drilling, as yet unverified by underground workings, indicates a zone 500 feet in length, containing lenses of primary uranium mineralization in the schist. If the log interpretations of the drill holes are correct, some substantial intersections have been made of material containing more than 0.1 percent U_3O_8, and there is a possibility of mineralization at greater depths not yet drilled. Another deposit warranting further physical exploration is located at Ragillar, where primary uranium mineralization is disseminated in a fetid limestone. Here, however, the host rock is restricted in area and the potential is apparently relatively small. Other deposits of lesser interest but deserving limited physical exploration are located at Kisir, Kocakovanlik, Gokgedik and an unnamed site along the Turgut River. Substantial progress has been made in appraising the uranium resources of Turkey and the MTA organization has the independent capability of continuing the exploration along sound lines.

INTRODUCTION

During the period July 8 through August 6, 1961, at the request of Maden Tetkik ve Arama Enstitusu (MTA) and in company with Dr. N. N. Tilev, Director of the Atomic Energy Materials Division of MTA, I examined the MTA facilities at Ankara and visited their uranium prospects and field camps in southwestern

Turkey. The itinerary prepared by MTA and followed during my stay in Turkey appears in Appendix A.

The purpose of my visit was to examine and evaluate uranium discoveries and to review and make recommendations on the overall exploration program.

I would like to express my sincere thanks to Dr. S. Alpan, General Director, MTA, and Dr. N. N. Tilev, Director of the Atomic Energy Raw Materials Division and their staffs for their assistance to me. Because of their warm hospitality my brief visit to Turkey was a stimulating and rewarding experience.

PROSPECT EVALUATION

Prior to my arrival, numerous prospects and radioactivity anomalies had been discovered in Turkey, especially in the southern portion of the Menderes massif; their location is shown on Figures 1 and 2. These discoveries have been the object of intensive surface study, including geologic mapping, radiometric surveying and trenching, but most of them were determined to be of no interest. Those occurrences warranting continued interest are discussed below in the order of their importance.

Demirtepe

Demirtepe is located in the southwestern portion of the Menderes massif, approximately 20 miles southwest of Aydin, a large agricultural and commercial community (see Figure 1). At Demirtepe a deposit of hematite and other iron oxides lies in an enclave of mica schist within a broad area containing mainly coarse- and fine-grained gneiss. Lenses of iron formation, some of which have been mined by shallow open pits, are distributed over a horizontal distance of about 500 feet as shown on Figure 3. Also shown on Figure 3 are the drill holes completed through June 1961 and the distribution of a silicified breccia which forms an arc around the northern margin of the iron-bearing area.

A detailed radiometric grid survey revealed that the most anomalous radioactivity was associated with this arc of silicified breccia. Accordingly, it was carefully trenched at appropriate locations, but this surface physical exploration revealed only minor concentrations of material assaying between 0.1 and 0.2 percent U_3O_8 and was not considered encouraging. However, disequilibrium between chemical and radiometric analyses was noted, and in order to test the nature of the mineralization at depth, drilling was initiated. The results of this drilling disclosed a completely different situation at depth as shown in Figure 4, in that the uranium mineralization was spatially related to the schist-gneiss contact rather than the silicified breccia, and the mineralization was of higher grade and was more widely distributed.

The eight diamond-drill holes shown in Figure 4 lie approximately in two rows of four holes each. Because core recovery was variable, the interpretation of the radiometric intersections shown on Figure 4 is based entirely on log interpretations; these interpretations are based on calibrations established by inserting the instrument into a metal cylinder surrounded by chips of uranium-bearing rock of a known grade. Although this calibration method has not been refined, previous MTA experience has found it to be generally satisfactory for approximation purposes. Assuming for the moment that the interpretations shown in Figure 4 are approximately correct, the following observations may be noted:

1. Some substantial intersections have been made of material containing more than 0.1 percent U_3O_8. In particular, Hole S-5 has an apparent intersection with 36 feet out of 50 feet containing more than 0.1 percent U_3O_8. Hole S-6 has narrower intersections but with higher grade material. Unfortunately, an intervening hole, S-4, is less promising.
2. There is no direct and invariable correlation between the distribution of iron formation and uranium. At times, and within the same drill hole, e. g., DDH S-2, the iron-bearing formation may be nonradioactive or extremely radioactive. Some radioactivity has no association with iron formation.
3. Attempts to correlate iron-formation beds or other identifiable lithologic units, or radioactive intersections between holes have been unsuccessful, indicating a strong tendency towards lenticularity.
4. Despite some exceptions, it appears that uranium mineralization is best developed at or within 150 feet of the schist-gneiss contact. This is a crude exploration criterion, but at the moment it forms the best guide for any future exploration drilling which may take place.
5. Unless drilling which was underway at the time of my visit develops startling new information, it appears that the northern and southern boundaries of the main uranium mineralization are fairly well established. It seems reasonable to assume that the area of prime interest lies roughly within a line drawn between DDH S-7 and DDH

S-8 to the south and an east-west line drawn through DDH S-6. In other words, the area of prime interest extends for approximately 500 feet between the east-west coordinate lines 165230 and 165060 on Figure 3.

6. Although important discoveries are not anticipated beyond the north-south limits mentioned above, the down-dip or westerly terminus of this deposit has yet to be determined. This is particularly important because the best mineralized holes are the farthest down-dip. Two rows of holes constitute meager evidence for establishing a trend of mineralization, but the possibility of continued and possibly improved mineralization at depth represents an exploration possibility not yet evaluated at Demirtepe.
7. A large, intensely hematized and kaolinized altered area exists on the margin of the deposit, but only a spatial relationship has been established between the alteration and mineralization. No mineralization has been discovered along the other margins of the altered zone or within the altered zone itself.

At the time of the visit, drilling was underway on the northern border of the radiometric zone to define more closely the northern limits of mineralization. It is planned to go underground, probably by means of a shaft approximately 75 feet deep at hole S-2, to test the log interpretation and study the nature of mineralization at depth. If results from this work are satisfactory, additional galleries are planned (see Figure 4) which will intersect DDH S-1, S-4, S-5 and S-6 and simultaneously explore portions of the schist-gneiss contact.

