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ENVIRONMENT, DISASTER, AND RECOVERY: A LONGITUDINAL STUDY OF THE 1970 GEDIZ EARTHQUAKE IN WESTERN TURKEY.

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Editorial Review by Lt Col Elser
Department of English
USAF Academy, Colorado 80840

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On March 28, 1970, an earthquake of Richter magnitude 7.1 occurred near the town of Gediz in western Turkey. One thousand and eighty six people were killed and 1,265 were injured in the disaster. The earthquake had a disastrous effect in 313 villages and towns, demolishing 14,852 homes and damaging 5,105 others. Soon after the emergency phase, the Turkish government implemented a vast relief, recovery and reconstruction program which included rebuilding the town of Gediz and building 9,099 housen throughout the damaged area. This report is a comprehensive analysis of the disaster from its beginning through the summer of →

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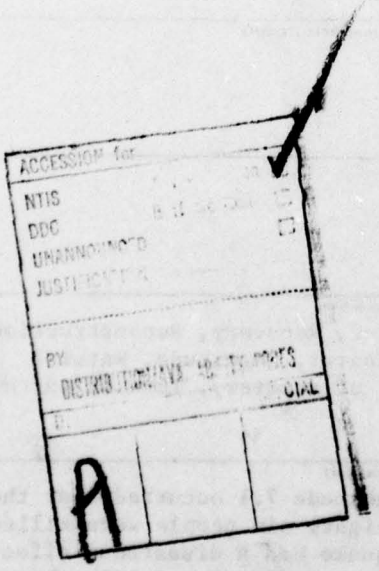
1978. It is the first longitudinal study of an earthquake disaster in Turkey.



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INTRODUCTION

There is an immediate need for empirical case studies addressing the nature and extent of earthquake disasters. This need has been recognized by the North Atlantic Treaty Organization, by the Central Treaty Organization, by the American Earthquake Engineering Research Institute, by the Turkish Earthquake Research Institute, by the Turkish Ministry of Reconstruction and Resettlement, and in reports to the National Science Foundation.[1] In an attempt to meet this need, a systematic report of the 1975 Lice, Turkey earthquake was completed by Mitchell in 1976.[2] The present report is the second in a series of comprehensive geographical reports of Turkish earthquake disasters.[3] Both reports were written with one common goal which was to bring together the diverse research on the disaster so that the pre- and post-earthquake activities could be viewed and interpreted with objective hindsight, resulting in a sound basis for decision makers to plan

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[1] See Committee on Earthquake Engineering Research, Earthquake Engineering Research, A Report to the National Science Foundation, (Washington: National Academy of Sciences, 1969); Gilbert F. White and J. Eugene Haas, Assessment of Research on Natural Hazards, (Cambridge: The MIT Press, 1975); Committee on the Challenges of Modern Society, NATO Disaster Assistance: Earthquake Hazard Reduction, No. 9, no date, and Earthquake Hazard Minimization Conference, July 22-27, 1968, (Ankara: CENTO, Office of United States Economic Coordinator, 1969).

[2] William A. Mitchell, The Lice Earthquake in Southeastern Turkey: A Geography of the Disaster, USAFA-TR-76-24 (United States Air Force Academy, 1976).

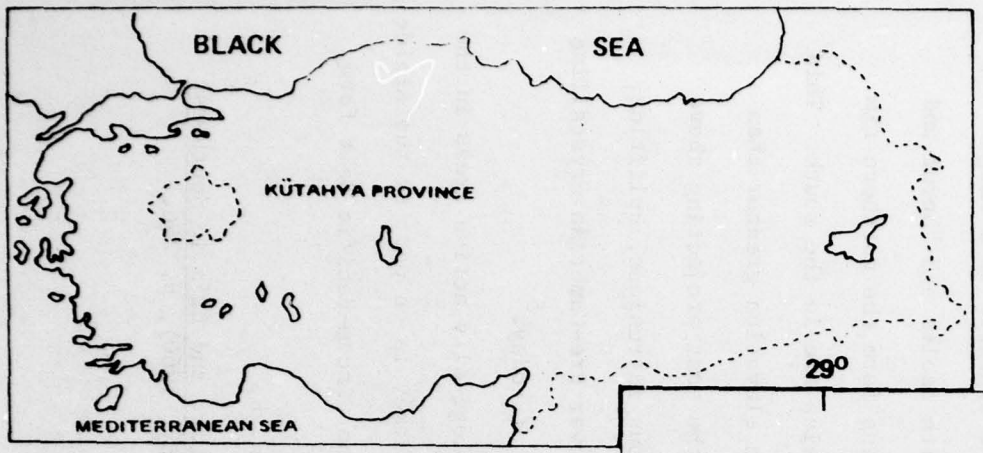
[3] A study of the 1976 Çaldıran-Muradiye disaster is planned.

future actions which would minimize the tragedy and human suffering of future victims.

There are various reports written about the earthquake which occurred near Gediz, in western Turkey, on March 28, 1970 (Figure 1). However, each article tends to focus on one particular aspect of that disaster, whether it be the initial physical effects investigated by the seismologist, geologist, geodesist, and civil engineer, or the post-earthquake socio-cultural changes interpreted by sociologists, economists, geographers, and others. This report incorporates all research presently available, including that by Turkish scholars, on the Gediz disaster and is a comprehensive longitudinal survey. Additionally, it is based on Mitchell's field work in the area during the summers of 1970, 1973, 1976, 1977, and 1978. It systematically describes the nature, extent, and recovery after the 1970 earthquake disaster near Gediz, in western Anatolia, Turkey.

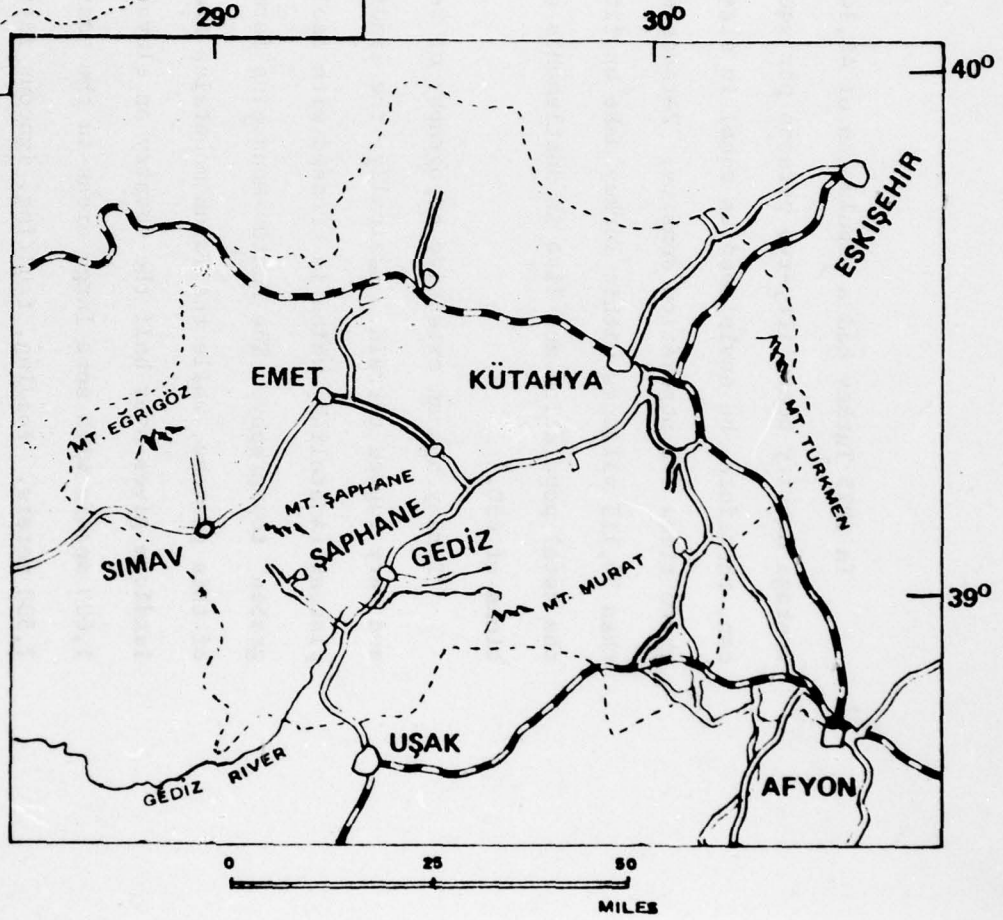
THE GEOGRAPHICAL SETTING

Turkey is bordered to the north by the Black Sea, to the east by the USSR and Iran, to the south by Iraq, Syria, and the Mediterranean Sea, and to the west by Bulgaria, Greece, and the Aegean Sea. This peninsular country covers 780,576 square kilometers with 757,179 square kilometers in Asia and 23,417 square kilometers in Europe.



LOCATION OF KÜTAHYA IN TURKEY

FIGURE 1



In 1975 Turkey had a population of 40,347,719 with the average density near fifty-two persons per square kilometer. Turkey can, therefore, be envisioned as equal in size to Texas but having three times the population density. Persons who live in the more than 36,115 villages within Turkey make up fifty-eight percent of the total population and live in settlements with average populations of 650.[4]

Turkey has an extensive topography of relatively high relief and very rugged terrain. Basically, the landform is a large plateau (Anatolian) which is crossed with faults and "horst and graben" topography. The Pontus mountains form the northern rim of this plateau, while the Tarus mountains are in the south. This landform gives over half the country an elevation greater than 1,600 meters with some large areas in the east projecting above 2,500 meters. Folding, faulting, igneous intrusions, uplifting, and the erosion of Tertiary sediments over Pre-Cambrian crystalline rocks have generally shaped the Turkey of today.[5]

Turkey is one of the most seismologically active areas in the world. This activity occurs because Turkey is on part of the Alpide Belt of seismicity, which along with the Circum-Pacific Belt form

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[4]Mitchell, The Lice Earthquake, p. 6.

[5]George B. Cressey, Crossroads, Land and Life in Southwest Asia (Chicago: J. B. Lippencott Company, 1960), p. 256.

the world's two great earthquake belts. The Alpide Belt runs from Sumatra to the Himalayas, Caucasus Mountains, Turkey, Greece, Italy, the Swiss Alps, and extends into the mid-Atlantic region.[6]

Every locality within the country is subject to earthquake activity; however, there are four main areas. Over fifty percent of the destructive activity is located along the North Anatolian Fault. This fault runs east-west along the northern portion of the country and is the source of generally shallow focus earthquakes (Figure 2). The second area is the Dead Sea fault zone which extends from Syria in a north-east direction to join the North Anatolian Fault near Bingöl (39°N, 31°E). The third seismic area is in the western region of Turkey where depressions run east-west causing mid-focus quakes. Finally, near Muğla, in the southwest, a zone of deep focus quakes runs toward several Mediterranean islands in a southwesterly direction.[7]

From the many seismic areas within Turkey and the country's relationship to world activity, there is no doubt that earthquakes have been a familiar phenomenon throughout history. In 7 A.D. the "hazard" began to be recorded, and in 33 A.D. the first specific area was mentioned; Bithynia near the Sea of Marmara's eastern

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[6]Joseph Pensien and Robert D. Hanson, The Gediz Turkey Earthquake of 1970 (Washington, D.C.: National Academy of Sciences, 1970), p. 3.

[7]Ministry of Reconstruction and Resettlement, Notes on Gediz Earthquake (March 28, 1970) (Republic of Turkey, 1971), p. 1.

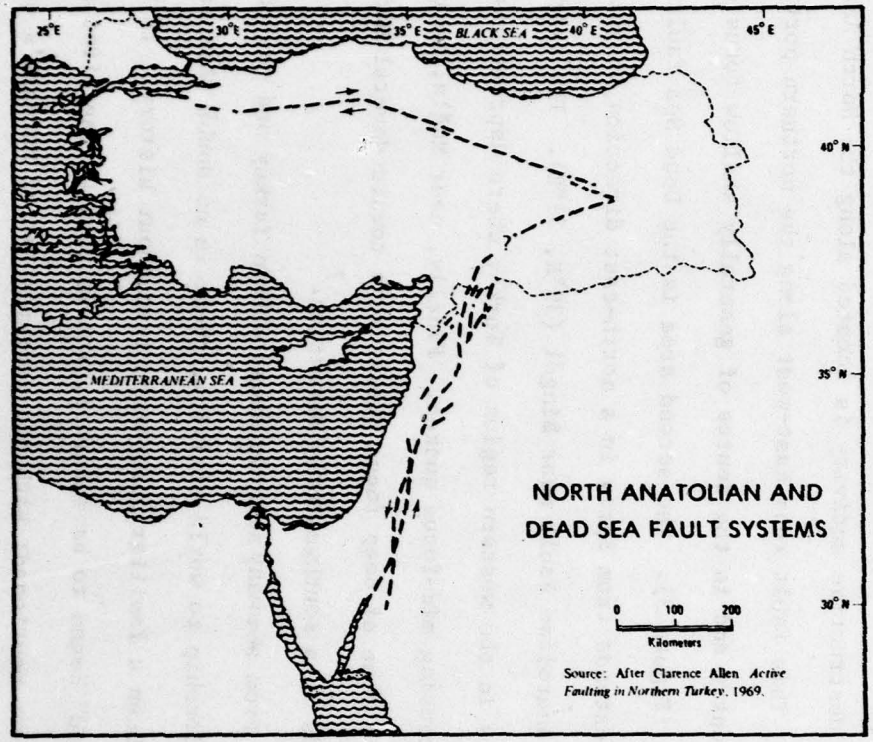
25°E
30°E
35°E
BLACK SEA
40°E
45°E
40°N
35°N
30°N
MEDITERRANEAN SEA
NORTH ANATOLIAN AND
DEAD SEA FAULT SYSTEMS
0
100
200
Kilometers
Source: After Clarence Allen Active Faulting in Northern Turkey, 1969.

Figure 2

shore.[8] Since 1900 over 700 earthquakes have struck Turkey with a magnitude greater than 4.0 Richter (Figure 3). These quakes have occurred most frequently in the months of March through May (Table 1). About one earthquake of magnitude 6.0 Richter has struck Turkey every year for the last few decades (Table 2).[9]

With intensities of such frequency, it is obvious that the destructive capacity of Turkey's seismic activity is great. This destructive potential is increased by the fact that 95 percent of the population, 98.3 percent of the industry, and 91.6 percent of the dams of Turkey are within definite earthquake zones (Figure 4).[10] Indeed, a majority of Turkey's population and much of its industry are concentrated within the highest frequency earthquake areas (Zones 1 and 2, Figure 4).

Kütahya Province

Turkey is administratively divided into sixty-seven provinces. These provinces are further divided into administrative districts of which there are 572 in all. Further division usually occurs to the administrative sub-district. All of these potential units are

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[8] William A. Mitchell, "Turkish Villages After an Earthquake: An Analysis of Disaster Related Modernization" (University of Illinois: unpublished Ph.D. dissertation, 1974), p. 12.

[9] Data provided by the National Geophysical and Solar-Terrestrial Data Center, NOAA, U. S. Department of Commerce, Boulder, Colorado.

[10] Country Monograph of Turkey, UNESCO, Intergovernmental Conference on Assessment and Mitigation of Earthquake Risk, Paris, February 10-19, 1976 (Ankara: UNESCO, February 1976), p. 1.

EARTHQUAKE OCCURRENCES IN TURKEY: 1900 THROUGH 1974

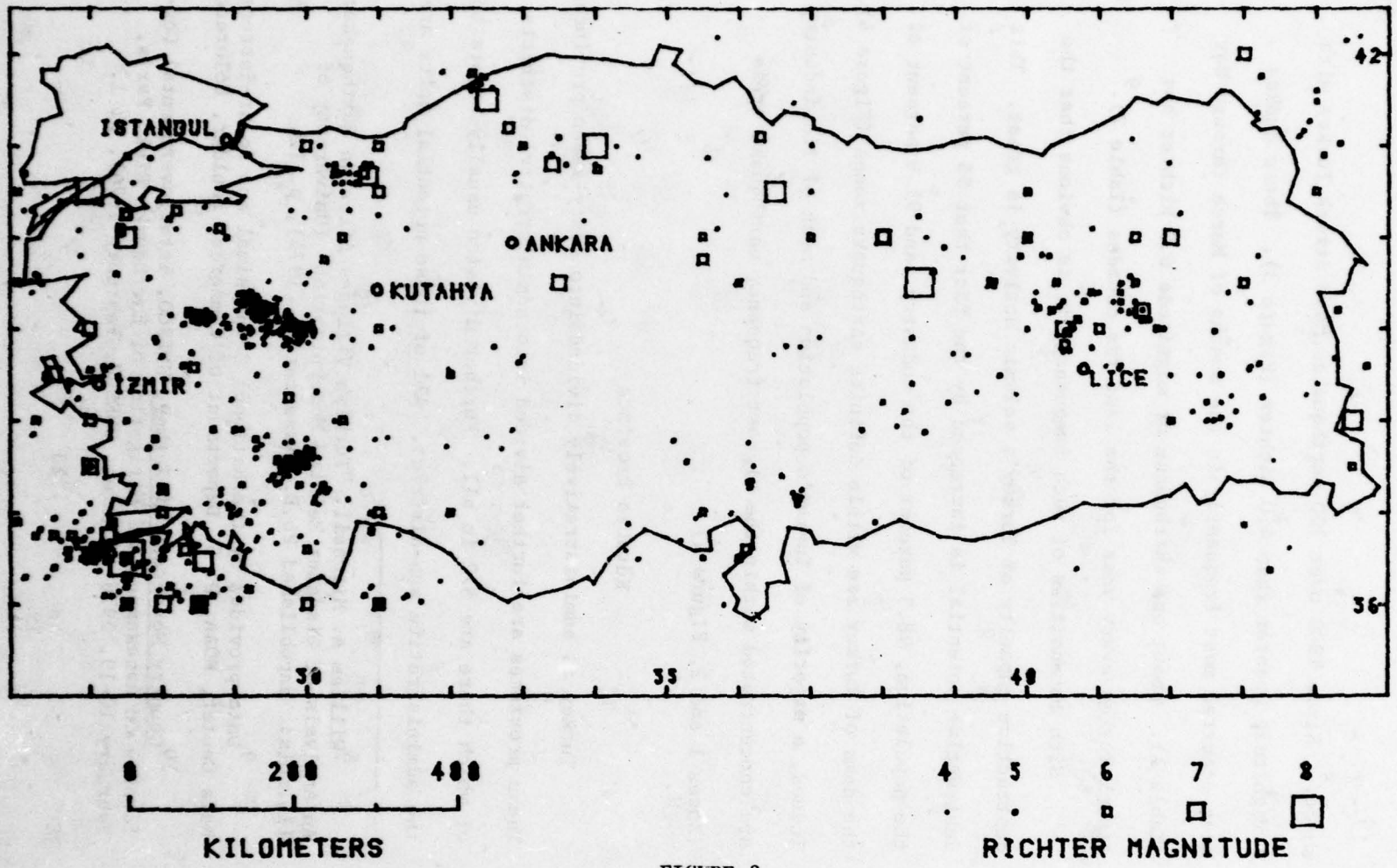

FIGURE 3

SOURCE: NATIONAL GEOPHYSICAL AND SOLAR-TERRESTRIAL DATA CENTER
PLOTTED BY MAJOR RICHARD WOLNIEWICZ AT USAFA/ERCC

TABLE 1

MONTHLY OCCURRENCES OF EARTHQUAKES IN TURKEY
(1900 Through 1974)*

	Richter Magnitude					Total And Percentage By Month
	4	5	6	7	8	
January	21	10	3	0	0	34 (4.8%)
February	31	9	1	1	0	42 (5.9%)
March	65	16	2	2	0	85 (11.9%)
April	67	18	5	1	0	91 (12.7%)
May	82	13	10	2	0	107 (15%)
June	43	7	4	0	1	55 (7.7%)
July	43	20	5	0	0	68 (9.5%)
August	45	14	5	1	0	65 (9.1%)
September	41	14	5	0	0	60 (8.4%)
October	33	8	3	0	0	44 (6.2%)
November	24	6	1	1	0	32 (4.5%)
December	26	3	1	2	0	32 (4.5%)
Total	521	138	45	10	1	715 (100%)

*Calculated from data provided by National Geophysical and Solar-Terrestrial Data Center. Earthquake parameters: 36.0-42.2N and 26.0-44.8E.

TABLE 2

EARTHQUAKES THAT HAVE CAUSED LOSS OF LIFE
DURING THE PAST 40 YEARS IN TURKEY

Name	Location		Year	Deaths
Erzincan	38.7° N	39.7° E	1939	40,000
Lâdik-Samsun	40.7° N	36.0° E	1943	4,000
Gerede-Çerkeş	40.8° N	32.4° E	1944	4,000
Karaburun	38.6° N	26.3° E	1949	7
Çankırı	40.8° N	33.4° E	1951	50
Yenice-Gönen	40.0° N	27.3° E	1953	250
Fethiye	36.4° N	28.5° E	1957	18
Abant	40.6° N	30.8° E	1957	66
Varto-Hinis	39.4° N	41.6° E	1959	18
Manyas	40.3° N	28.2° E	1964	19
Varto	39.2° N	41.6° E	1966	2,279
Mudurnusuyu	40.6° N	31.0° E	1967	86
Pülümür	39.6° N	39.9° E	1967	97
Bartın	41.6° N	32.4° E	1969	25
Alaşehir	38.4° N	28.6° E	1969	41
Gediz	39.0° N	29.3° E	1970	1,086
Bingöl	39.5° N	40.5° E	1971	755
Burdur	37.3° N	29.8° E	1971	57
İzmir	38.5° N	27.2° E	1974	2
Lice	38.5° N	40.7° E	1975	2,385
Kars	40.9° N	42.9° E	1976	2
Doğu	39.9° N	43.7° E	1976	5
Denizli	36.6° N	28.9° E	1976	4
Çaldıran	39.1° N	44.1° E	1976	3,840

SOURCE: Data provided by General Directorate of Natural Disaster Affairs, Ministry of Reconstruction and Resettlement, Ankara, July 1977 and June 1978.

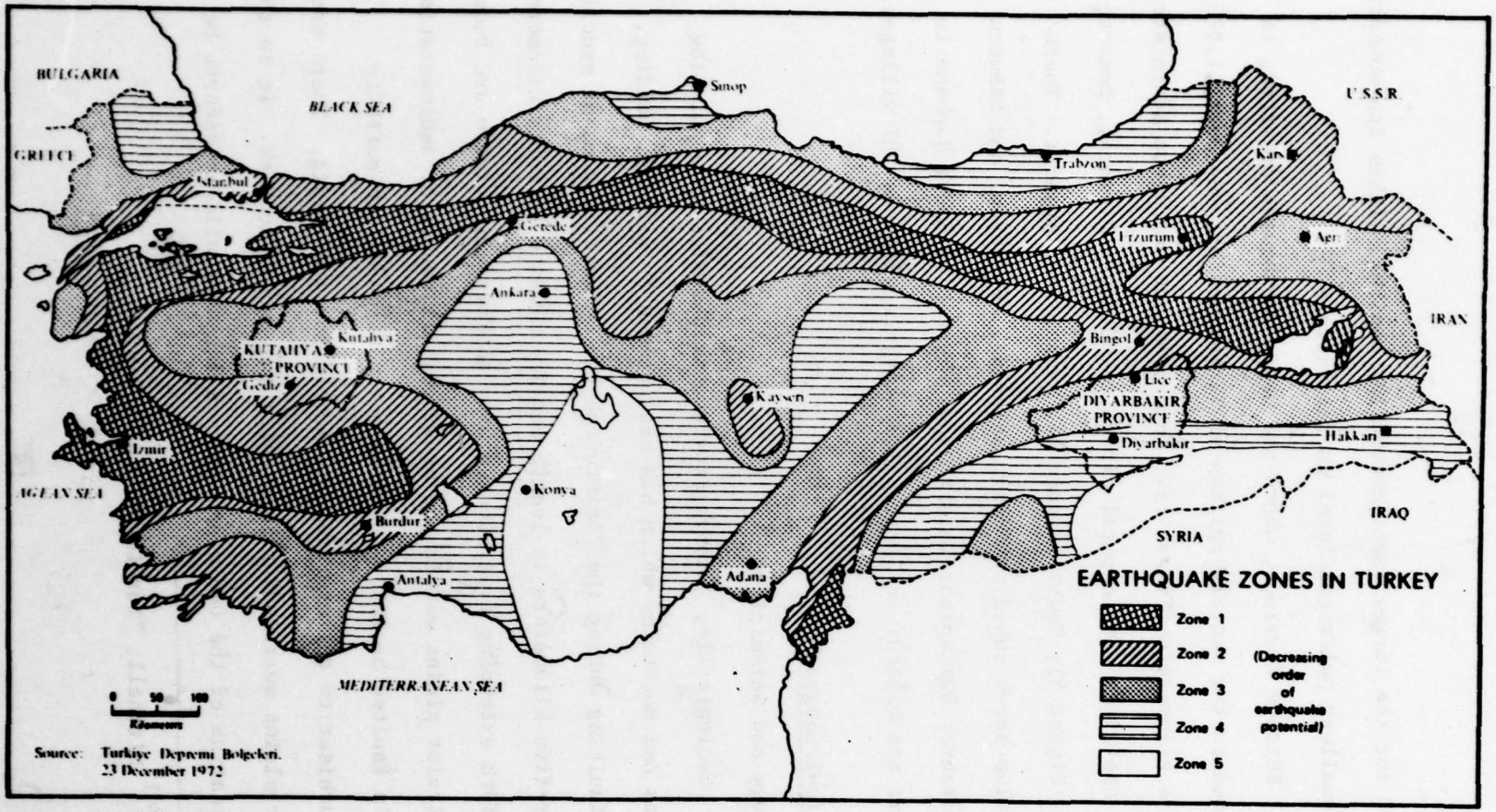
BULGARIA
BLACK SEA
GREECE
Istanbul
Sinop
USSR
Trabzon
Kars
Gerede
Erzurum
Ağrı
Ankara
IRAN
KUTAHYA PROVINCE
Kutahya
Gediz
Bingol
Lice
DIYARBAKIR PROVINCE
Kayseri
Izmir
Diyarbakir
Hakkari
AEGEAN SEA
Konya
Burdur
IRAQ
SYRIA
Antalya
Adana
MEDITERRANEAN SEA
0 50 100
Kilometers
Source: Turkiye Depremi Bolgeleri. 23 December 1972
EARTHQUAKE ZONES IN TURKEY
Zone 1
Zone 2
Zone 3
Zone 4
Zone 5
(Decreasing order of earthquake potential)

FIGURE 4

named for the largest settlement, the capital, within its boundaries. The smallest political level is the village.[11]

Kütahya Province, where the Gediz earthquake occurred, is located in the western portion of Turkey and extends over 11,875 square kilometers (Figure 1). This province has seven administrative districts with capital cities in Kütahya, Altıntaş, Domanıç, Emet (Figure 5), Gediz (Figure 6), Simav, and Tavşanlı. There are also seven sub-districts: Aslanapa, Köprüören, and Sabuncu in Kütahya; Dumlupınar in Altıntaş; Örencik in Emet; Şaphane in Gediz; and Dağardı in Simav. The province also has 587 villages.

Physical Geography

Geology and Seismicity

Geologically, Kütahya Province is a series of undulating plains and mountains which has been caused by warping, folding, and faulting during the Pleistocene era. There is a major syncline fifty-five kilometers in length and from twelve to forty kilometers in width extending from Kütahya City to Tavşanlı. There are four particular plains within the province, all caused by sedimentation within faulted basins. A narrow plain extends from north to Çavdarhisar to thirty-three kilometers south of Gediz. There are other plains surrounding Emet, Altıntaş, and Tünçbilek. It is the combination of the Gediz and Emet plains that will henceforth be

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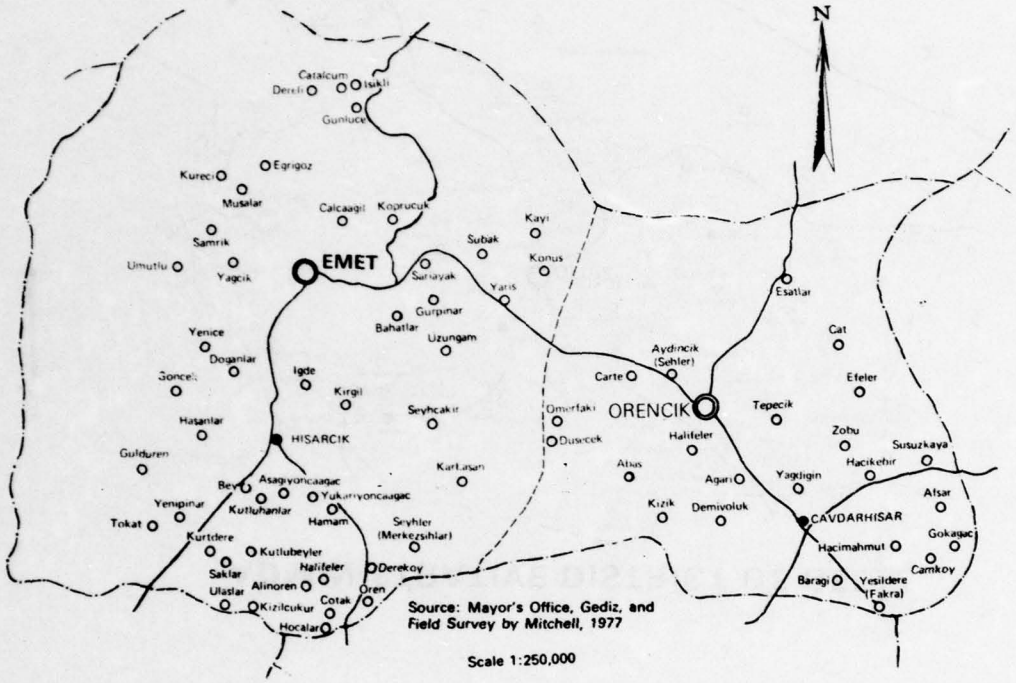
[11] Mitchell, "Turkish Villages," p. 35.

ADMINISTRATIVE DISTRICT OF EMET

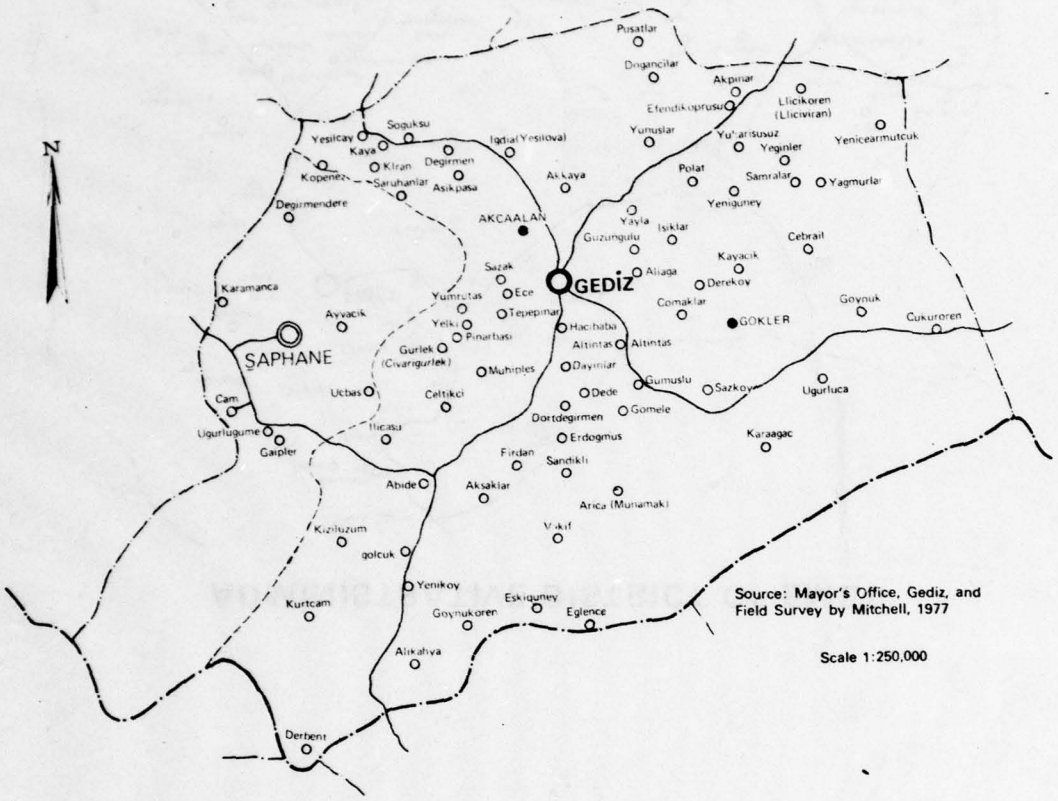


Source: Mayor's Office, Gediz, and Field Survey by Mitchell, 1977

Scale 1:250,000

FIGURE 5

ADMINISTRATIVE DISTRICT OF GEDİZ



Source: Mayor's Office, Gediz, and Field Survey by Mitchell, 1977

Scale 1:250,000

FIGURE 6

referred to as the Gediz-Emet basin. With elevations ranging from 750 to 1,500 meters the basin is shadowed by five mountain ranges within the province rising above 2,000 meters. Murat (2,312 meters) to the south, Şaphane (2,120) and Ak (2,089) to the west, and Yellice and Gümüş (2,000) to the northeast are all generally east-west trending mountains. The only north-south trending range is Eğrigöz (2,181), northwest of Gediz City.[12]

There is no exclusive type of geologic formation within the area, for metamorphic, igneous, and sedimentary rocks are all prevalent. The mountains are all cored with crystalline schists. Andesit and gneiss are common in Elma Mountain and Şaphane Mountain to the south. Granite is prevalent along Eğrigöz Mountain while the whole north-central portion of the province finds gneiss prominant. These formations were caused by massive Hercynian movements of Alpine orogeny which, with faulting, also caused the horst and graben topography and its basins. Neogene sediments eventually filled these depressions, sometimes to over 1,500 meters thick (especially near Gediz). From the underlying base rock of mica schists, calc-schists, quartzites, and marbles (from Permian-Mesozoic sediments) the neogene formations are generally layered to the surface in the following manner: conglomerates from base rock, sandstones, shales, marls, cherty limestones, pebbles, and

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[12]Ministry of Reconstruction, Notes on Gediz, p. 7 and Mitchell, "Turkish Villages," p. 30.

sands. Sedimentary formation, sandstone and limestone are also common in the eastern portion of Kütahya province. Igneous formations, lavas, tuffs, and agglomerates are especially common west of a line from Gediz to Akçaalan and Deresevindik. The city of Gediz (old) was located on three sides of such a volcanic outcrop called the Gediz Rock.[13]

Kütahya province is very active seismologically. According to Taşdemiroğlu, the region leads the rest of Turkey in total number of earthquakes though not in intensity.[14] Located in seismic zone II and III (Figure 4), between 1700 and 1969 there were twenty earthquakes within the region of intensities greater than V (Modified Mercalli scale) as seen in Table 3, Figure 3. In April of 1896, an earthquake at Emet with widespread flooding damaged many homes. The Gediz-Uşak earthquake of June 1944 destroyed over 3,500 homes.[15] This activity is greatly enhanced by the number of faults within the area. The Koca, Şaphane, and Murat faults are pre-neogene faults which are the most predominant as they weave in

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[13]Mehmet Taşdemiroğlu, "The 1970 Gediz Earthquake in Western Anatolia, Turkey," Bulletin of Seismological Society of America, Vol. 61, No. 6 (December 1971), pp. 1507-1510 and Pensien and Hanson, The Gediz Turkey Earthquake, p. 21.