At present, it is premature to estimate the uranium reserves at Demirtepe because any such estimate requires prior determination of the accuracy of the log interpretation and verification of the continuity of mineralization down-dip and along the strike. Therefore, the proposed shaft and galleries, or equivalents thereof, represent reasonable approaches to evaluating the log interpretations and untested ground between drill holes by direct observation. Some additional physical exploration will be required to evaluate possible down-dip extensions, but this should be deferred, if possible, until completion and evaluation of the shaft and galleries.

With the completion of the work described above, it should be possible to ascertain the significance of this occurrence. It is already evident, however, that Demirtepe represents one of the better, if not the best, prospects in Turkey and as such warrants continued physical exploration within the context of MTA's resource appraisal activities.

Ragillar

Uraninite (?) is disseminated in a silicified, fetid limestone of Paleozoic (?) age near Ragillar, a village located approximately 80 miles northeast of Izmir (see Figure 1). This occurrence was discovered by systematic airborne reconnaissance of the Menderes massif region north of the Menderes River.

As can be seen from the geologic sketch map and cross sections (Figs. 5 and 6) the limestone host rock overlying a Precambrian gneiss is of limited extent, being approximately 800 feet wide and 2,300 feet long. Its estimated thickness is approximately 75 feet in the area of the most pronounced radioactivity.

Faulting has apparently taken place between the limestone and adjoining breccia pipe. Neogene sediments, mainly mudstones, shales and some sandstones, are also intruded by the breccia pipe and overlain by breccia. No anomalous radioactivity is present in the breccia pipe or the adjoining Neogene sediments although there are scattered occurrences of anomalous radioactivity in other Neogene sediments in the vicinity.

A detailed and systematic radiometric grid survey was made of the radioactive area and its environs; the results are shown in Figure 7. This survey clearly indicates two distinct trends of anomalous radioactivity, one northeast and the other northwest; the pattern thus revealed suggests an intersection or joining of trends or a branching of a single main trend. Regardless of the interpretation of the pattern, the most intense radioactivity is situated at the intersection, junction or separation of these trends.

At the time of my visit three trenches had been placed on some of the highest anomalies. Trench Y-1, approximately 150 feet long and 3 feet wide, contained radioactive material assaying over 0.1 percent U_3O_8 throughout the length of the trench. Trench Y-2, about 60 feet in length, is somewhat lower in radioactivity, with the overall grade estimated at approximately 0.1 percent U_3O_8. Only the soil had been removed at Trench Y-3, and possibly as a result of this radioactivity appeared to be more erratically distributed and of somewhat less intensity than in the other trenches.

As can be seen from Figure 7 there are at least five places where surface radioactivity is comparable to those sites where the trenching was done. In addition, there are at least ten other sites of equal intensity but of smaller area.

As in the case of Demirtepe it is premature to estimate ore reserves at the present time; however, the geometry of the occurrence indicates a limited potential. Assuming that mineralization is present only in the limestone and no evidence indicates otherwise - there apparently are only 75 feet of limestone between the surface and the gneiss basement. In addition to the vertical limitation, the radiometric survey has clearly delineated the horizontal limits of mineralization.

Notwithstanding the above limitations, the broad extent of radioactivity is such as to warrant further physical exploration in order to evaluate generally the significance of the surface radioactivity.

Two main problems should be resolved by the physical exploration:

1. Does the radioactivity persist in depth to the gneiss basement, and is it possible that the radioactivity pattern reflects structural conditions which might continue into the basement?
2. How much of the surface radioactivity represents mineralization exceeding 0.1 percent U_3O_8?

These problems may be resolved by at least two alternatives. Drilling could be exclusively relied on to test the trends at various key points and at different depths. The second alternative involves a combination of drilling and underground workings, with a shaft in the approximate center of maximum radioactivity where the trends are joined and exploration galleries extending from the shaft bottom in northeast, northwest and southeast directions for distances of approximately 100 feet each. Drilling could supplement these exploratory underground workings by testing areas at the extremities of the trends.

However, before deciding which alternative will give sufficient information at minimum cost, surface trenching and sampling should be completed on the radiometric highs in the northwest trend, which appears to be the weakest. If this results in essentially negative results, the scope of both of the aforementioned alternatives should be reduced accordingly, but minimal drilling still should be done in the northwest trend to corroborate that the surface information adequately reflects subsurface conditions.

Kargicak

Some of the numerous radiometric anomalies discovered along the southwestern margin of the Menderes massif have been trenched, and in some cases limited drilling has been undertaken (e. g., Yenikoy). As a result of these preliminary exploration activities, all the occurrences except one at Kargicak, were abandoned as not warranting further effort (see Figure 2).

The Kargicak prospect consists of radioactive lenses and pods in a garnetiferous mica schist near its contact with gneiss. After a detailed radiometric grid survey had delineated the main anomalous zone, six trenches were dug to average depths of 15 feet and careful channel samples were taken in the main trench (see Figure 8). These trenches and samples revealed a mineralized lenticular zone in the schist, containing about 350 tons at about 0.35 percent U_3O_8.

Four holes were then diamond-drilled to cut the contact of the mica schist and gneiss at a depth of 75 feet. Some radiometric anomalies were detected, and it was decided to explore the prospect by underground workings. Approximately 300 feet of drifts from a 75-foot shaft tested the contact in a northwest-southeast direction. Unfortunately, the galleries were flooded at the time of my visit so that direct observation was impossible. However, I am informed that the results were essentially negative except for a small pod of material assaying from 0.06 to 0.10 percent U_3O_8 located at the southeast end of the drift near a fault which intersected the contact zone and offset it slightly. No radioactivity was detected in short drifts into the contact zone on the other (east) side of the fault or in a trench on the surface which located the fault for projection purposes.

Additional drilling was then undertaken to test the contact zone at greater depth. These drill holes also encountered small pods of radioactivity, but the intersections occurred at a depth less than estimated because the dip of the contact zone had decreased considerably, from 66 degrees at the surface and 60 degrees in the shaft bottom to 40 degrees at 300 feet in depth. Of importance is the decrease in size and grade of mineralized intersections coinciding with the decrease in dip.