[14]Taşdemiroğlu, "The 1970 Gediz Earthquake," p. 1507.

[15]Pensien and Hanson, The Gediz Turkey Earthquake, p. 4.

TABLE 3

DAMAGING EARTHQUAKES IN THE GEDİZ REGION

DATE	MACROSEISMIC DATA			LOCATION	REFERENCES
	COORDINATES		INTENSITY		
1700	39°.42N	29°.98E	VI	Kütahya	a
1795	38°.76N	30°.50E	VIII	Afyon	a
1859	39°.42N	29°.97E	VI	Kütahya	a
1866, Sep 18	39°.40N	29°.20E	VI	Uşak-Bursa	a
1875, May 11	38°.10N	30°.20E	VI	Uşak	a
1886, Oct 6	39°.55N	28°.95E	VII	Tavşanlı	a
1896, Apr 16	39°.30N	29°.20E	VII	Emet	a
1901, Mar	38°.20N	29°.40E	VI	Uşak	a
1912	38°.20N	30°.00E	VI	Uşak	a
1928, May 6	39°.80N	30°.50E	VI	Eşkişehir	a
1930	39°.34N	29°.25E	VI	Emet	a
1934, Jun 10	38°.70N	30°.00E	VII	Uşak	a
1941, Jan 29	38°.76N	30°.50E	V	Afyon	a
1941, Jul 3	38°.67N	29°.40E	VI	Uşak	a
1942, Jan 18	38°.76N	30°.50E	V	Afyon	a
1943, Apr 14	39°.34N	29°.25E	---	Kütahya-Bursa	b
1944, Jun 25	39°.04N	29°.40E	VII	Uşak-Gediz	b
1949, Feb 5	39°.91N	29°.20E	VII	Harmancık	c
1949, May 10	38°.54N	28°.65E	VI	Kula	d
1969, Mar	39°.19N	28°.43E	VII	Demirci	e

a = Türkiye Depremleri İzahli Kataloğu, Pinar, N. ve Lahn, E. (1952).

b = International Seismological Summary.

c = Bureau Central Internationale de Seismologie.

d = Ministry of Reconstruction and Resettlement.

SOURCE: Mehmet Taşdemiroğlu, "The 1970 Gediz Earthquake in Western Anatolia, Turkey," Bulletin of Seismological Society of America, Vol. 66, No. 6 (December 1971), p. 1513.

a mosaic pattern throughout the province. Reverse faults are also located in some areas.[16] These numerous faults point to a seismologically active area.

Climate

Climate within Kütahya province is transitional with no one particular classification. It is influenced by the Mediterranean climate to the west, the semi-arid climate to the east, the humid Black Sea climate to the north, and finally by a continental location.

The average temperature at Kütahya city is 10.6° centigrade. During July the average temperature is 20.4°C (69°F) and in January the average is 0.3°C (32.5°F).[17] The maximum and minimum temperatures recorded are 37°C (98°F) and -28°C (-18°F).[18] Frost is common in the highlands from late August to April.

Precipitation averages between 550 and 600 millimeters per year in Kütahya province. With snow generally covering the ground for thirty-five days a year and thunderstorms a familiar sight in summer, there is no dry month.[19] The duration of the longest relatively dry period is three and one-half months.

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[16]Taşdemiroğlu, "The 1970 Gediz Earthquake," p. 1510.

[17]Yusuf Dönmez, "The Position of the Kütahya Plain and Its Surroundings from the Point of Climatology," Review of the Geographical Institute of the Istanbul University. International Edition, XIV (1972-73), pp. 131-154.

[18]Ministry of Reconstruction, Notes on Gediz, p. 7.

[19]Mitchell, "Turkish Villages," p. 32 and Ministry of Reconstruction, Notes on Gediz, p. 7.

Water Resources

There are eight main streams flowing through Kütahya province. These streams and their lengths within the province are: Adranos (130 kilometers), Porsuk (90), Murat (80), Emet (80), Gediz (60), Simav (50), Hamzabey (35), and Felent (28). Porsuk stream, from six miles northeast of Kütahya city and downstream, was observed to be relatively useless in 1973 because of sewerage, oil, and chemical wastes from local chemical factory pollution.[20] Conditions appeared no better when observed by Mitchell in 1977 and 1978.

Soil Characteristics

Pedacals, pedalfers, and alluvial soils are all common in this area. This variety is caused by the different climate controls and the variety of parental material. Pedacals predominate in the eastern and central parts of the province, mostly as brown or brown steppe soils. Gray-brown podzolic soil (pedalfer) is common in the north and west portions, and especially around the Eğrigöz, Murat, and other mountain ranges. Alluvial soils are in all the river basins (Figure 7).

Vegetation

Vegetation is varied throughout the province. Coniferous trees inhabit the largest area within Kütahya province. Growing

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[20] Mitchell, "Turkish Villages," p. 34.

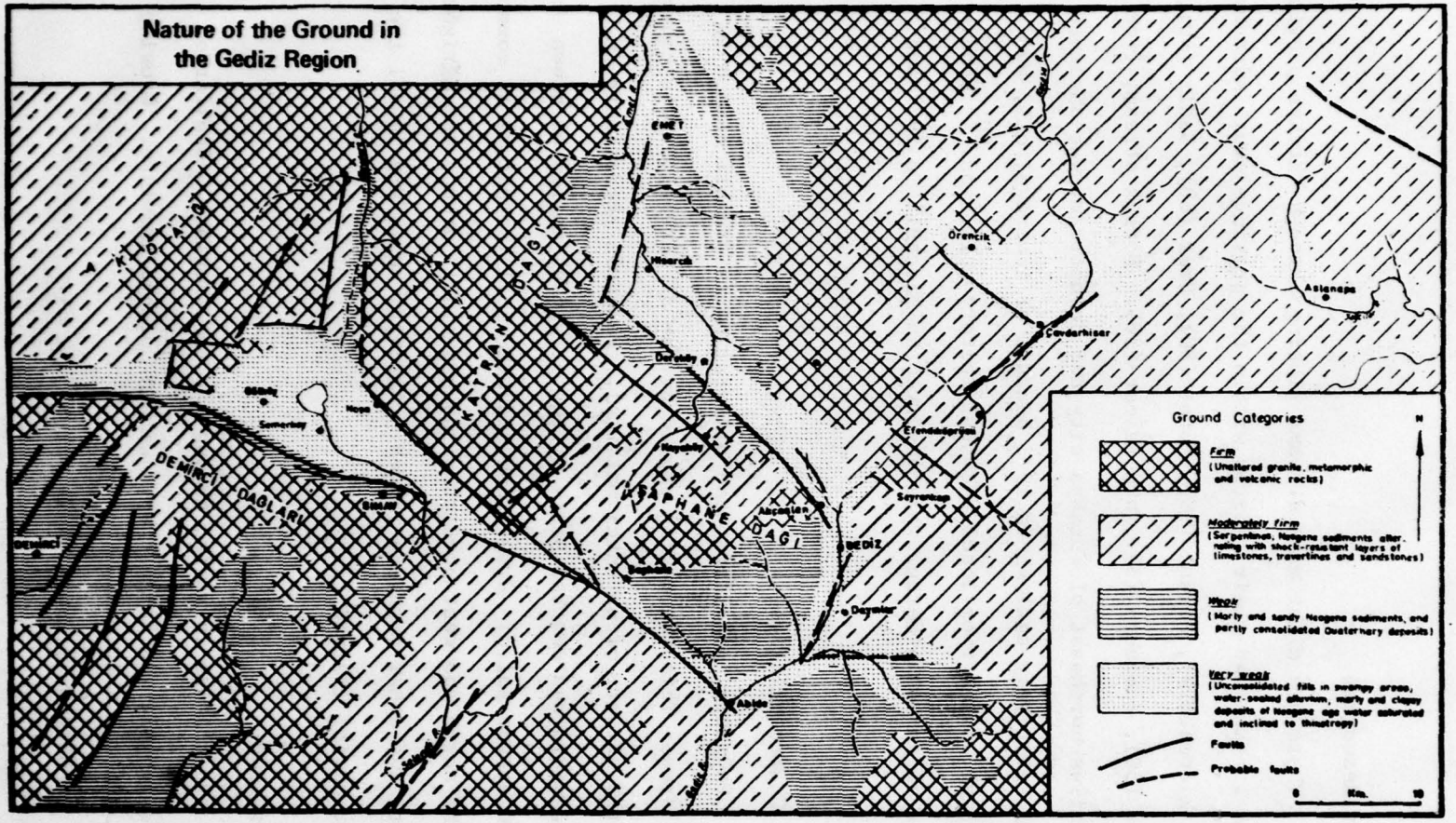

FIGURE 7

SOURCE: Sirri Erinç, "The Gediz Earthquake of 1970," Geology and History of Turkey, p. 446.

east of a line from Simav to Domanıç, firs, pines, and cedars are common in the elevations above 1,600 meters, especially around the Murat mountains. Deciduous trees, beech, hazel, and chestnut, are found near Domanıç and Tavşanlı where the humid climate is more conducive to their growth. Many areas within the province are barren of trees (about 30 to 35 percent of the total land forested) except for poplars which are planted by villagers along streams which, due to their quick growth, are used in building construction. Vegetation here is a function of the different climate zones, altitudinal changes, continental location, and finally, man's intervention.

Cultural Aspects

Population

In 1970 there were over 439,967 persons residing in 622 cities, towns, and villages within the province of Kütahya, illustrated in Tables 4 and 5. Of this population, seventy-five percent were rural. This can be seen in the fact that only four percent of the settlements had a population greater than 2,000 (Table 5), the official size limitation of a village; there were only seven actual urban centers. There were, however, only four cities with populations greater than 10,000 (the official minimum population of an "urban" settlement). These four cities were Kütahya (62,222), Tavşanlı (16,625), Gediz (10,651), and Simav (10,183). There are great contrasts

TABLE 4

KÜTAHYA PROVINCE: POPULATION, AREA AND DENSITY BY DISTRICTS 1970-1975

DISTRICTS	POPULATION[a]		AREA	DENSITY[b]	
	1970	1975	(Km^2)	1970	1975
(Turkey)	(35,666,549)	(40,347,719)	(779,445)	(46)	(52)
Kütahya (Capital)	129,056	147,928	3,231	39	46
Altıntaş	33,898	32,153	1,210	28	27
Domaniç	17,096	19,155	619	27	31
Emet	54,177	55,227	1,605	33	34
Gediz	66,951	65,097	1,719	38	38
Simav	74,446	80,087	1,687	44	47
Tavşanlı	64,343	70,776	1,804	35	39
TOTAL	439,967	470,423	11,875	37	40

[a]Census of Population, 25 October 1970 and Census of Population, 26 October 1975.

[b]Population per square kilometer.

TABLE 5

SIZE DISTRIBUTION OF SETTLEMENTS
IN KÜTAHYA PROVINCE[a]
1970-1975

Population	Number of Settlements		Percentage of Total	
	1970	1975	1970	1975
1 - 100	16	23	2.57	3.71
101 - 200	87	91	13.99	14.70
201 - 300	114	133	18.33	21.49
301 - 400	112	77	18.01	12.44
401 - 500	67	70	10.77	11.31
501 - 750	105	109	16.88	17.61
751 - 1,000	57	41	9.16	6.62
1,001 - 1,500	32	35	5.14	5.65
1,501 - 2,000	5	8	.80	1.29
2,001 - 2,500	7	8	1.13	1.29
2,501 - 3,000	6	3	.97	.48
3,000 and above	14	19	2.25	3.07
TOTAL	622[b]	619	100.00	100.00

[a]Calculated from data in Census of Population, 25 October 1970 and Census of Population, 26 October 1975.

[b]This number includes all cities, towns, and villages in Kütahya province.

between the 600 settlements for some range from the traditional subsistence village to the prosperous, market-oriented town, to the relatively large city. Relative growth and change for the province between 1970 and 1975 is shown in Tables 4 and 5.

Transportation

Transportation is a problem within the province for many. Although there is bus and taxi service in parts of Kütahya, roads are poor. Only twenty-seven percent (731 kilometers) of the entire road system was stabilized (paved) in 1970. The major paved road system enters from Eskişehir and Afyon to Kütahya and extends to Tavşanlı and into Bursa province (Figure 1). Leveled and loose surfaced roads comprise fourteen (381 kilometers) and fifty-eight (1,566) percent of the total surface roads.[21] For several months during especially wet periods, these dirt roads become quagmires thereby isolating some villages. Yet, despite these problems, Kütahya's transportation network has been assessed as relatively good.[22]

Economics

The culture of Kütahya province is basically agrarian. Almost fourteen percent of the total land is used for cultivation, .04 percent is allocated to orchards, .04 percent to vegetable fields and

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[21] Recommendations of the Joint Turkish/American Agricultural Mission, Improving Farm Income in the Poppy Region, Appendix B, Table B-17, n.p.

[22] Mitchell, "Turkish Villages," p. 46.

gardens, and 9.4 percent is given to pasture/fallow land (Tables 6 and 7). Major crops are wheat and barley with over seventy percent of total cultivated land used for them. The major cash crops are opium poppy, sugar beets, tobacco, and sunflower seeds (Figures 8 and 9).[23] Other crops grown in the province are a wide variety of fruits, especially grapes, melons, and watermelons; vegetables including potatoes, onions, garlic, and sesame; peanuts and almonds; and cotton. Herding of sheep, goats, oxen, and cattle and bee keeping are also very important.

The industry within the province is limited to mining, some manufacturing, and lumbering. Mining activities take place in the districts of Emet, Cediz, Kütahya, and Tavşanlı. Within these districts, lignite coal, boron, chromite, and magnesite are mined for national export and use, and for limited use within the province (coal as a heating supplement). Manufacturing is mostly located around Kütahya city where there are three major industries: sugar beet processing, chemical works, and ceramics. Simav and Tavşanlı are also manufacturing centers for carpets and pekmez (a boiled down grape juice), respectively. Lumbering is also

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[23] Opium poppy production was illegal in Turkey from June 30, 1971 to February 14, 1974. Kutahya province is one of the seven major opium poppy producing provinces and this cash crop is extremely important to local farmers. For an understanding of why Turkey stopped and then resumed opium production, see William H. Brundage and William A. Mitchell, "Toward an Understanding of Opium Poppy Production in Turkey," Journal of Asian and African Studies, Vol. XII, October 1977, pp. 259-267.

TABLE 6

LAND USE IN KÜTAHYA PROVINCE PRIOR TO 1970
(in Hectares)[a]

District	Cultivated in Crops	Fallow	Orchards	Vegetables (Fields & Gardens)	Forests
Kütahya	91,980	64,750	868	722	607,770
Altıntaş	36,725	28,860	80	80	N/A
Domaniç	8,795	8,380	135	265	N/A
Emet	28,590	13,745	1,750	955	159,994
Gediz	26,570	17,190	1,720	2,760	158,783
Simav	13,855	9,480	1,770	875	108,557
Tavşanlı	25,440	17,016	327	358	263,921
TOTAL	(231,955)	(159,421)	(6,650)	(6,015)	(1,299,025)

[a]Calculated from data in Kütahya: İl Yıllığı, pp. 252a and 256.

TABLE 7

PERCENTAGE OF LAND USE IN KÜTAHYA PROVINCE PRIOR TO 1970
(in Hectares)[a]

District	Cultivated in Crops	Fallow	Orchards	Vegetables (Fields & Gardens)	Forests
Kütahya	40	41	13	12	47
Altıntaş	16	18	1	1	N/A
Domaniç	4	5	2	4	N/A
Emet	12	9	26	16	12
Gediz	11	11	25	46	12
Simav	6	6	27	15	8
Tavşanlı	11	10	5	6	20

[a]Calculated from Table 6.

Figure 8

OPIUM POPPY FIELDS IN THE GEDIZ AREA (1978)

Figure 9

This junior high school suffered structural damage during the earthquake and was abandoned. It is now used to store opium poppy.

important within the region to the point that between ten and twenty percent of the villages subsist on the activity.[24]

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[24]A comprehensive discussion of various historical, economic and social characteristics of the province is found in Kütahya: İl Yıllığı (Yearbook of Kutahya Province), 1967, and in William A. Mitchell and Edward A. Glowatski, A Geography of Kutahya Province, Turkey, USAFA-TR-76-4, USAF Academy, Colorado, January 1976.

THE GEDIZ EARTHQUAKE

On Saturday, March 28, 1970, at 2302 Turkish Standard Time (1202 Greenwich Mean Time), shortly after a foreshock occurred at 38.91°N and 29.42°E, the main earthquake struck Kütahya province. Table 8 outlines the specific data on the main quake as released by various agencies worldwide.

The main shock was felt as far away as İzmir, Istanbul, Ankara, and Erzincan (Figure 4). The major damages were, however, mainly in the Gediz-Emet basin, located in Kütahya province where intensity was determined at VIII on the Modified Mercalli scale for an area eight kilometers wide and thirty-five kilometers long from Gediz in a northwest direction (Figure 10). The intensity was found to be VII for a boundary of thirty-five kilometers long from northeast to southwest and fifty kilometers long from northwest to southeast. With some exceptions, only light damage occurred beyond these boundaries (Figures 11 and 12).[26]

Although the focus was only thirteen kilometers, it appears that much of the energy of the quake was dissipated to great distances. Erzincan, over 880 kilometers away to the East, felt the shock. Intensities which equalled or exceeded the intensity near Gediz were felt at a Fiat plant in Bursa, 130 kilometers NNW

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[25] Taşdemiroğlu, "The 1970 Gediz Earthquake," p. 1517.