At the present time two holes are planned to complete the Kargicak project. One multipurpose hole is planned to explore the possible downward extension of the radioactive zone discovered in the gallery near the fault, and at the same time test for possible offset extensions of the radioactive zone on the other side of the fault while examining the schist for possible mineralized zones not reflected in surface anomalous radioactivity. Following this, a final hole is planned to test the contact at greater depth.

Geologic probabilities suggest that neither hole is likely to be successful in intersecting important uranium concentrations; but there is an advantage to carrying the project to full completion and evaluation so as to exhaust all possibilities and obtain geologic information.

As a consequence of the systematic surface and subsurface exploration program outlined above, virtually all favorable ground has been tested, and it appears that the property potential is limited. Uranium concentrations are small in size, with the largest lens apparently located at the surface.

Although conclusive information is unavailable, it appears likely that the fault is post-ore, and while it may have exerted some influence on the secondary redistribution of uranium it does not seem to be genetically important. Perhaps the most significant control was the flattening of the schist-gneiss contact, whereby the fractures and schistosity planes, which provided the main locus of deposition near the surface, were closed by the vertical pressure of the overlying rock, and as a result circulation and deposition were inhibited.

Gokgedik and Turgut River Bridge Occurrences

In the United States we have come to an increasing realization that uranium deposits in sedimentary rocks may form from ground water carrying small quantities of uranium leached from surrounding rocks. Such deposits may form and re-form with variations in the water table and hydrodynamic gradient levels, and with proper structural and lithofacies conditions large deposits may form.

On a small scale, the processes described above have clearly taken place at Gokgedik and near the gendarmerie station by the bridge over the Turgut River (see Figure 1). At Gokgedik, Recent conglomeratic sandstone exposed in a small trench contains radioactivity equivalent to approximately 0.10 to 0.15 percent U_3O_8. Unfortunately, the sandstone is very thin perhaps in the range of 10 to 20 feet, as evidenced by the outcroppings of bedrock at various points near the trench. Because the host rock is thin and of limited lateral extent at this site, it has insufficient volume to permit deposition of important concentrations of uranium minerals. However, in the vicinity of the trench larger bodies of conglomeratic sandstone may exist, and additional ground search is warranted to locate such lithologic bodies to determine their radioactivity. A small amount of additional drilling for geologic information, perhaps in the amount of 300 feet divided among ten holes, may be advisable near the discovery site, so as to provide data which might guide future exploration activities in the vicinity.

South of Cine along the Turgut River, the Menderes massif approaches the river very closely, and at various reentrants in the massif recent alluvial sediments have been deposited. Exploration along the schist-gneiss contact in the region crossed such an alluvial deposit and disclosed anomalous radioactivity near a bridge over the Turgut River. A trench over the main anomaly revealed a section of fine-grained, limonite-stained sandstone and clay with a grade of 0.5 to 1.0 percent U_3O_8 over a 6-foot vertical thickness.

A radiometric survey completed over this field shows that two distinct trends are present. Plans have been made to trench these trends, and it is possible that a high-grade deposit of small tonnage might be developed. Prospecting, following recommendations to examine the Recent sedimentary rocks in the reentrants of the Massif north along the Turgut River partway to Cine, has disclosed a new anomaly of some four times background, but once again the volume of the host rock places limitations on the size of the body to be expected. However, if numerous such bodies can be located, their cumulative total may be of interest, and physical exploration in such an environment is extremely easy and cheap.

In summary, the significance of the deposits at Gokgadik and by the Turgut River bridge is based on three elements:

1. Reserve tonnages in individual bodies are small, but their cumulative total may be of interest if enough deposits can be discovered.
2. They demonstrate geological processes of uranium deposition in Turkey similar to those which have resulted in major sedimentary deposits of uranium in the United States.
3. They are an indication of unevaluated uranium-mineral potential in the sedimentary rocks of Turkey.

Miscellaneous Prospects

As can be seen from the itinerary, numerous prospects were examined in the field. Based on these examinations and the results of the previous radiometric grid surveys, trenching and geologic mapping, it was determined that only two prospects, Kisir and Kocakovanlik, warrant limited testing by physical exploration.

At Kisir a well-defined fracture zone about 1 foot thick, extending along a 15-foot trench, contains radioactivity equivalent to 0.15 to 0.25 percent U_3O_8. Other smaller indications, some of which are extremely radioactive, are also present in the immediate vicinity. For these reasons, which make Kisir the best uranium occurrence discovered in the gneiss to date, the fracture zone should be investigated. However, because the zone is dipping at only 30 degrees, and due to the tendency of other nearby uranium occurrences to pinch out at shallow depths in the gneiss, the possibility of using an inclined gallery to follow the fracture zone should be considered in preference to drilling. In this way direct observations can be made and if the fracture zone pinches out quickly, the project can be discontinued at an early stage.

At Kocakovanlik a brecciated schist, invaded by large quantities of quartz and adjacent to a major quartz vein, contains a width of about 5 feet of radioactive material, 3 feet of which will probably assay above 1.0 percent U_3O_8. Intense hematitic alteration is also present. This occurrence represents a distinct type of deposition in this area, and although it appears to be limited in strike length and might be equally limited in depth, it is extremely radioactive and warrants some exploration if possible.

GENERAL PROGRAM ACTIVITIES

Because all minerals in Turkey are regarded as belonging to the state, the control of the mining industry is vested in the Ministry of Industry, which is responsible for developing mineral resources and the mining industry by carrying out geological and preliminary mining activities through the MTA. The MTA is a completely integrated organization (see Figure 9), capable of carrying out full-scale exploration in many different commodity fields and then completing the necessary preliminary mining activities and evaluations before exploitation. If a deposit is proven to be economically mineable its exploitation then becomes the responsibility of another Turkish agency, the Etibank. To carry out its assignment, MTA has its own technical staff, laboratory and library support facilities, its own drilling and mining equipment, repair shops, and also publishes and distributes the scientific periodicals resulting from its field activities.

About 250 professional employees (e. g., mining engineers, surveyors, ore dressers), including 70 geologists, staff this organization; about half the professional staff is non-Turkish. During the field season temporary help is used to considerable extent in the field camps so that as many as 1,000 people might be in the employ of MTA from time to time.

Under Dr. S. Alpan, the General Director of the MTA, the Atomic Energy Raw Materials Division carries out an exploration effort, directed by Dr. N. N. Tilev, for minerals of possible use in atomic-energy applications in Turkey. Prime emphasis is placed upon uranium exploration; however, if in the course of such exploration thorium occurrences are discovered these receive a surface evaluation but no physical exploration. At present no effort is directed to exploration for beryllium.

In addition to prospection parties maintained by Dr. Tilev's group, there are supporting radiometric laboratories and an aerial survey group. Also, geologic, geophysical and other laboratory facilities are available from other divisions of the MTA when required. Full facilities to determine amenability of uranium ores to processing, however, are not available.

Ground prospecting for uranium in Turkey began in 1957; and was supplemented in 1958 by an airborne exploration unit. Areas which have been covered by ground prospection are shown in Figure 1. Broad areas of Turkey have also been covered by airborne units.

At present, the airborne radiometric survey is being carried out by a private contractor rather than with the use of Army planes. The aircraft being used is a Piper Cub fitted out with standard radiation-detection equipment, including a 5-inch sodium iodide crystal and a recording device which shows the radioactivity and altitude of each point along the flightline. Depending on the terrain, the height of the aircraft averages 200 feet above the ground, with flight lines about one kilometer apart. Any anomalies observed are located and evaluated on the ground by teams of prospectors.

After the flight the geologic observer notes, for orientation purposes, geographic locations on the flight record which is rolled into a small spool. He then plots the flight line onto a master map for reference purposes. This forms a compact, easy-to-refer to, permanent record of the airborne survey and is a reference system which deserves praise and continuation.

At first, priority was given to airborne exploration of granitic and massif regions. Now that these areas are largely covered, attention is focused on the areas of Tertiary sediments and volcanic rocks. It was in the course of a survey in an area of the latter type that the deposit at Ragillar was discovered.

The recently completed magnetometer-scintillation counter survey of about 50,000 square miles of Turkey revealed no significant radiometric anomalies, probably because the plane was at too great a height for efficient detection.

Very substantial progress has been made by MTA in finding and appraising uranium resources in Turkey since 1957, considering the limited number of people engaged in the search for uranium and the difficulties of accessibility. A staff of young geologists, mining engineers, and prospectors capable of conducting field exploration for uranium has been assembled, trained, and provided with required equipment, and the program is carried on under aggressive and qualified leadership.

A problem arises, however, in that the leadership, because of general programmatic and management demands, is not always able to provide as close direction to or supervision of the field parties as they would like. To assist management by providing guidance at the field level and to develop recommendations and sound exploration programs, consideration might be given to obtaining the services of two experienced geologists to act at the district or area geologist supervising level.

Exploration for uranium in Turkey clearly reflects the earlier cooperative program with the French CEA, which emphasized systematic and detailed search for radioactive anomalies, particularly in massif regions. Such methods have demonstrated their value, not only in the successful uranium exploration program in France but also in the substantial increase in the number and importance of uranium occurrences in Turkey in the last two to three years. However, too intensive or detailed work on small showings must be avoided as inconsistent with the aims or objectives of the MTA program. Also, to achieve a well-balanced program discovery opportunities for uranium deposits in sedimentary rocks should not be neglected.

Actually, MTA's program has been evolving in just such a direction. Experience in the Menderes massif has revealed the general tendency for uranium occurrences or deposits in the gneiss and schist to be relatively small (except possibly for Demirtepe). Experience has also indicated the presence of uranium in Recent sediments within the massif. Elsewhere airborne and ground exploration has discovered uranium in limestone and in Neogene formations. Thus, although primary emphasis has been placed on massif exploration, other types of deposits have also been discovered, and this tendency should be encouraged wherever possible.

To this end airborne exploration should continue to search in areas outside the massif or granite intrusions. Logging of wells drilled for water in sediments by other Government agencies should be continued. No favorable sediments were noted in a one-day examination of Oligocene formations near Ankara, but of course such a cursory examination cannot be considered conclusive. The exploration organization should remain especially alert to deposits in continental sediments.

In order to amplify the exploitation of discovery opportunities in continental sediments, as discussed above, it would be desirable that Dr. Tilev, Director of the Atomic Energy Materials Division, and possibly his counterpart in the MTA mining and physical exploration department, visit the United States in order to examine the geologic environments in which major sedimentary deposits of uranium occur. Such a visit, would supplement the previous experience obtained from examination by MTA personnel of the French uranium deposits and useful analogies to Turkish geology and appraisal problems will become apparent and can be translated into fruitful MTA programmatic activities.

It is well known that uranium supplies currently exceed requirements. Under such circumstances an exploration program for uranium is not justified if it has as its objective immediate exploitation of any discoveries. On the other hand, there will be a future need for uranium in the development of nuclear power and it is generally agreed that efforts to appraise the uranium resources and potential of a country are justified if kept at reasonable levels and not emphasized at the expense of other programs.

Turkey does not have existing needs for nuclear raw materials but it does have a nuclear-power program under consideration; therefore, the present scale of uranium exploration appears reasonable and does not, I understand, materially affect the allocation of funds and personnel to other programs.

SUMMARY AND CONCLUSIONS

1. Uranium deposits at Demirtepe and Ragillar warrant continued physical exploration. If funds and equipment are available, limited exploration is also justified at Kisir and Kocakovanlik. Except for minor concluding work at Kargicak, Gokgedik, and near the Turgut River bridge, physical exploration does not appear warranted at any of the other occurrences visited.
2. MTA now has sufficient staff, facilities and equipment to carry out, on its own initiative, an uranium exploration program. However,

this capability could be improved with additional supervisory or district geologists to assist MTA management. Also, study of American uranium deposits and methods and techniques by appropriate MTA division directors might improve program emphasis and orientation.