[26] Pensien and Hanson, The Gediz Turkey Earthquake, p. 8.

TABLE 8

1970 GEDIZ EARTHQUAKE DATA

Agency	Time (GMT)	Epicenter	Magnitude
U.S. Coast and Geodetic Survey	21 02 22.33	39.2N 29.6E	7.1[ac]
Kandilli Observatory, Istanbul		39°7'N 29°23'E	c
Bureau Siesmologique International	21 02 20	39.1°N 29.6°E	d
İstanbul Technical University	21 02 28.5	39.12°N 29.5°E	d
Pasadena			7.3[d]
Strasbourg			7.75[d]
Upsala			7.4[d]

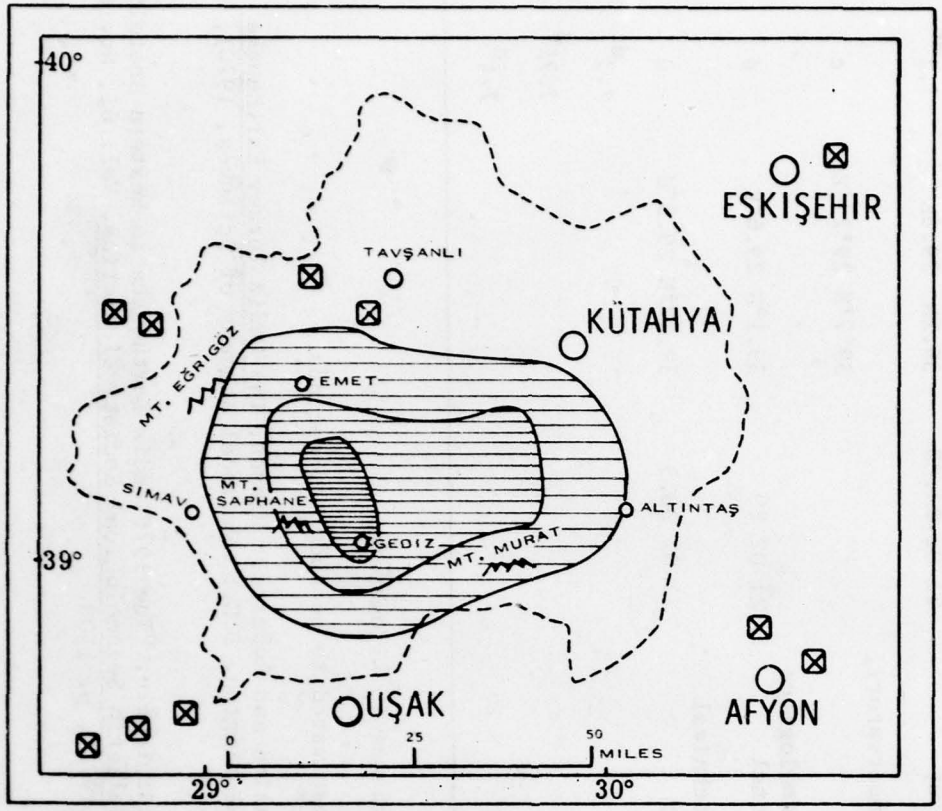
[a]Focal depth was 13 kilometers.

[b]Duration estimated to be about 10 seconds.

[c]Joseph Penzien and Robert D. Hanson, The Gediz Turkey Earthquake of 1970 (Washington, D.C.: National Academy of Sciences, 1970), p. 8.

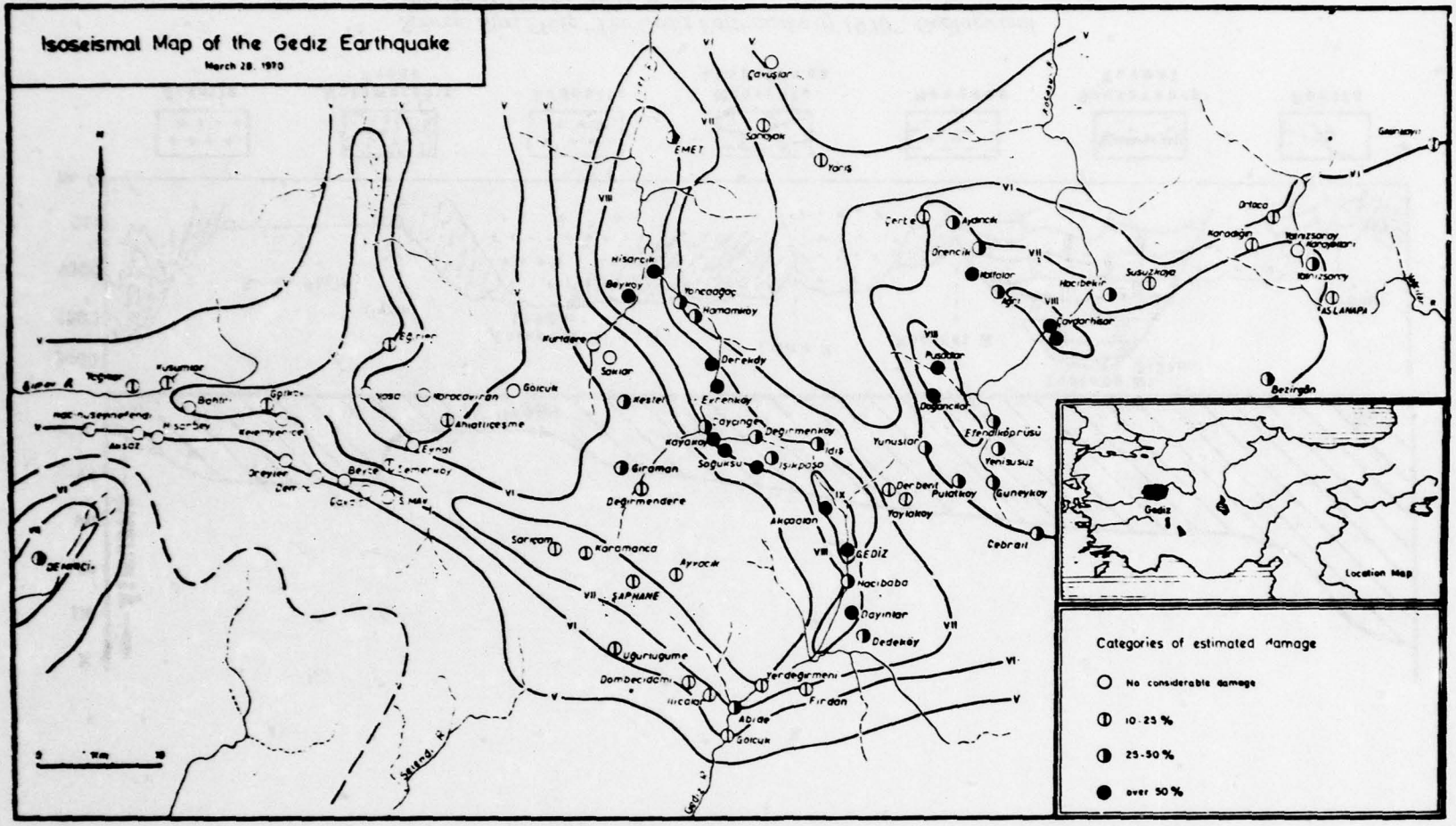
[d]Mehmet Taşdemiroğlu, "The 1970 Gediz Earthquake in Western Anatolia, Turkey," Bulletin Seismological Society of America, Vol. 61, No. 6 (December 1971), p. 1508.

INTENSITY OF THE GEDİZ EARTHQUAKE DAMAGE



AREA OF HEAVIEST DAMAGE
DAMAGE LESS SERIOUS AND VARIED OVER SHORT DISTANCES
DAMAGE IS LESS SERIOUS, LITTLE STRUCTURAL DAMAGE
HISTORICAL EARTHQUAKES OF MAJOR INTENSITY

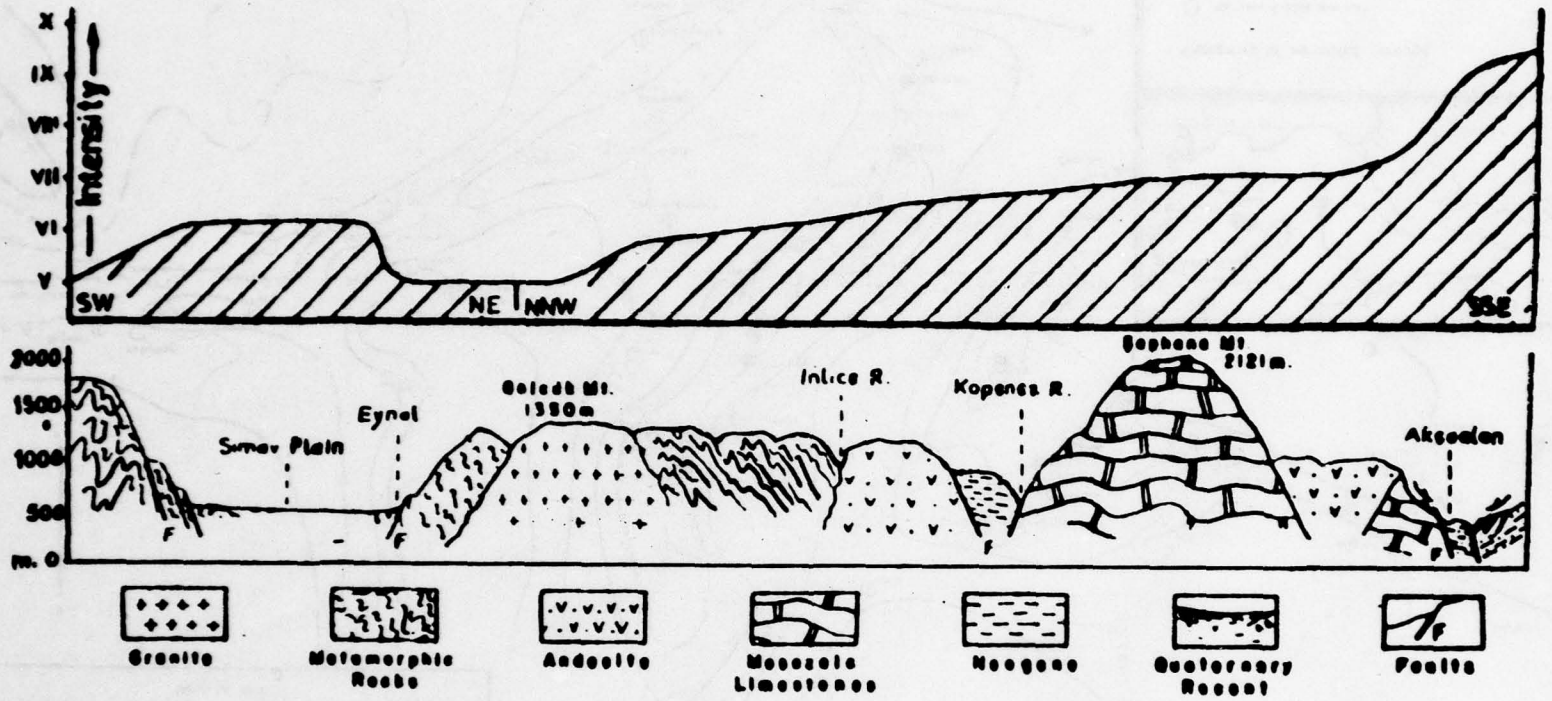
FIGURE 10



Sirri Erinç, "The Gediz Earthquake of 1970", Geology and History of Turkey.

FIGURE 11

RELATIONSHIP OF INTENSITY TO GEOLOGY



Source: Sirri Erinç "The Gediz Earthquake of 1970", Geology and History of Turkey, 1971. p. 447

FIGURE 12

of Gediz, where reinforced concrete buildings received major damage. Large areas between the plant and Gediz received very little force and damage, thereby suggesting that strain energy was, in fact, transmitted deep within bedrock until focused to the surface near the plant.[27]

Thousands of aftershocks occurred within the area (Table 9). According to the USCGS, there were seven shocks between 2102, the time of the main quake, and 2400 on the same day that were between 4.4 and 5.1 Richter. Thirteen shocks of the same range occurred after 31 March though at a longer interval.[28] Epicenters were generally close to the main quake and many were near the Murat and Simav mountain faults (Figure 10).

Physical Effects of the Earthquake

Five main geologic effects occurred because of the disaster. These were rockfalls, landslides, sand ejections, groundwater changes, and faults.[29]

Rockfalls occurred throughout the deformation region (Figure 13). There was no general direction or type of rock formation associated with the quake. Table 10 lists the many types of rock that fell during the Gediz earthquake.

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[27] Ibid., p. 9.

[28] Ibid., p. 9.

[29] Taşdemiroğlu, "The 1970 Gediz Earthquake," p. 1517.

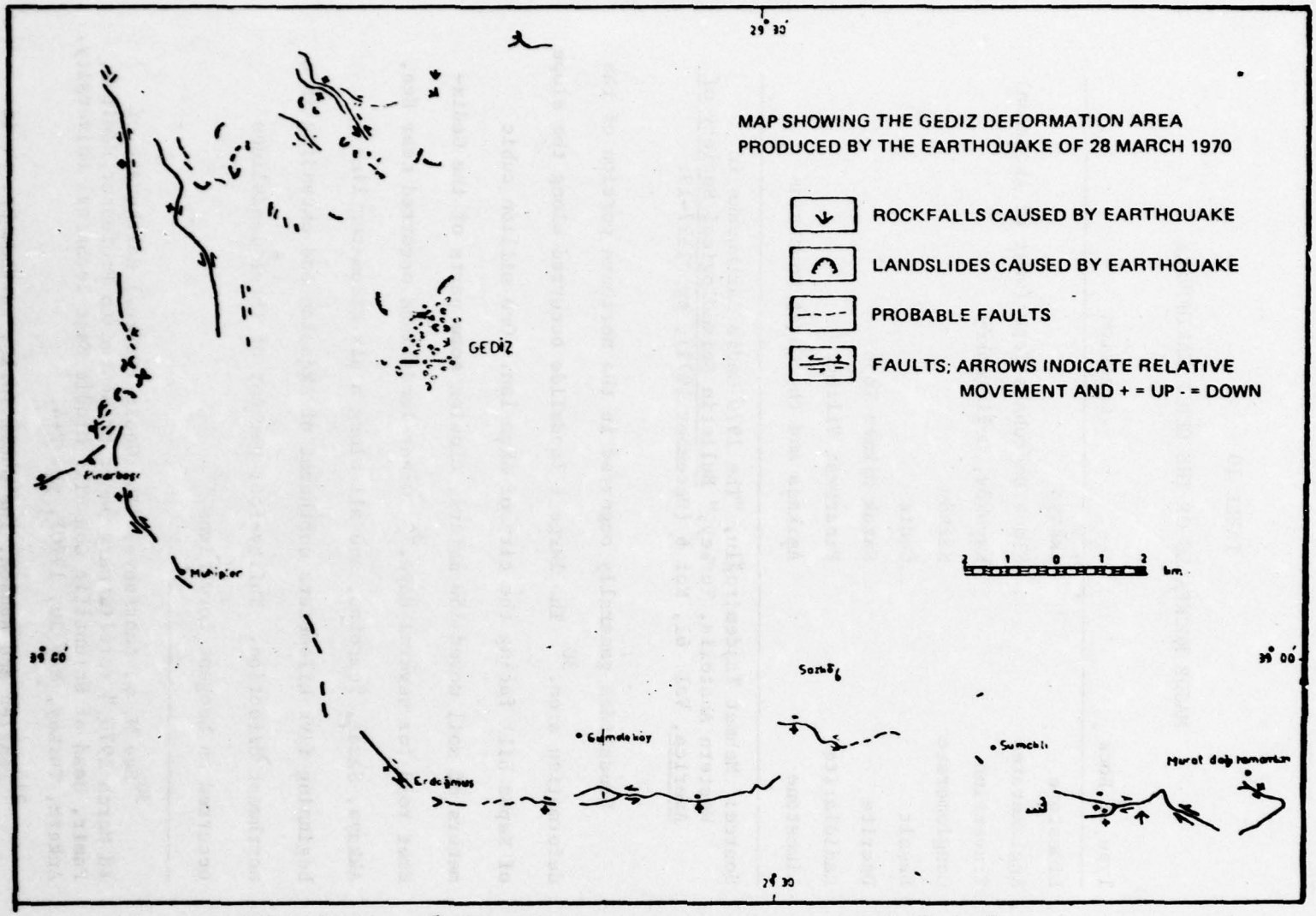
TABLE 9

PRELIMINARY AFTERSHOCK SEQUENCE
(GEDIZ EARTHQUAKE)

DATE	TIME (GMT)	EPICENTER	MAGNITUDE
March 28	210233	39.2°N - 29.5°E	6.5-7.1
	214123	39.1 - 29.3	4.2
	215913	39.2 - 29.3	4.9
	231144	39.1 - 29.5	4.9-5.7
	232822	39.1 - 29.6	4.5
	234355	39.0 - 29.7	5.0-5.1
March 29	025450	39.2 - 29.8	4.2
	031042	39.1 - 29.8	4.5
	065620	39.0 - 29.6	5.1-5.3
	191144	39.1 - 29.2	4.6-4.7
March 30	064905	39.3 - 29.0	4.6-5.0
	075950	39.3 - 29.3	5.3-5.5
	083515	39.5 - 29.4	4.5-5.0
	163234	39.2 - 29.8	5.1-5.2
	203802	38.9 - 29.5	4.5
March 31	005134	39.3 - 29.7	4.4-4.8
	034647	38.9 - 29.7	4.8-5.0
	041002	39.2 - 29.5	4.4-4.8
	115755	39.0 - 29.8	4.2-4.4
April 1	155601	39.4 - 29.5	4.8-4.9
April 2	002828	39.2 - 29.8	4.6
	203504	39.1 - 29.9	4.4-4.7
April 7	170508	39.2 - 29.3	5.1-5.5
April 16	104222	39.0 - 29.8	5.4
	114323	39.0 - 29.9	4.7
April 19	132938	39.0 - 29.7	5.7-5.9
	134736	39.0 - 29.7	5.5-6.0
April 22	052412	39.1 - 29.6	5.0
	183855	39.3 - 29.1	5.6
April 23	071833	39.0 - 30.0	4.6-4.9
	090129	39.3 - 28.7	5.5-5.7

SOURCE: N. N. Ambraseys,"The Gediz (Turkey) Earthquake of 28 March 1970," Imperial College of Science and Technology, London, May 1970, p. 9, (mimeographed).

PHYSICAL EFFECTS



Mehmet Taşdemiroğlu, "The 1970 Gediz Earthquake in Western Anatolia, Turkey", Bulletin of Seismological Society of America, Vol. 61, No. 6, (December 1971): 1519.

FIGURE 13

TABLE 10

MAJOR ROCKFALLS OF THE GEDIZ EARTHQUAKE

Type of Rock	Location
Limestone	Akkaya
Agglomerates	Slope Doğrubaba Tepe (west of Akçaalan)
Travertine	Kayaköy, Değirmenköy
Conglomerate	Sazköy
Basalt	Gediz
Dacrite	Sazak Dikmen Tepe
Radiolarite	Pınarbaşı Village
Limestone	Aşıkaşa and the Murat Mountains

Source: Mehmet Taşdemiroğlu, "The 1970 Gediz Earthquake in Western Anatolia, Turkey," Bulletin Seismological Society of America, Vol. 61, No. 6 (December 1971), pp. 1517-19.

Landslides generally occurred in the northern portion of the deformation area.[30] The largest landslide occurred along the slope of Kepez hill facing the city of Akçaalan. One million cubic meters of soil moved 150 meters, closing some parts of the Gediz-Emet road for several days.[31] Other landslides occurred near Ece, Akkaya, Sazak, Yumrutaş, and all along a six kilometer line beginning five kilometers northeast of Akçaalan and extending in a northwest direction. Thirty-four percent of these landslides occurred on Neogene formations.[32]

[30]See N. N. Ambraseys, "The Gediz (Turkey) Earthquake of 28 March 1970," (preliminary paper presented to Professor Hamit N. Pamir, Head of Scientific Council, Middle East Technical University, Ankara, Turkey, May 30, 1970), pp. 2-4.

[31]Penzien and Hanson, The Gediz Turkey Earthquake, p. 16.

[32]Taşdemiroğlu, "The 1970 Gediz Earthquake," p. 1519.

A variety of groundwater effects were common. Thermal springs in some locations changed their activity. Hamamılıcası increased its number of thermal springs. Kayaköy developed one new spring.[33] The Simav-Eynal region developed new springs, mud volcanoes, and a sporatic geyser. Discharge at Hamamköy increased threefold. Hot water began flowing from alluvium at Sazköy. Gediz's spring stopped during the earthquake but began six hours later. Cold springs at Sazak, Çaycinge, and Ayıkayası also changed their activity. Soil liquification caused sandcraters to form along Emet-Gediz Creek.[34] Despite these changes of discharge and surface activity, the watertable itself did not really change to any extent.[35]

No single fault was associated with the Gediz earthquake. Many faults totaling over sixty-one kilometers in length were produced during the quake in the Gediz area. These faults generally are left-lateral normal faults that strike north or east.[36] Vertical displacements of up to two meters occurred with the more predominant movement near Aşikpaşa (six miles north of Gediz) and

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[33] Ambraseys, "The Gediz Earthquake," pp. 2-4.

[34] Taşdemiroğlu, "The 1970 Gediz Earthquake," p. 1519.

[35] Penzien and Hanson, The Gediz Turkey Earthquake, p. 16.

[36] Taşdemiroğlu, "The 1970 Gediz Earthquake," p. 1507.

Gümelköy (eight miles southwest) (Figure 13 and Table 11).[37] Soil separation occurred and in some limited cases subsidence of soil took place between parallel cracks (twelve kilometers NNW of Gediz intersecting the Gediz-Emet road).[38] Study of this activity produced two conclusions. First, that Gediz City and the immediate area sunk in relation to its surroundings. Secondly, predominantly left-handed displacements on all west-northwest faults give evidence of the regional strain pattern.[39]

Human Effects of the Earthquake

Officially, there were 1,086 deaths and 1,265 wounded as a result of the earthquake.[40] These casualties generally resulted from falling debris and the collapse of buildings, especially dwellings. Table 12 and Figure 14 give a breakdown of casualties and damages by town and district. It is obvious that the Gediz-Emet districts received the burden of the human suffering in terms of casualties and property lost or damaged (Appendix B).

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[37] Ibid., p. 1507 and Ambraseys, "The Gediz Earthquake," pp. 2-4.

[38] Penzien and Hanson, The Gediz Turkey Earthquake, p. 16.

[39] Taşdemiroğlu, "The 1970 Gediz Earthquake," pp. 1525-1526.

[40] Ministry of Reconstruction, Notes on Gediz, p. 4.

TABLE 11

GROUND DEFORMATIONS RESULTING FROM THE GEDIZ EARTHQUAKE

Name of Fault	Maximum Displacements (cm)		Length (km)	Sense of Movement	Notes
	Vertical	Horizontal			
Ayıkayası	275	30	5	Left Lateral	West up
Dikmen Tepe	150	10	6	Left Lateral	West up
Tuzluburun Tepe	120	--	4	---	West-East up
Nennıkırı Tepe	110	50	10	Left Lateral	East up
Pınarbaşı	60	10	3	Left Lateral	North up
Erdoğmuş	75	35	19	Left Lateral	South up
Sazköy	10	Small	3	Left Lateral	South up
Muratdağ	60-35	80-30	7.5	Left-Right Lateral	South up
Others	--	--	3.5	---	West up

SOURCE: Mehmet Taşdemiroğlu, "The 1970 Gediz Earthquake in Western Anatolia, Turkey," Bulletin of Seismological Society of America, Vol. 61, No. 6 (December 1971), p. 1525.

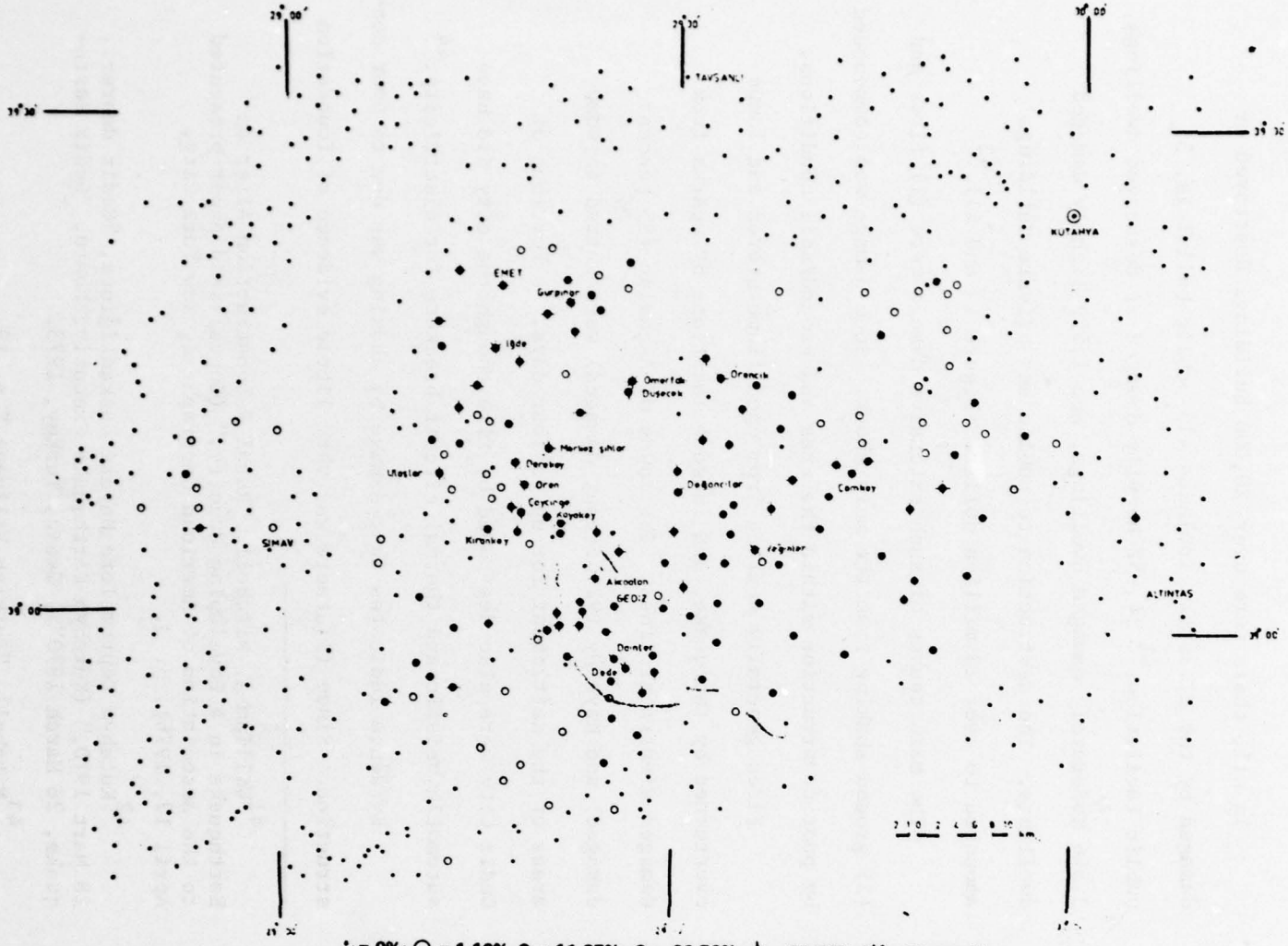
TABLE 12

INJURIES/DAMAGES BY DISTRICTS

Province	Town	Loss of Life	Injured	Destroyed or Heavily Damaged Buildings	Moderately Damaged Buildings	Lightly Damaged Buildings
Kütahya	Gediz	972	842	7,755	755	--
	Emet	105	310	4,822	2,026	--
	Simav	2	5	920	114	--
	Altıntaş	4	84	120	--	--
	Merkez	3	17	833	--	--
Uşak	Banaz	--	2	212	467	1,152
	Ulubey	--	--	14	--	--
	Merkez	--	--	28	62	150
Manisa	Selendi	--	--	20	6	--
	Gördeş	--	2	36	52	185
	Demirci	--	3	--	1	--
Afyon	Sandıklı	--	--	25	10	14
	Sinanlı	--	--	21	6	11
	İhsaniye	--	--	1	1	--
	Merkez	--	--	--	--	1
Bursa	--	--	--	9	--	--
Balikesir	Dursunbey	--	--	36	46	46
TOTAL		1,086	1,265	14,852	3,546	1,559

SOURCE: Ministry of Reconstruction, Notes on Gediz Earthquake (March 28, 1970)(Republic of Turkey, 1970), p. 4.

DAMAGES TO VILLAGES IN THE GEDİZ AREA



●= 0%; ○ = 1-10% ● = 11-25%; ◉ = 26-50%; ✦ = 51-75%; ✷ = 76-100 %

Source: Mehmet Taşdemiroğlu, "The 1970 Gediz Earthquake in Western Anatolia, Turkey", Bulletin of Seismological Society of America, Vol. 61, No. 6 (December 1971): 1514.

FIGURE 14

In all, there were over 20,000 buildings destroyed or damaged by the disaster, includes 413 public buildings, 35 public facilities,[41] 14,852 heavily damaged or destroyed dwellings, 3,546 moderately damaged dwellings, and 1,559 lightly damaged dwellings. The destruction to public and private buildings amounted to over 23 million dollars (Figure 15 and A1).[42]

The main causes of such extensive damage were (1) fires and (2) ground shaking from the main shock. Such damage was compounded by poor construction within the area and ground/soil conditions.

Fires generally started from open flame stoves and lamps overturned by the quake, and in some locations by sparks from damaged electrical lines. The towns of Akçaalan (85 percent damaged) and Kayaköy (92 percent damaged) were gutted in some areas of the settlement for up to four days.[43] Portions of Gediz City were also destroyed by fire though the city did have automatic seismic and thermal circuit breakers for electricity.[44]

Evidence indicates that damage by shaking was due to poor construction. Since (1) there was very little evidence of foundation

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[41]William A. Mitchell, "Rural Reconstruction After an Earthquake in a Developing Country," (Unpublished paper presented to the Association of American Geographers, New York City, April 12, 1976), p. 3.

[42]Kutahya Deprem Icra Heyeti Baskanliğinca, "Gediz depremi, 28 Mart 1970," (Kütahya Earthquake Executive Board, "Gediz Earthquake, 28 March 1970"), Gediz, Turkey, 1973.

[43]Mitchell, "Turkish Villages," p. 19.

[44]Penzien and Hanson, The Gediz Turkey Earthquake, p. 23.

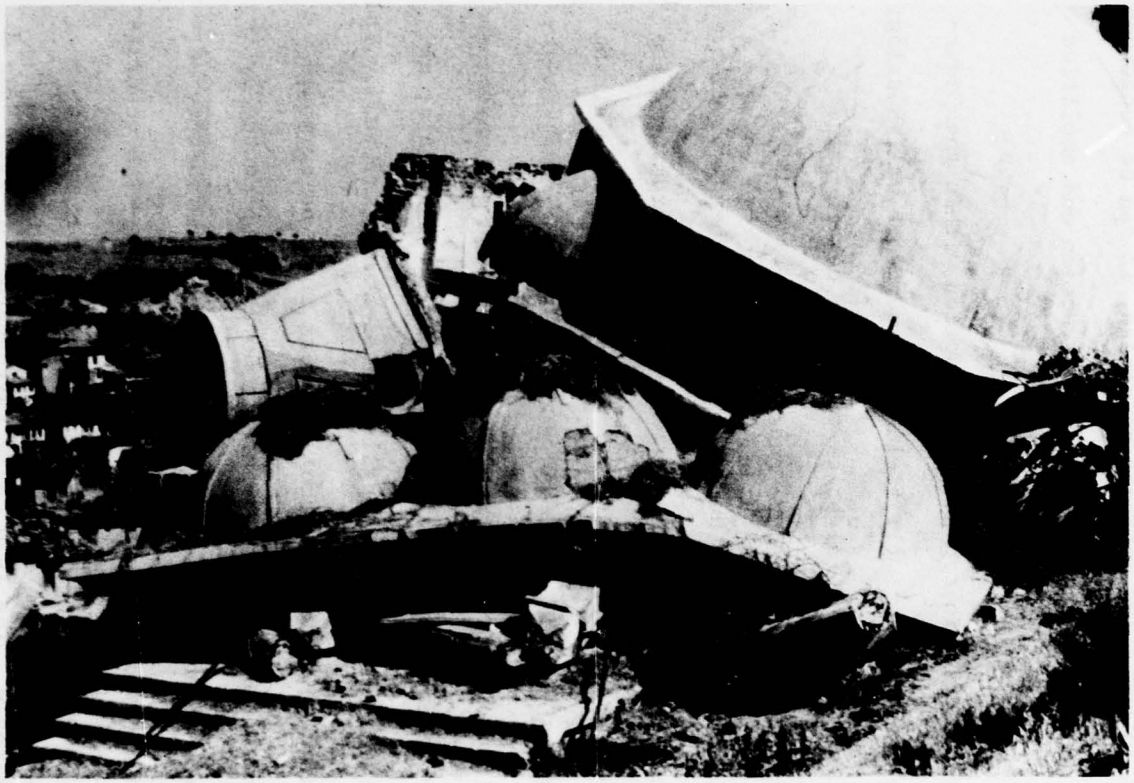

Figure 15

A COLLAPSED MOSQUE IN GEDIZ

failures occurring in even the most intensely affected areas, (2) there was no evidence that bridges moved, and (3) although cities such as Gediz showed many instances of individual buildings collapsing while neighboring buildings often suffered no damage, it can be construed that property damage was the result of construction and amplified by soil conditions.[45]

There are four basic types of construction within the Gediz-Emet districts. These are: (1) fieldstone/mud adobe wall bearing, (2) round post/sawn timber, (3) brick/tile wall bearing, and (4) engineered reinforced concrete construction.

The fieldstone/mud adobe buildings suffered the worst damage of the disaster (Figure 16). Round-post timber construction also received heavy damage with sawn timber frame construction fairing much better (Table 13).

The ability of brick construction to withstand the earthquake varied greatly depending upon actual construction, materials, and location. The village of Soğuksu illustrates this quite well. This settlement was being rebuilt by the villagers after being moved by the government from a landslide area. Homes, constructed by the owners, were all of one plan supplied by the Turkish Ministry of Construction and Housing, a one-story brick dwelling with concrete tie beams and timber supports. The forty-eight homes varied in

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[45]Taşdemiroğlu, "The 1970 Gediz Earthquake," p. 1513, and Penzien and Hanson, The Gediz Turkey Earthquake, p. 23.

Figure 16

Fieldstone/adobe wall-bearing construction such as this suffered the greatest damage.