3. Present levels of effort in uranium exploration by MTA appear reasonable under the circumstances.

APPENDIX A - VISIT ITINERARY (Uranium Occurrences Examined are Underlined)

8.7.1961 Saturday	Arrived Ankara Esenboga Airport.
9.7.1961 Sunday	Rest.
10.7.1961 Monday	Met Dr. Alpan at MTA. Visited MTA.
11.7.1961 Tuesday	Worked on documentation at MTA.
12.7.1961 Wednesday	Worked on documentation at MTA.
13.7.1961 Thursday	Departed from Ankara by car, arrived at Denizli. On the way, we met the group of Aerial Prospection.
14.7.1961 Friday	Departed from Denizli, arrived at Kargicak.
15.7.1961 Saturday	Investigated Kargicak.
16.7.1961 Sunday	Rest.
17.7.1961 Monday	Investigated Kargicak and Yenikoy. Afternoon general open discussion on Kargicak and Yenikoy area.
18.7.1961 Tuesday	Departed from Kargicak, visited Gokgedik and Turgut area. Arrived at Cavdar.
19.7.1961 Wednesday	Investigated Saricay and Mersinbeleni.
20.7.1961 Thursday	Investigated Demirtepe.
21.7.1961 Friday	Investigated Kocakovanlik area and Quartz vein.
22.7.1961 Saturday	General open discussion on Cavdar,Kocakovanlik and Saricay area. Departed Cavdar, arrived at Soke.

23.7.1961 Sunday	Rest.
24.7.1961 Monday	Investigated Karacahayit and Kisir area.
25.7.1961 Tuesday	Visited Bayindir camp site. Arrived at Izmir.
26.7.1961 Wednesday	Departed from Izmir, arrived at Demirci.
27.7.1961 Thursday	Investigated Mezitler and Cavullar.
28.7.1961 Friday	Investigated Ragillar. Open discussion on Mezitler, Cavullar, Ragillar.
29.7.1961 Saturday	Departed from Demirci via Balikesir, arrived at Bandirma.
30.7.1961 Sunday	Rest.
31.7.1961 Monday	Departed from Bandirma, arrived Orhaneli.
1.8.1961 Tuesday	Visited anomalies sites near Orhaneli. Departed from Orhaneli, arrived at Bursa.
2.8.1961 Wednesday	Short visit in Bursa. Departed from Bursa for Ankara.
3.8.1961 Thursday	Preparation of report at MTA.
4.8.1961 Friday	" " " " "
5.8.1961 Saturday	" " " " "
6.8.1961 Sunday	Rest.
7.8.1961 Monday	Departed for U.S.A.