TABLE 13

DAMAGE TO SOME TRADITIONAL VILLAGES

Village	Soil Conditions	Type Construction	Damage
Kıranköy	Sandstone/shale, marls, sands	Wood frame stone/mud	100%[a]
Aydıncık	Alluvium, Pliocene beds	Stones, mud brick	95%[a]
Kayaköy	Thin soil	Undressed stone	92%[a]
Örenköy	An old landslide	Piled stone	91%[a]
Dereköy	Pleicene sand-gravel/alluvium	Mud bricks	88%[a]
Akçaalan		Adobe, stone, timber	85%[b]

[a] Taşdemiroğlu, "The 1970 Gediz Earthquake," p. 1513.

[b] Penzien and Hanson, The Gediz Earthquake, p. 20.

damage from very light to severe damage and collapse. Heavy damage in this town was accredited to what was considered very poor quality lime mortar. Mortar failure was also found in many brick structures throughout the damaged area of the Gediz disaster. The few undamaged buildings, despite thinner joints than usual, had hollow tile rather than normal brick.

Reinforced concrete and other engineered structures tended to withstand the shock the best. A forestry building in Gediz City built of concrete survived the quake without damage while a brick counterpart incurred heavy damage (Figure 17). A three-story bank building within Gediz withstood the shock while both its neighboring buildings collapsed. However, the Fiat plant near Bursa did receive heavy damage to its reinforced concrete buildings. Some garages under construction there collapsed. Further damage was prevented by the 42 millimeter anchor bolts in laced steel double columns stretching two to four inches. The Gediz Hospital, also under construction, received damage as well. Concrete bridges in Gediz City received no damage. Electric power poles, steel angle construction, and three or four supports for transformers were damaged only by falling debris within Gediz City.

Many cultural structures were also damaged by the quake. Most of the mosques within Gediz and the surrounding villages were severely damaged, including the Gediz Ulu Cami which was built in the 15th Century by Mehmet Çelebi. Columns along the northeast corner of the Temple of Zeus, near Çavdarhisar, also fell (Figure A2).

FIGURE 17

Buildings that survived total collapse were often subsequently temporarily supported by timber braces.

It was the poorer construction located on loose soils (Negene formations) and influenced by age and fire which received the greatest damage. Engineered structures for the most part survived the earthquake.

RELIEF

As has happened many times before, immediately after the disaster struck, Turkey had to mobilize its resources and begin the difficult task of providing emergency assistance. Within hours, the Turkish government sent the army to help with cleanup and relief efforts (Figure 18). Turkish soldiers living in Kütahya province or with relatives there were given a thirty to forty-five day pass to assist in the cleanup.[46]

Treatment of the injured was the primary immediate concern; however, there were several problems. The day after the disaster, March 29, rain and snow hampered many of the initial relief operations. There was a dearth of transportation within the province. Ambulances were scarce and, when available, the roads were generally blocked. Many of the local medical facilities were damaged, and there was an inadequate medical staff to man them.[47]

Despite the rain and snow, fires burned in many of the villages and cities for several days. There were three particular problems

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[46]Mitchell, "Reconstruction After Disaster: The Gediz Earthquake of 1970," The Geographical Review, Vol. 66, No. 3 (July 1976), p. 303.

[47]Penzien and Hanson, The Gediz Turkey Earthquake, p. 14.

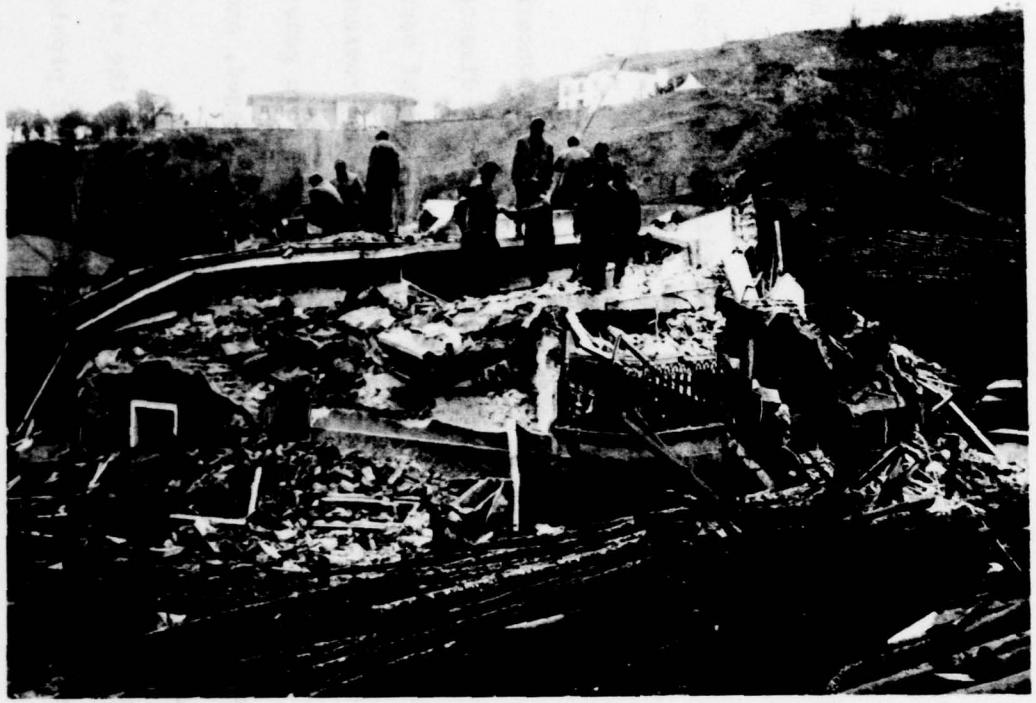

Figure 18

Turkish soldiers helping with relief efforts near Gediz.

SOURCE: Ministry of Reconstruction and Resettlement.

which hampered the city fire department in Gediz. At the onset, some pieces of fire equipment were damaged or destroyed by the quake. Rubble and debris prevented the remaining equipment from reaching the fires. Finally, water lines where water was flowing were ruptured. Gediz was without its water supply for two days, and after two weeks, some sections of the city (one-third) were still without.[48]

Transportation was a major problem within the province and the settlements. Roads were blocked in many areas by landslides and by the flooding of local spring rains and water from ground spring activity. Streets in the settlements were filled with debris (Figures 19 and A3). Finally, with personnel, equipment and supplies for the relief operations, and injured being evacuated, overcrowding was common on the roads.

Organization of relief efforts was swift. Almost immediately after the disaster struck, the Turkish government activated a "Central Committee for Aid and Coordination for Gediz and Surrounding Earthquake Affected Area" which contained representatives from the Undersecretary of the Ministries of Domestic Affairs, Public Health, and Reconstruction and Resettlement, and the Head of the Turkish Red Crescent (Red Cross) Association. Local committees were established by this Central Committee organization. The following commissions were also created:

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[48] Ibid., pp. 14, 23.

Figure 19

This major street in old Gediz was cleared within a few days after the disaster.

1. Emergency Rescue and Ruin Removal
2. Tent Distribution and Accommodation
3. Health Affairs
4. Food Distribution
5. Evaluation of Damage[49]

Aid from within Turkey and from without arrived quickly (Figures 20 and A4). The Turkish Red Crescent dispatched 6,000 tents, 1,500 blankets, a field kitchen, and a mobile hospital. Table 14 gives a list of the tents and/or aid provided by other countries. By the 4th of April, one week after the disaster, 15,169 tents from Turkey, West Germany, France, and Sweden were distributed as temporary shelters for as many victims as possible (Figures 21 and A5).[50] Although some homes were undamaged, fear of aftershocks forced their residents to live in tents and in shelters such as "Bayer Shelters," which will be discussed in the next chapter. Within three days medical teams, volunteered by Germany, Italy, and the United States, were innoculating for disease.

Although there were many problems, Turkey and the local regional authorities reacted quickly to relieve the human suffering. Three days after the earthquake, the Prime Minister was quoted as saying:

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[49]Ministry of Reconstruction, Notes on Gediz, p. 11.

[50]Mitchell, "Reconstruction After Disaster," p. 303.

HEADQUARTERS FOR RELIEF EFFORTS
NEAR GEDIZ

FIGURE 20

SOURCE: Turkish Kizilay

TABLE 14

ASSISTANCE TO GEDIZ REGION

United States Aid

U.S. Government			
U.S. Ambassador	generators, lifting equipment, medical supplies, rations, cots, blankets, tents, water.....	$ 6,000	
USAID	1,000 tents, airlift of private donations.....	$168,000	
	release to CARE of 55 tons wheat and 10 tons edible oil, other food commodities.....	114,430	
	excess property (2 bulldozers, 2 crane shovels, 3 dump trucks)...	35,000	$323,430
U.S. Private Donations			
CARE	blankets and cash.....	$15,000	
American Red Cross	cash and 5,000 units gamma globuin	20,000	
Catholic Relief Svcs	100 tons clothing, water purification tablets, cash.....	286,895	
Lutheran World Relief	185,000 pounds used clothing.....	185,000	
Church World Service	cash.....	5,000	$511,895

Assistance By Other Nations

The following contributions were made by governments, Red Cross societies and relief organizations. Contributions are shown in dollar equivalents.

Afghanistan - cash.....	$5,000	
Embassy - cash.....	40	$ 5,040
Algeria - cash.....		2,040
Australia Government - cash.....	$15,000	
Red Cross - cash and supplies.....	3,740	18,740
Austria Red Cross - cash and supplies.....	$45,240	
Private sources - cash.....	9,700	
Caritas - cash.....	8,000	52,940
Belgium - supplies.....		14,100
Bulgaria - supplies.....		7,530
Canada Government - cash.....	$15,000	
Red Cross - cash.....	15,000	30,000
Cyprus private sources - cash.....		390
Czechoslovakia - supplies.....		14,100
China Government - cash.....		6,870
Denmark - supplies.....		15,500

Finland Red Cross - supplies	$78,830	
Turkish-Finnish Association - cash	3,350	$ 82,180
France - supplies		21,720
Germany Democratic Republic - supplies		29,270
Germany Federal Republic - supplies (1,056 tons)	$317,240	
Private sources - cash	27,310	344,550
Great Britain - supplies		233,760
Greece Red Cross - supplies	$32,660	
Government - supplies	54,870	87,530
Honduras - cash		50
Hungary - supplies		12,560
Iceland - supplies		2,880
India - supplies		3,740
Iran - supplies		41,920
Iraq - supplies		2,800
Indonesia Government - cash		6,870
Ireland - cash		3,600
Italy - supplies	$97,290	
Students of Gibellina High School - cash	130	
Caritas - cash	3,000	100,420
Japan Red Cross - supplies	$ 4,860	
Government - cash	20,000	24,860
Jordan - cash		700
Republic of Korea Government - cash	$10,000	
Red Cross - cash	300	10,300
Kuwait Red Cross - cash	$ 2,390	
Government - cash and supplies	129,230	131,620
Lebanon - cash		120
Liechtenstein - cash		1,440
Luxembourg - cash		1,400
Liberia Government - cash		15,000
Monaco Red Cross - cash	$ 1,570	
Government - cash	4,080	5,650
Netherlands - cash and supplies	$111,440	
Caritas - cash	3,000	114,440
New Zealand - cash		16,850
Nigeria - cash		560
Norway Government - cash	$22,400	
Red Cross - cash and supplies	18,220	40,620
Pakistan - supplies	$ 9,610	
Embassy - cash	440	10,050
Philippines - cash		500
Poland - supplies		4,180
Rumania - supplies		16,740
Saudi Arabia Red Crescent - cash		12,190
South Africa - cash		280
Sweden - cash and supplies		196,940
Switzerland - supplies	$66,140	
Caritas - cash	7,500	73,640
Syria Red Crescent - cash		3.980

Thailand - cash	380
Tunisia - supplies	5,530
USSR - supplies	22,190
United Arab Republic Government - supplies	21,630
Vietnam Government - cash	550
Yugoslavia - supplies	7,110
Zambia Government - cash	1,420
Magen David Adom in Israel - supplies	5,000
Various private donations through League of Red Cross Societies	14,160
UNESCO - relief bonds	7,000
Pope Paul - cash	5,000
World Council of Churches - $10,000 less US/CWS contribution	5,000
Caritas International - cash	5,000
European Urban Fund - cash	5,000
European Investment Bank - cash	5,500
	$1,933,630

World Food Program

The World Food Program authorized the use of food commodities for up to 100,000 people for four months in the Gediz area.

SOURCE: USAID Unpublished Report, "Turkey, Gediz Earthquake," pp. 295-305; Mitchell, "Turkish Villages," pp. 19-21.

Figure 21

DISTRIBUTING TENTS TO THE SURVIVORS

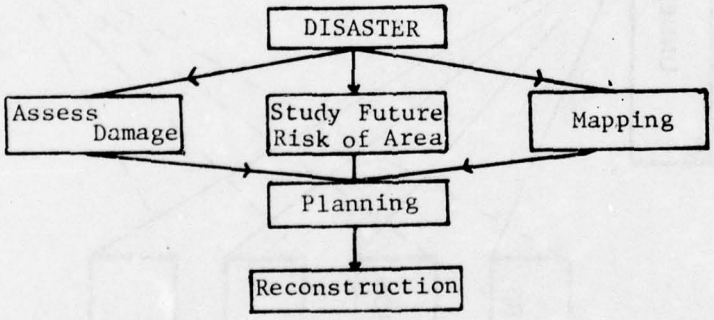
SOURCE: Turkish Kizilay

> Humans cannot tamper with Divine Province, and because of this indisputable fact, one should not lose hope. We should not forget that this nation, hand-in-hand, can build better towns and cities to replace the ones demolished. This will be our compensation.[51]

One week after the earthquake, the President of Turkey announced that Gediz City would be rebuilt on another location (Figure A6).[52]

RECONSTRUCTION

The task of reconstruction is the responsibility of the Ministry of Reconstruction and Resettlement (Figures 22 and 23). Soon after the disaster a draft bill of 446,374,150 Turkish Lira for reconstruction efforts was sent to the National Assembly. The procedure followed for reconstruction by the Ministry was:[53]



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[51]"Tragic Disaster," Daily News (Ankara, Turkey), March 31, 1970, p. 2 (Editorial).

[52]"Quake Toll Reached 1,086," Daily News (Ankara, Turkey), April 4, 1970, p. 1.

[53]Ministry of Reconstruction, Notes on Gediz, p. 12.

ORGANIZATIONAL CHART OF RECOVERY EFFORT

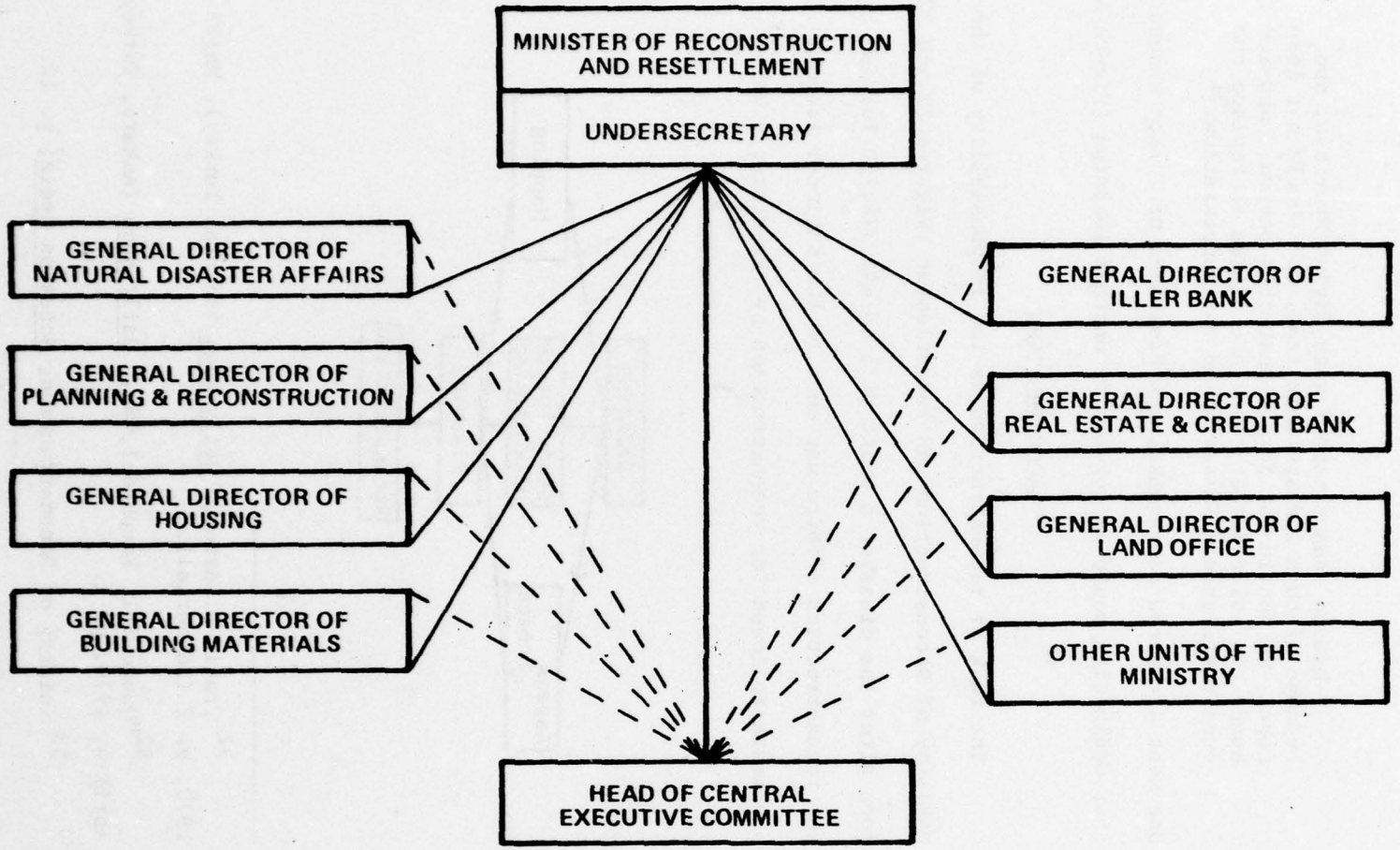

FIGURE 22

Source: Ministry of Reconstruction and Resettlement, Notes on Gediz Earthquake (March 28, 1970), Republic of Turkey, p. 14

FLOW-CHART FOR CONSTRUCTION ACTIVITY

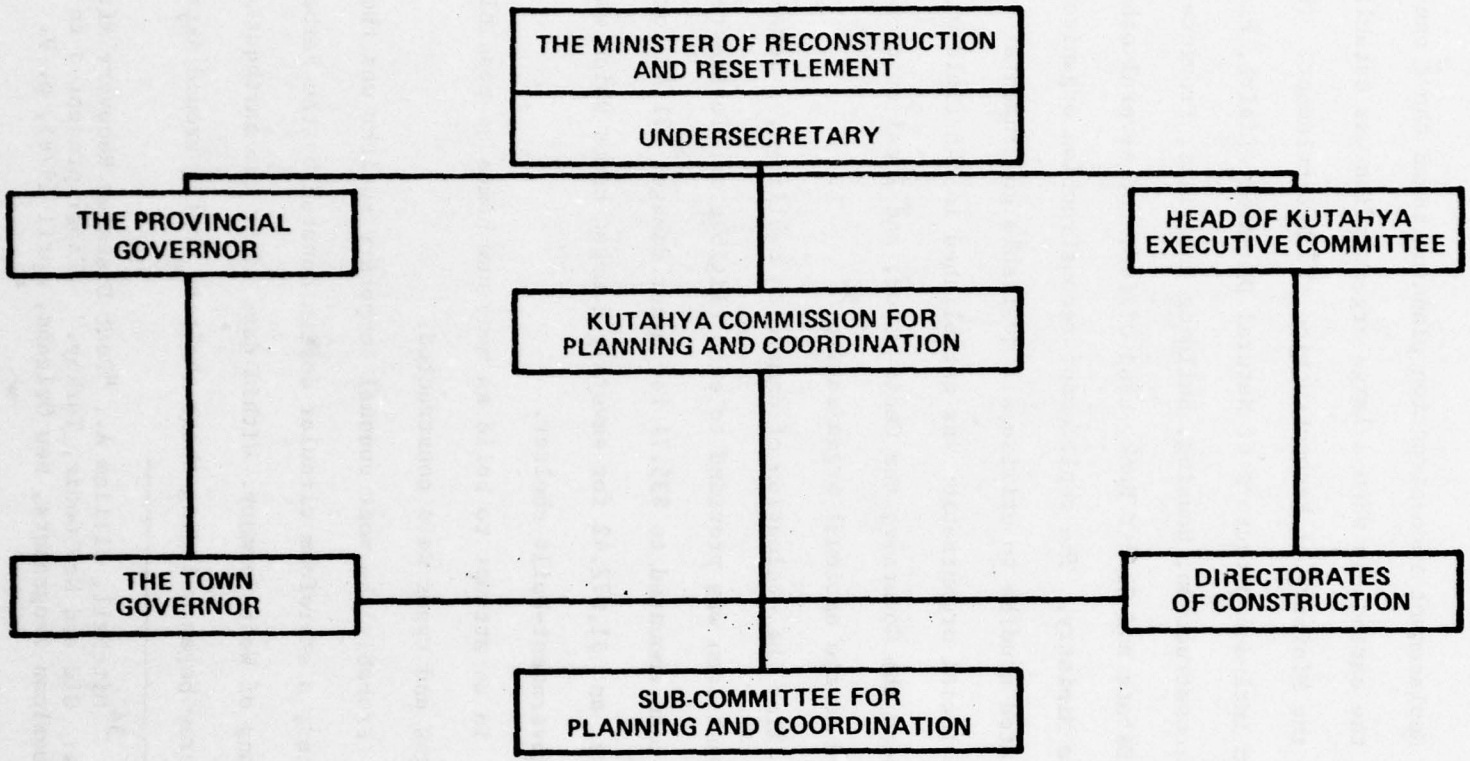

FIGURE 23

Source: Discussions with the Gediz Field Team, Ministry of Resettlement, Gediz, Turkey, Jun 1973 (Mitchell).

Replacement reconstruction planning began about one week after the earthquake when a large organization was established under the Ministry of Reconstruction and Resettlement. The organization included Directors of Natural Disaster Affairs, Planning and Reconstruction, Housing, Building Materials, Province Banks, Real Estate and Credit Bank, Land Office, and several other units of the Ministry. The replacement reconstruction organization initiated studies to utilize all available governmental resources. A provincial organization was established in the field which included the Governor, the Gediz mayor, and local units that corresponded to the national organization.[54]

Ater the evaluation of damage to dwellings, a long-term, low interest loan was provided to each eligible and interested family. This loan amounted to $35.71 for minor damage, $71.42 for medium damage, and $1,072.42 for severely damaged homes which went for a new government-built shelter.

In an attempt to build as many new homes as possible, several designs and types were constructed.

Probably the most unusual temporary shelter was the Bayer shelter, a styrofoam circular design donated by the Farben-Bayer Company of West Germany. Within days after the earthquake, a thirteen-man crew began building these shelters mostly around Akçaalan. A

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[54]Mitchell, William A., "Post Disaster Recovery After Seven Years: Old and New Gediz, Turkey." (Paper presented to Association of American Geograhers, New Orleans, April 1978), p. 9.

sixteen-foot diameter balloon was placed on a revolving turntable inside a temporary shelter. Styrofoam was sprayed on to a depth of 4 1/2 inches after which a waterproofing/hardening compound was sprayed. Elliptical doors and small circular windows were cut and covered with plastic sheets. Ventilation openings were cut 30 degrees from the vertical of the dome. Two men then carried the shelter to its site. Over 300 were made the first week, and in 1978, many were still being used, though badly weathered (Figure 24).[55]

At other locations prefabricated buildings were erected within weeks after the quake for housing and storage. The exterior was water and fireproofed asbestos board while the interior was pressed wood-type material. Panels were joined by forced key strips and a timber frame for a galvanized steel roof was built.[56] Figures A7, A8, and A9 show plans of these new homes.

In three years following the earthquake (by August 1973) the Turkish government erected 9,099 new homes. Fourteen percent (1,263) were in urban locations while the remaining 86 percent (7,836) were located in villages.[57] During the same time, the number of tents decreased from over 15,000 to less than ten which were used just for storage.[58]

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[55]William A. Mitchell, "Reconstruction After Disaster," p. 304, and Penzien and Hanson, The Gediz Turkey Earthquake, pp. 71-72.

[56]Penzien and Hanson, The Gediz Turkey Earthquake, p. 71.

[57]Mitchell, "Rural Reconstruction," p. 6.

[58]Mitchell, "Turkish Villages," p. 20.

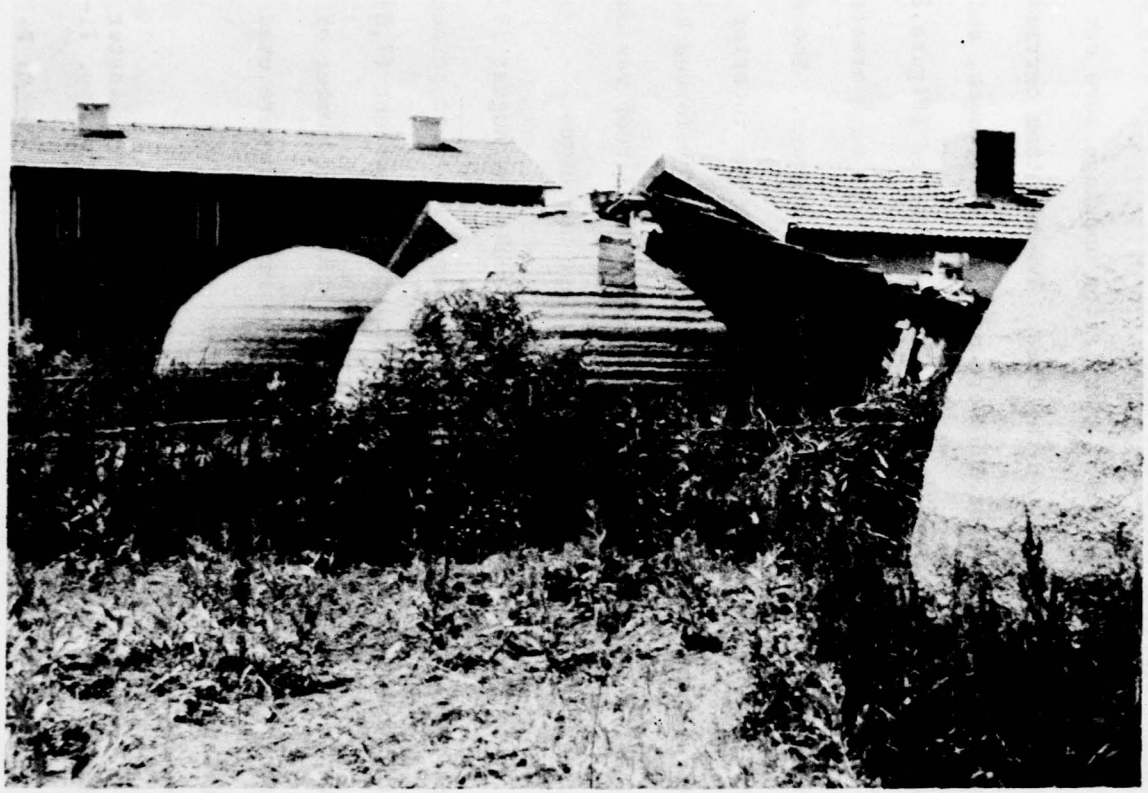

Figure 24

Igloo (Bayer) temporary shelters are used for storage eight years after the earthquake (1978)

Despite the government's attempt to relocate victims into new homes, many of the structures have been abandoned over time because of problems associated with location and construction.

Relocation from the site of their original homes and a dependable source of water caused great concern for the villagers. Of 313 damaged settlements, 138 were moved to geologically more stable sites.[59] Distances ranged from 35 meters to several kilometers. However, once a new site was chosen, dwellings were often placed in hazardous locations such as drainage slopes, on alluvial fans, or in an undesirable pattern. Homes in the villages of Sandıklı and Tepepınar had mud and water marks up to several feet above the floor from this problem.[60] In some instances, water was not piped to the village and, therefore, the old site, which may be several kilometers away, continued to be a water source for homes which were designed with kitchen sinks and indoor toilet facilities.[61]

Construction of homes in terms of quality, size, and windows was also a problem. In villages such as Kıran and Yeniköy, broken tile roofing, fallen plaster, and structural cracks developed within three years. Inferior materials were used in many cases. People living in old homes generally kept the animals in the first floor

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[59]Ministry of Reconstruction, Notes on Gediz, p. 12.

[60]Mitchell, "Reconstruction After Disaster," p. 311.

[61]Mitchell, "Rural Reconstruction," p. 7-9.

(of common two-story dwellings) or just near the shelter. New homes had no room available nearby for storage or the animals. In many cases, heating (which the animals helped supply) was a considerable problem (as well as cooling in summer). Unlike the small, high windows of traditional homes, the new large glass windows added to this problem. Within three years many windows were broken and replaced by boards because of cost.

Gediz City also changed rapidly during this replacement period. By April 4, 1970, the government had decided to rebuild the city five kilometers south of the old location (See Appendix B). Construction of the new city began three months later after ground clearing and street layout were underway, and by three years later, New Gediz was almost 90 percent complete. This new city comprised: housing (singles, duplexes, and four-and six-apartment dwellings. It also included all the modern conveniences of sewerage, wide streets, electricity (from the Kayaköy generator), and a high school. A weaving plant, truck terminal, grain market building, slaughter house, bakery, outdoor movie, outdoor toilets, police station, mosques, library, hospital, and municipality buildings were also built. Yet, with all this construction, Old Gediz continued to be the hub of activity with a few returning to live and most returning daily to work. Many residents of Old Gediz lived in New Gediz but commuted to their shops and businesses which had escaped damage or had been ptached up in the old town. The new town was reported to

be unattractive, sterile, and generally unpopular. The Saturday market day was held in both towns; however, the old town drew far more buyers and sellers.

By August 1973, about 24 million dollars were spent by the Turkish government to reconstruct what the Gediz disaster brought down. Table 15 presents the amount of material used in the early phases of the reconstruction.

As a further means of increasing the capital available to victims of the 1970 disaster, the government allowed about 7,000 citizens to migrate to Germany for foreign employment. Only one male from each home of 80 percent damage or greater was eligible to participate as the attempt was to give only the most eligible this coveted employment. Such employment meant an increase from about 300 dollars annual income to about 2,500 dollars. The following time schedule was used:

April 1970	Project assigned to the Ministry of Reconstruction; Local Administrator selects eligible; Ministry receives list; 7,500 invited to Kütahya for counsel and medical exam.
May 1970	First group left.
May 1972	5,341 in Germany.
July 1973	Only 704 remain on the waiting list.

Besides an increase of capital, benefits included access to material goods such as electronic equipment, an inflow of ideas, and increased economic activity for Kütahya province.[62]

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[62]Mitchell and Barnes, Change After an Earthquake Disaster in Western Anatolia, USAFA-TR-78-5, U.S. Air Force Academy, Colorado, 1978, p. 57.

TABLE 15

SOME MATERIALS USED IN THE EARLY PHASES OF GEDIZ RECONSTRUCTION

MATERIAL	AMOUNT
Corrugated iron plate	950,000 m^2
Timber	130,000 m^3
Cement	75,000 tons
Reinforcement bar (for concrete)	15,000 tons
Nail	1,000 tons
Window glass	75,000 m^2
Glass wool (thickness 5 cm.)	750,000 m^2
Stirophore globules	550 tons

SOURCE: Ministry of Reconstruction, Notes on Gediz Earthquake (March 28, 1970) (Republic of Turkey, 1970), p. 13.

Mitchell has examined the variables of coffee houses, doctors, guest rooms, houses, animals, stores, tractors, threshers, wells, veterinarians, post, telephone and telegraph offices, roads, district service centers, gas stoves, migrants to Germany, migrants within Turkey, radios, new schools, students, and population to determine if modernization came quicker to damaged settlements of the Gediz earthquake because of reconstruction. The increases in doctors, veterinarians, post, telephone and telegraph offices, migrant workers to Germany and within Turkey, radios, stoves, roads, and schools (79 elementary and 5 secondary built), all demonstrated that modernization did come quicker for earthquake affected villages.[63] This can also be seen in the continued changes in Gediz.

The new town of Gediz reached recovery between 1973 and 1976. During this period, new Gediz reached the level of population of pre-disaster old Gediz.

By 1977 a complete reversal in the new city's appeal took place. The population grew to 10,649 with no vacancies in housing.[64] Market day now finds new Gediz more popular with villagers and residents than old Gediz. The streets are now paved and all urban and municipal services are functioning including a municipal bus service with connections to the provincial capital of Kütahya and two taxi services (Figures 25 and 26).

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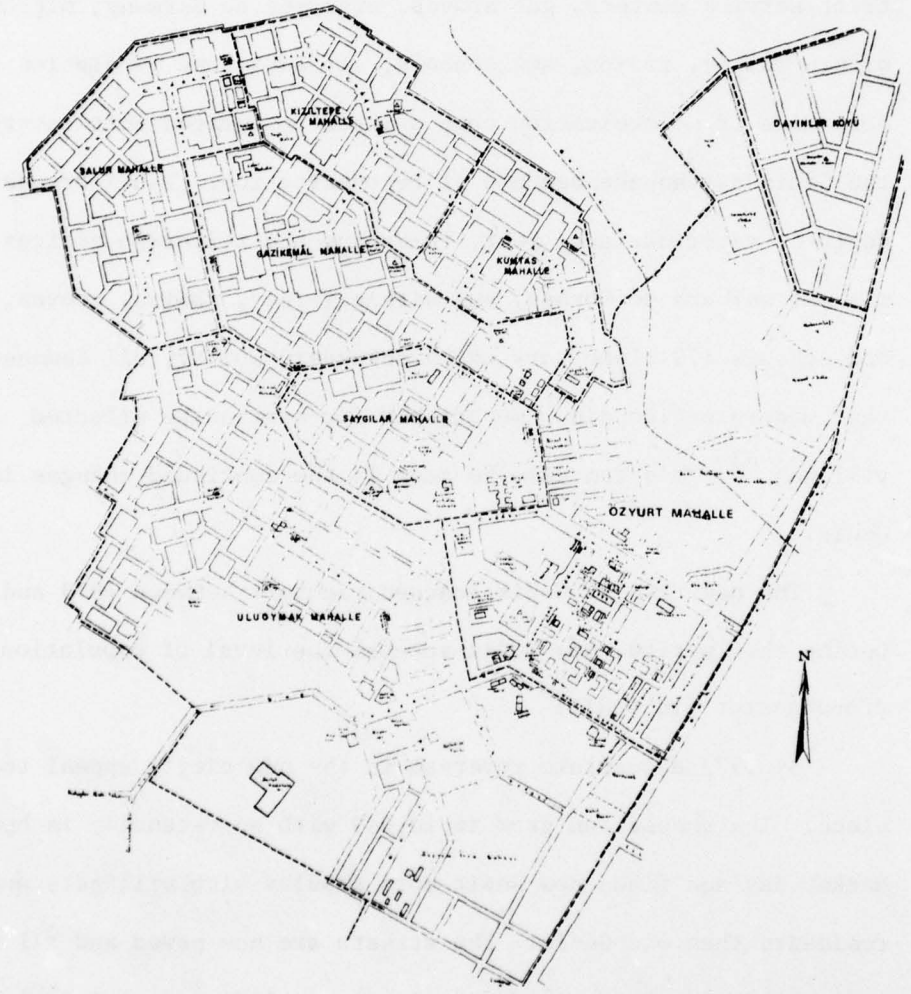
[63] Mitchell, "Turkish Villages," pp. 96-110.