Figure 1 URANIUM LOCALITIES AND AREAS OF GROUND EXPLORATION IN TURKEY

– MASSIF DU MENDERES - ZONE OUEST –

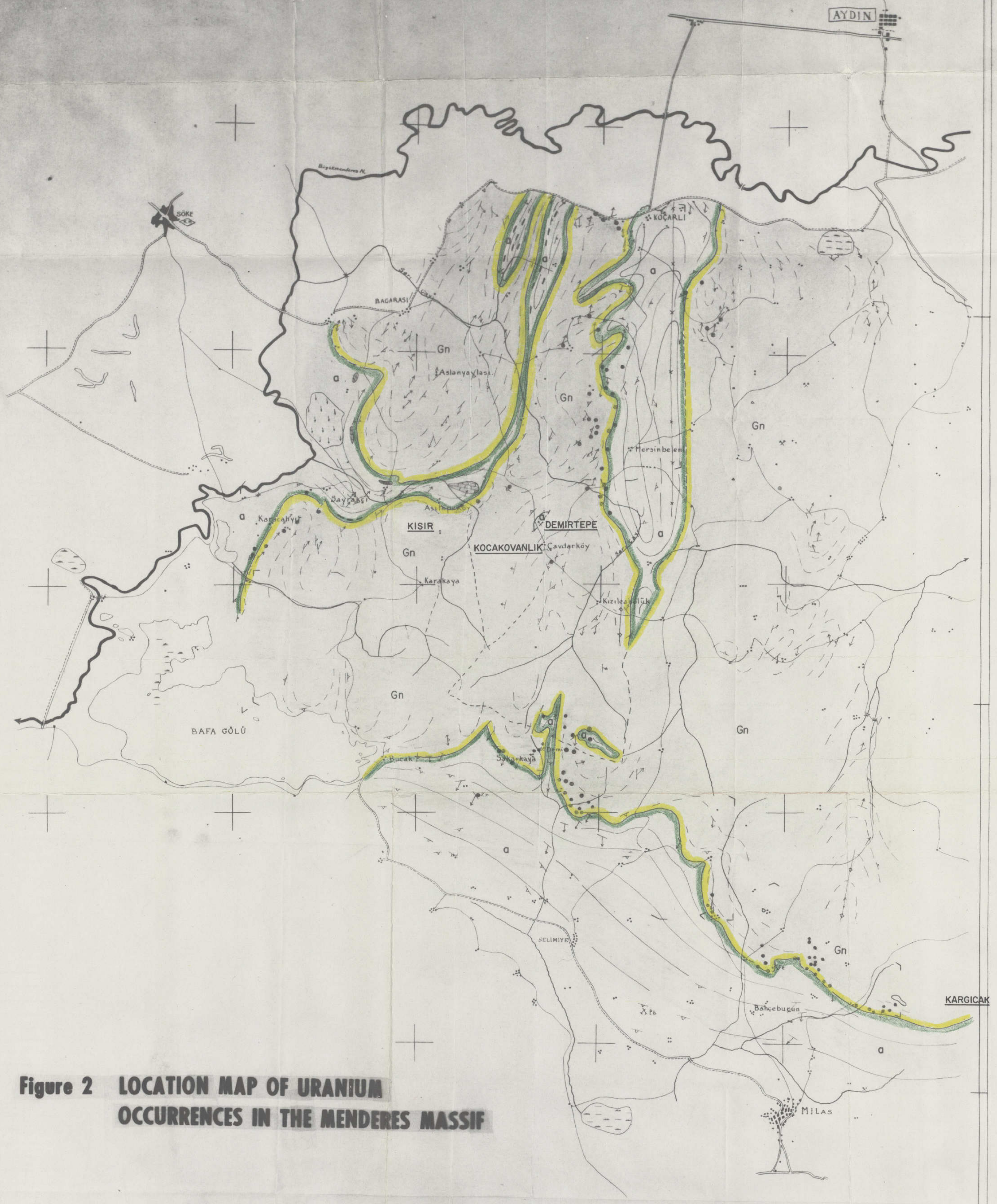

Figure 2 LOCATION MAP OF URANIUM OCCURRENCES IN THE MENDERES MASSIF

LÉGENDE Lejand_

Gn ▨	GNAYS_ Gneiss
a	ŞİST_ Schistes
▭	MERMER _ Calcaires
/ /	AMFİBOLİT_ Amphibolites
~	GNAYS_ŞİST KONTAKT HATTI _ Contact Gneiss / Schistes
●	RADİOAKTİF ANOMALİ _ Anomalies radioactives
⚒	KURŞUN, DEMİR ZUHURU _ Mines de Fe, Pb.
✕	SENKLİNAL AKSI _ Axe synclinal
✕	ANTİKLİNAL AKSI _ Axe anticlinal
⁄	FAY _ Faille
⊥	İSTİKAMET VE YATIM _ Pendage et direction

14341

M.T.A. ENSTİTÜSÜ GENEL DİREKTÖRLÜĞÜ Atom Enerjisi Hammaddeleri Şubesi Mudürlüğü			
MENDERES MASİFİ BATI BÖLGESİ ANOMALİ VE JEOLOJİK HARİTASI			
Hazirlayan	Y. PAROUTY.	Şb. Md.	
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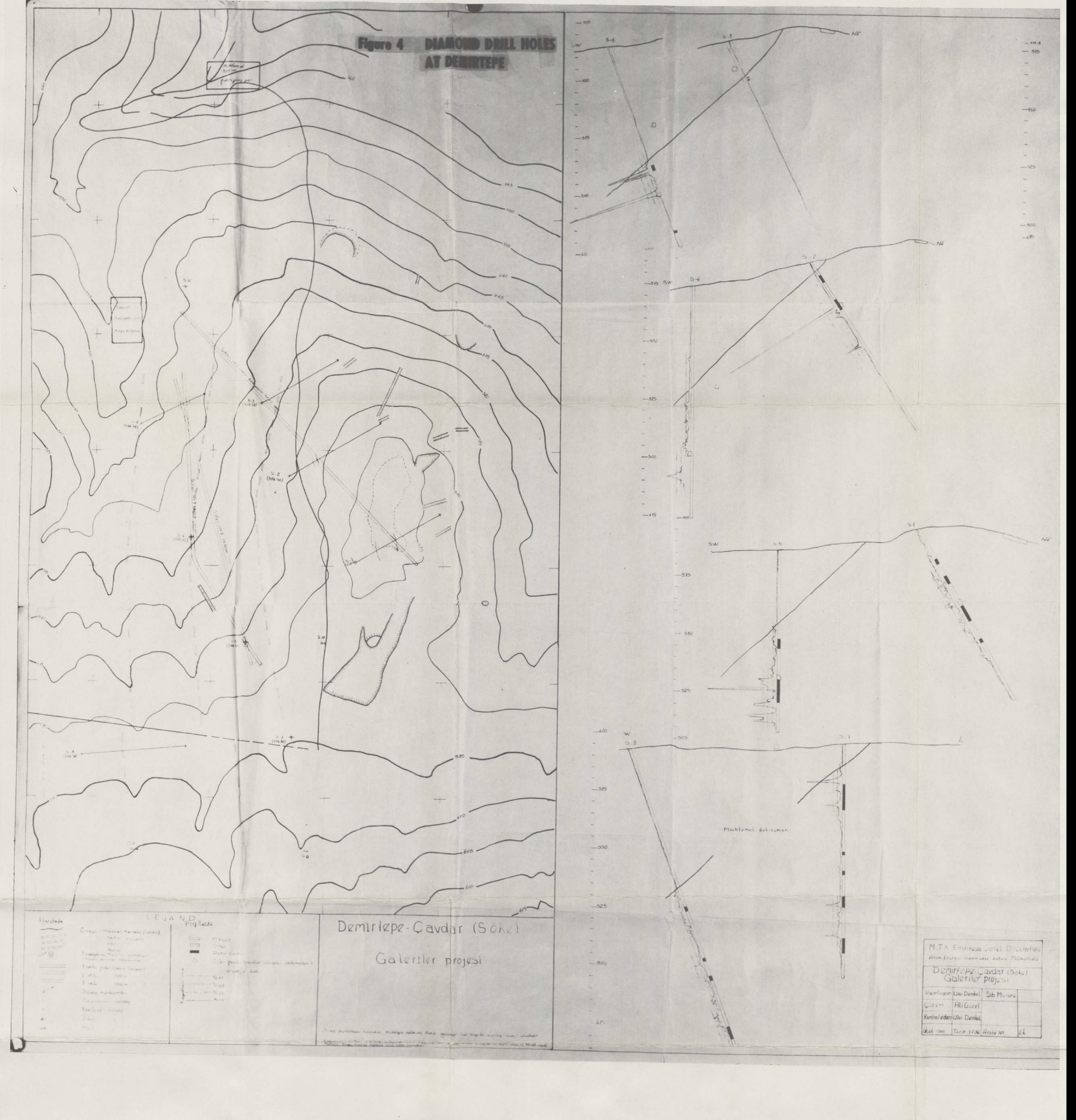
Kontrol eden	"		
Ölçek: 1/100,000	Arşiv N°: 14341	Tarih: 8-8-1961	

Figure 3 GEOLOGIC MAP OF THE DEMIRTEPE AREA

Figure 4 DIAMOND DRILL HOLES AT DEMIRTEPE



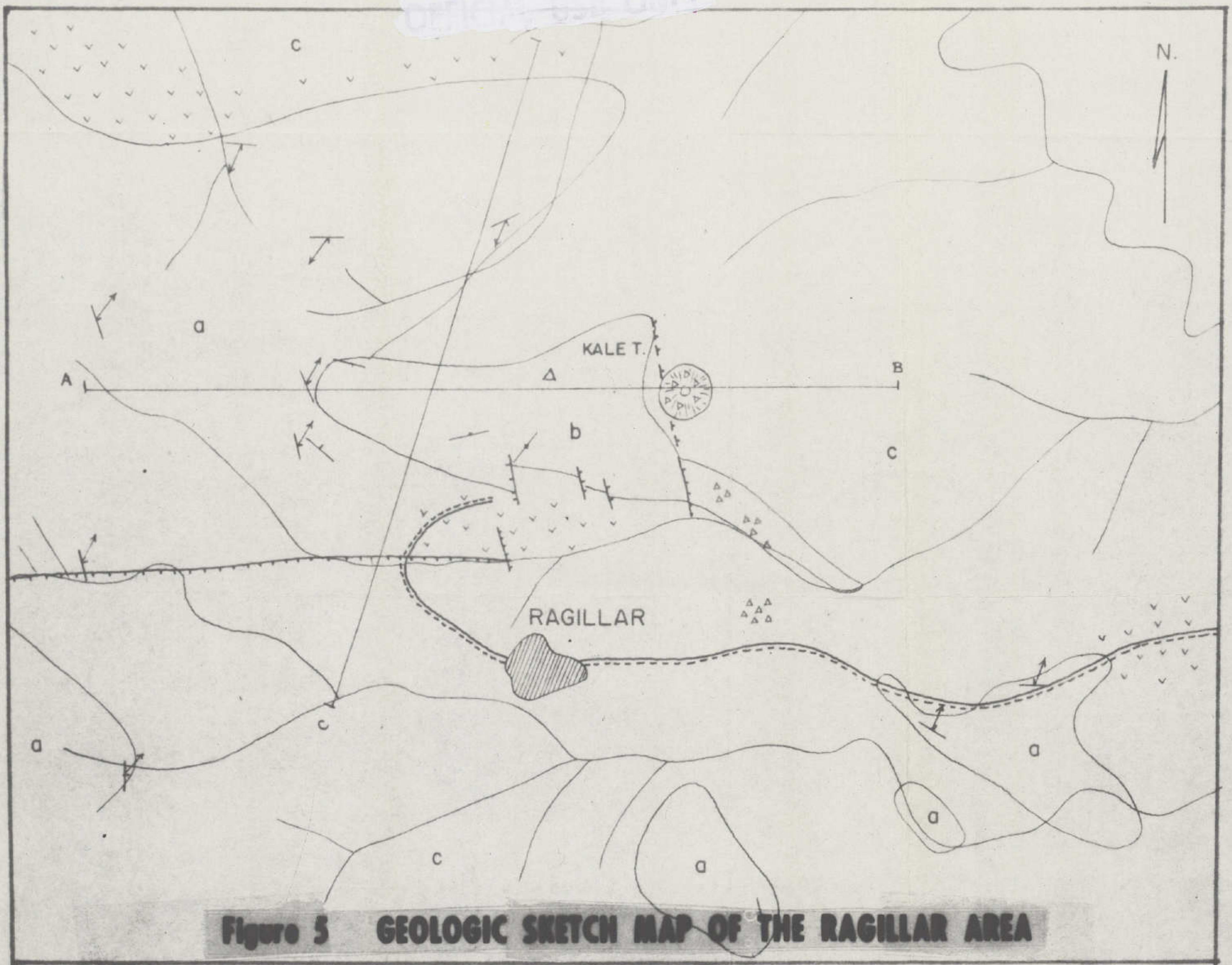


Figure 5 GEOLOGIC SKETCH MAP OF THE RAGILLAR AREA

L E J A N D

a	GNAYS	△ △ △	VOLKANİK BREŞ
b	KALKER (Kale T.)	┬┬┬	FAY
c	NEOJEN	↗	İSTİKAMET VE YATIM İLE BİRLİKDE TEKTONİK HATLAR İSTİKAMETİ
ᵛ ᵛ ᵛ	FANGLOMERAT	----	KESİT

DEMİRCİ _ RAGILLAR
CİVARININ DETAY JEOLOJİSİ

M. T. A. ENSTİTÜSÜ GENEL DİREKTÖRLÜĞÜ
Atom Enerjisi Hammaddeleri Şubesi Müdürlüğü

HAZIRLAYAN:	SCHUILING	Şb. Md.	Varlitnasi
ÇİZEN:	Ö. F. ATABEK		
KONTROL EDEN:	SCHUILING		
ÖLÇEK: 1/10,000	TARİH: 6/7/61	ARŞİV No: 14300	EK:

14300

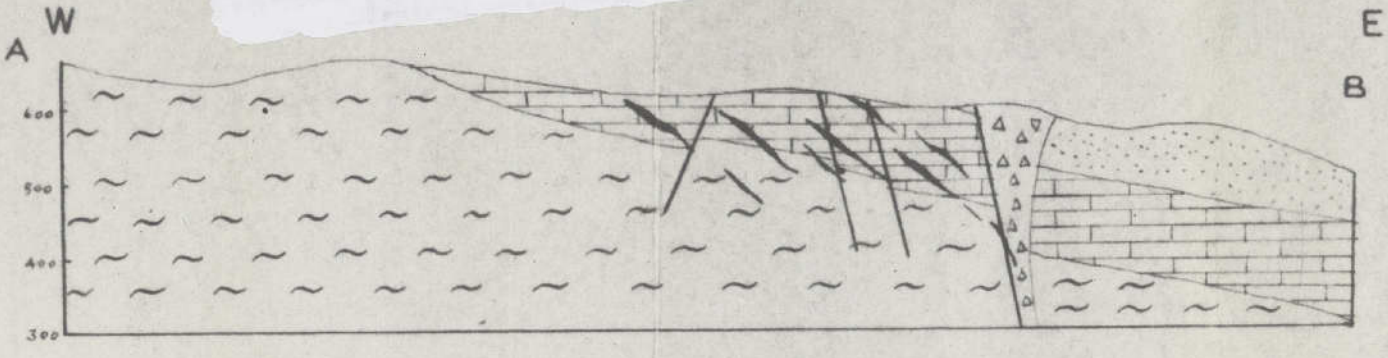
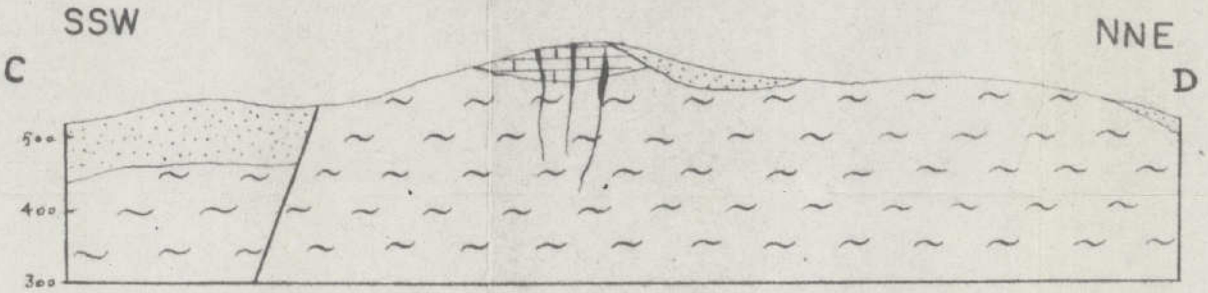


Figure 6 GEOLOGIC CROSS-SECTIONS OF THE RAGILLAR AREA



LEJAND

〜〜	GNAYS
▤	KALKER (Kale T.)
⁖	NEOJEN
△ △	VOLKANİK BREŞ
⟋	RADİOAKTİF SİLİSİFİYE DASİT

DEMİRCİ_RAGILLAR
JEOLOJİK KESİT

M. T. A. ENSTİTÜSÜ GENEL DİREKTÖRLÜĞÜ
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HAZIRLAYAN:	SCHUILING	Şb. Md.	Verilmesi
ÇİZEN:	Ö.F. ATABEK		
KONTROL EDEN	SCHUILING		
ÖLÇEK 1/10.000	TARİH 6/7/61	ARŞİV No. 1430[illegible]	[illegible]

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Figure 7 RADIOMETRIC GRID SURVEY [redacted] DEPOSIT

Figure 8 GEOLOGIC MAP OF THE KARGICAK DEPOSIT SHOWING LOCATION OF TRENCHES AND DIAMOND DRILL HOLES

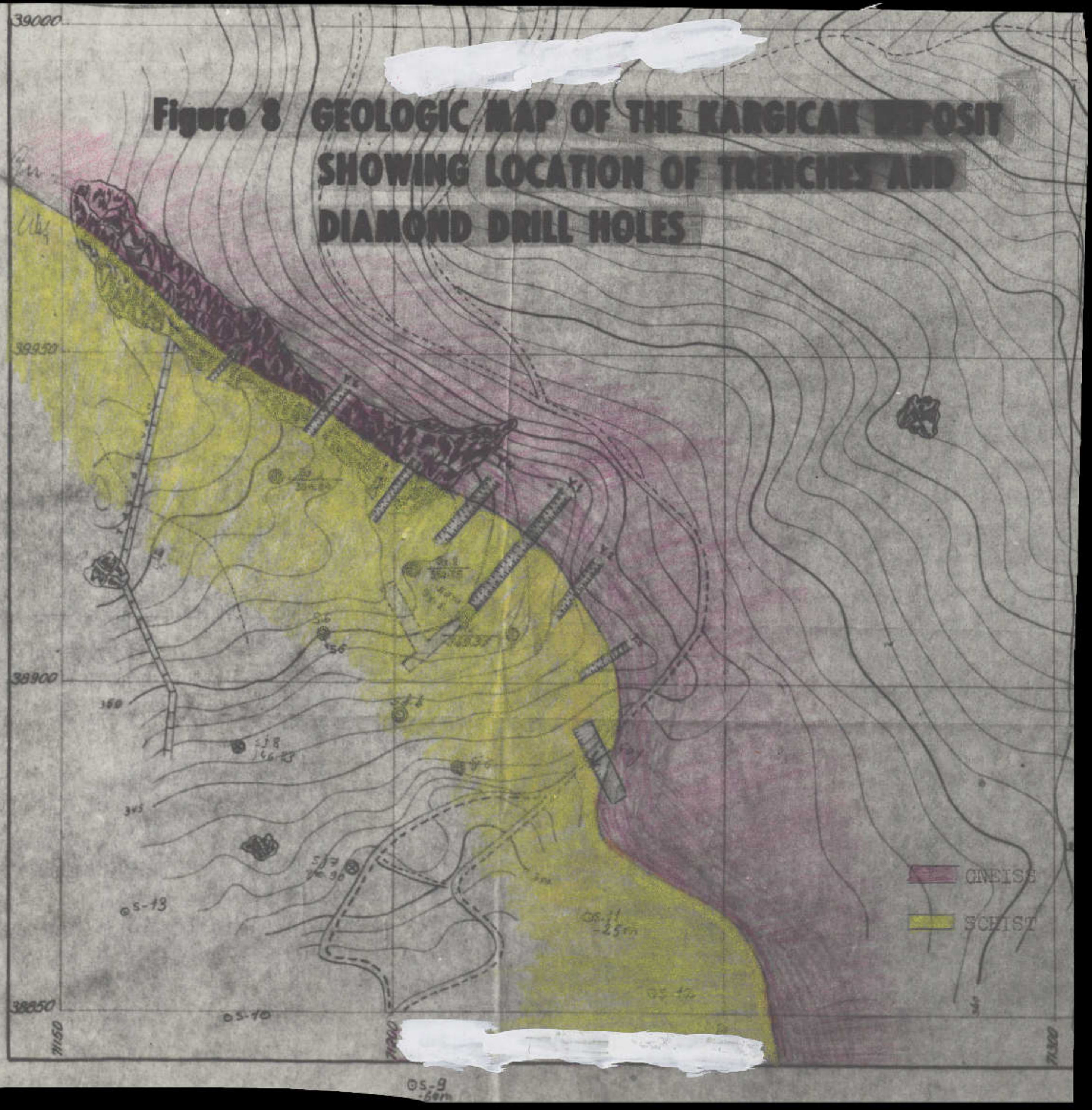

Figure 9 ORGANIZATION OF M.T.A. INSTITUTE