[64] Mitchell, "Post Disaster Recovery. . .," p. 13.

NEW GEDİZ
(By Neighborhoods)

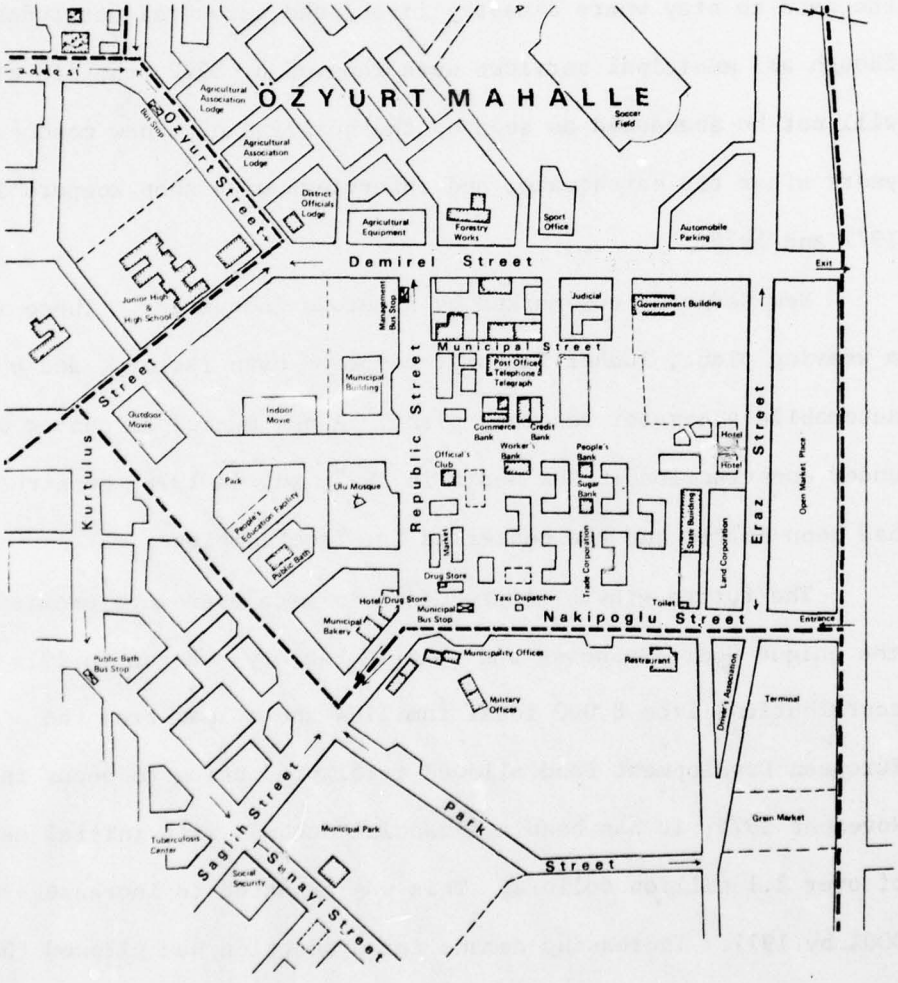


Source: Ministry of Reconstruction and Resettlement, and Field Survey by Mitchell, 1977

Scale 1:1000

FIGURE 25

NEW GEDIZ
(Central Business District)



Source: Ministry of Reconstruction and Resettlement, and Field Survey by Mitchell, 1977

Scale 1:1000

FIGURE 26

Old Gediz had an estimated population of 2,500 in 1976. This is due to (1) villagers occupying abandoned homes, usually buying or renting them from owners who now live in the new city, and (2) the elderly who were reluctant to move due to folklore (belief in the need to stay where ancestry lived) and parochial attitudes. Though all municipal services were removed by 1972, the old city will not be abandoned as seen by the building of a new mosque six years after the earthquake, and interviews with shop keepers in 1977 and 1978.

New Gediz is now marked by numerous industries. These include a weaving plant, lumber factory, tempered oven factory, and an automobile generator assembly plant. A new municipal center was under construction in New Gediz in 1977, but in 1978, construction had been halted and the center is far from complete.

The future growth of new Gediz is made even more promising by the unique Gediz Spinning and Textile Factory. Begun in 1974 when contributions from 8,000 local families and a loan from the European Development Fund allowed trial production to occur in November 1975, it has been a financial success with initial capital of over 2.1 million dollars. This was expected to increase by 300% by 1977. Increasing demand for production has allowed the plant to expand to 24-hour operation with its 365 employees working three shifts. There was a 1,100 person waiting list for employment

at the plant, with its liberal salaries (3.75 to 9 dollars a day plus bonuses), training, and fringe benefits (two weeks paid vacation, uniforms, and a retirement plan).[65]

A CHRONOLOGICAL SUMMARY OF THE GEDIZ DISASTER

In an attempt to summarize and order the relief, recovery and reconstruction activities following the Gediz disaster, we have compared the Gediz case to a model of reconstruction proposed by Kates and Pijawka for disasters in the western hemisphere (Figure 27).

Kates and Pijawka's sequential model of disaster recovery activity suggests that the sequence of events and processes by which a city recovers from disaster is ordered by activity, is also regular in temporal and spatial needs, and is explainable in terms of four significant factors. Their four stages of recovery from disaster are identified as: (1) emergency responses, (2) restoration of the restorable, (3) reconstruction of the destroyed, and (4) reconstruction for commemoration, betterment, and development. They suggest that the time required for each of the first three activities is about ten times that of the previous one. The last activity may extend over twice the time of the third (reconstruction of the destroyed) activity. Thus, the model suggests that there is a logarithmic relationship, a tenfold and hundredfold time

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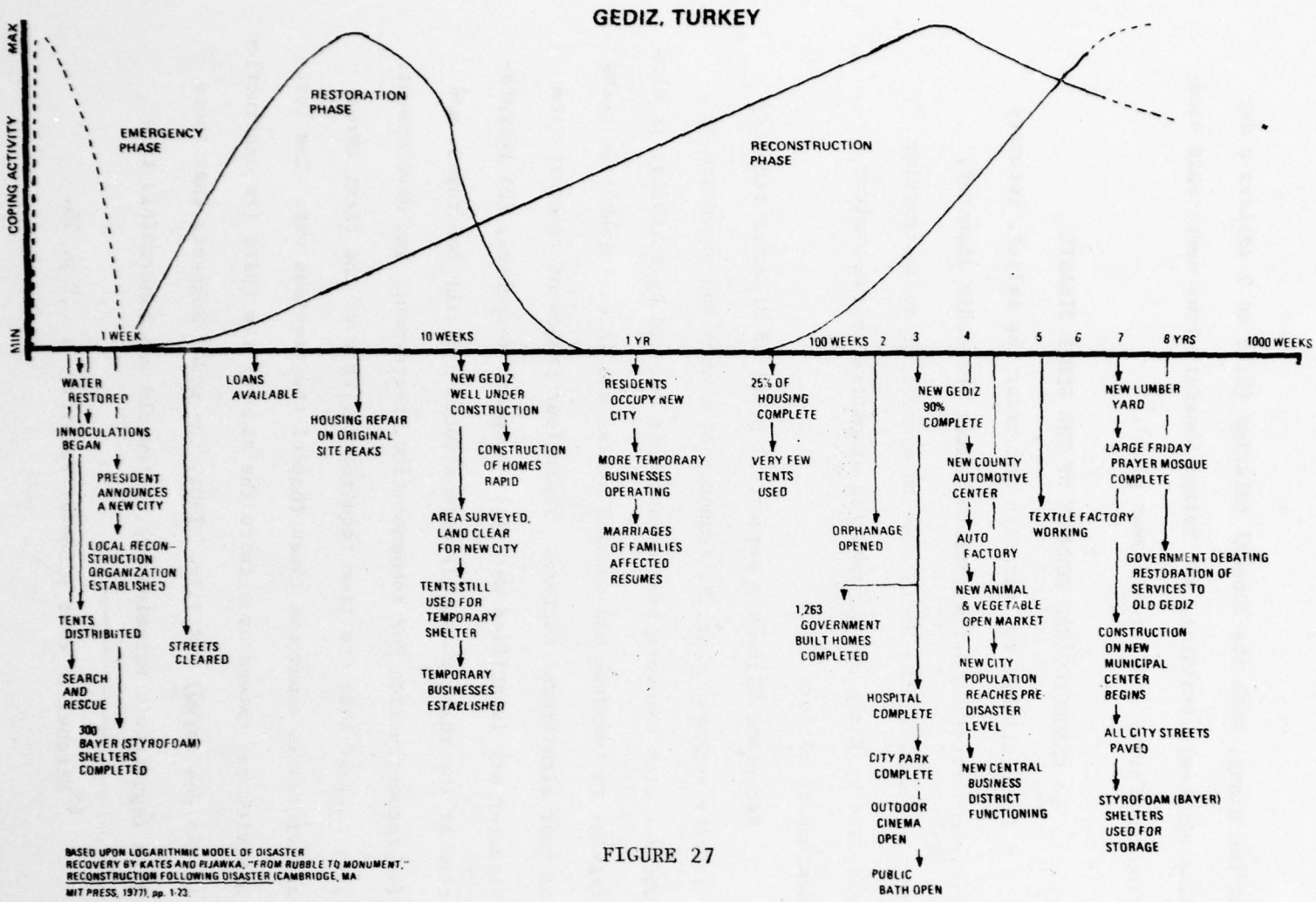
[65] Mitcheli, "Post Disaster Recovery. . .," p. 15.



BASED UPON LOGARITHMIC MODEL OF DISASTER RECOVERY BY KATES AND PIJAWKA, "FROM RUBBLE TO MONUMENT," RECONSTRUCTION FOLLOWING DISASTER (CAMBRIDGE, MA: MIT PRESS, 1977), pp. 1-23.

FIGURE 27

CHRONOLOGICAL SUMMARY
OF THE GEDIZ DISTRICT

difference, between restoration and reconstruction and the emergency period. Commemorative reconstruction is half again the total time period of replacement reconstruction. This model also recognizes that each activity during the post-disaster recovery may be overlapping, that numerous activities from different phases may be occurring simultaneously and the probable variation in the pace of reconstruction, depending on the socio-economic status of a country. We are presently evaluating the Gediz case against this model to see how typical or unusual it may have been.

CONCLUSION

Earthquake disasters similar to the one of Gediz are not new to Turkey. Many more will occur with time; however, by examining case studies and drawing upon the constructive criticism they offer, the human suffering and misery can be reduced.

The 1970 Gediz earthquake showed that much of the destruction was caused by faulty building design and construction. This points out the need for (1) increased mapping of structural and seismic danger areas within zones of lithological instability, (2) increased technical advice for construction of homes and other buildings, and (3) increased quantities of the proper construction materials, all of which should be commensurate with the economic level of the population. An extensive hazard minimization education program needs to be presented to as much of the population as possible.

After the disaster struck, some investigative sources gave the government of Turkey credit for a quick response in providing

physical and financial assistance to the victims. This demonstrates the importance of extensive pre-disaster planning. There were, however, several deficient areas which can be improved. For example, housing needs met by prefabricated and other shelters as well as village relocation plans were in many cases inadequate. Plans for future relief efforts should center upon a "family unit" concept which meet the needs of the displaced traditional family. This "unit" includes a home detached from an animal shelter and a close water source. Where no central water or electricity is foreseeable, omit water faucets, flush toilets, and electric wiring. These homes should be built as close as possible to traditional building styles with no glass windows and a clustered placement rather than an orderly western style arrangement. Indeed, for the cost of one or two of the new villages which were constructed for the victims of the Gediz disaster but were abandoned because the needs of the rural villager were not met, a team from the Turkish government should survey villagers located in the high seismic risk areas of the country to find their desires for housing style, location, and construction techniques should an earthquake destroy the present village. This information would then be used to provide adequate housing when the next disaster occurs.

In 1973 the Turkish government, as a result of the Gediz earthquake, made a commitment to educate the rural population on minimizing earthquake hazards by improving traditional construction

techniques, home site selection, and what to do in an earthquake. The impact of this overall education/action program offers interesting and useful opportunities for research.

After the disaster there were many changes that occurred to the area. Initially, New Gediz was unpopular and unattractive, but with time, the city is now considered a success. Modernization did come to the areas affected by the disaster quicker than the unaffected areas. This modernization was enhanced by the decision to allow external migration to Germany for employment, and by an increased economic activity due to new industry. It might be asked, however, whether this economic launching of Gediz could have occurred without the earthquake. This is another area for future study.

The "Gediz disaster" deserves far more analysis than it has yet been given if the Turkish government is to improve its capability for reacting to earthquake damage or, indeed, if an appropriate model for dealing with this natural hazard is to be evolved any time soon.

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APPENDIX A

EMERGENCY AND RECOVERY

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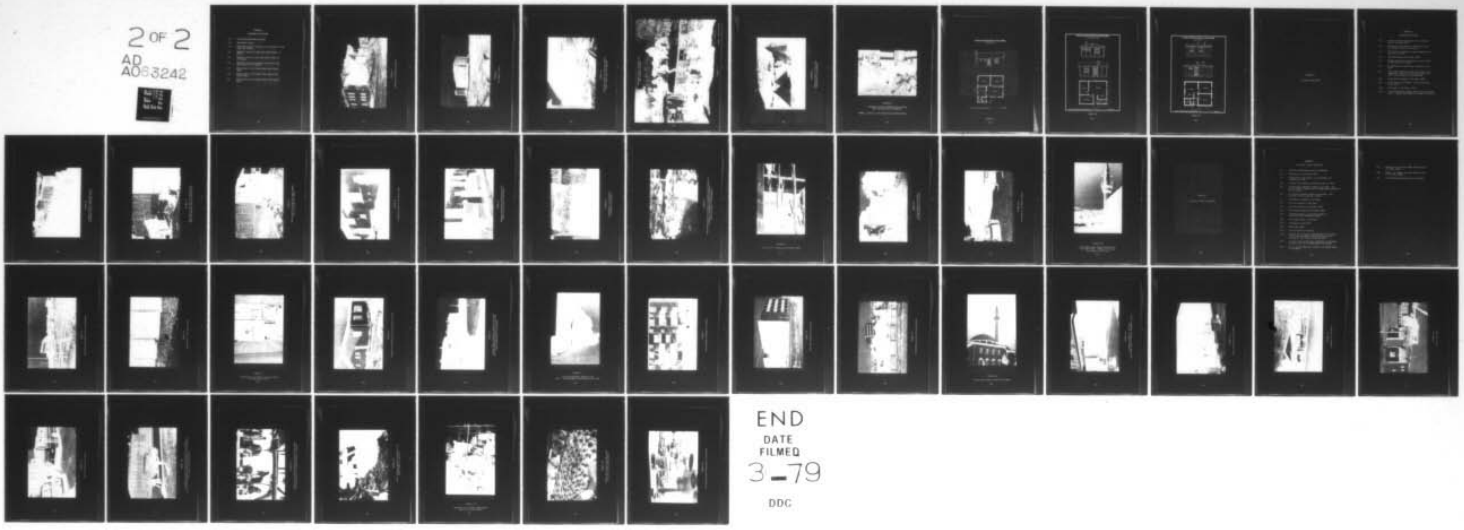

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APPENDIX A

EMERGENCY AND RECOVERY

A-1 A destroyed government building

A-2 The Temple of Zeus

A-3 This major street in Gediz was cleared within a week after the disaster.

A-4 Emergency surplus included this CARE donation of flour.

A-5 Temporary shelter in use three months after the earthquake.

A-6 Government leaders reassuring the survivors that they would not be forgotten.

A-7 House plans for new village homes (Most Popular Type)

A-8 House plans for new village homes (Second Most Popular Type)

A-9 House plans for new village homes (Least Popular Type)

FIGURE A-1

A Destroyed Government Building

FIGURE A-2

The Temple of Zeus

FIGURE A-3

This major street in Gediz was cleared
within a week after the disaster

FIGURE A-4

SOURCE: Turkish Kizilay

FIGURE A-5

Temporary shelter in use three
months after the earthquake

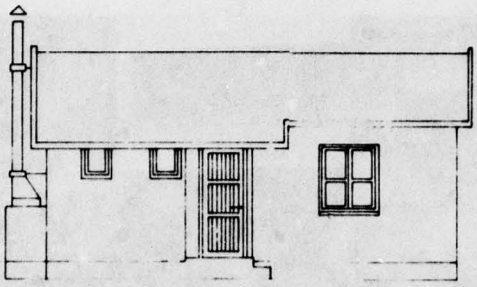
FIGURE A-6

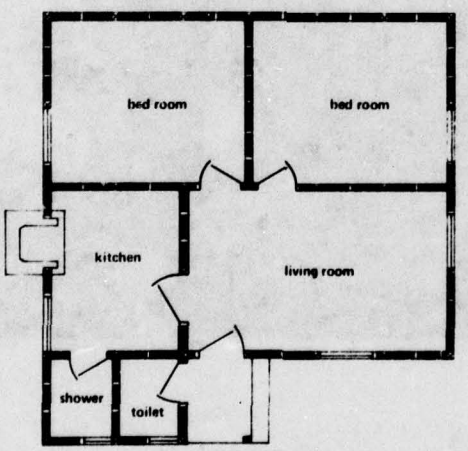
Government leaders reassuring the survivors
that they would not be forgotten

SOURCE: Ministry of Reconstruction and Resettlement.

HOUSE PLANS FOR NEW VILLAGE HOMES

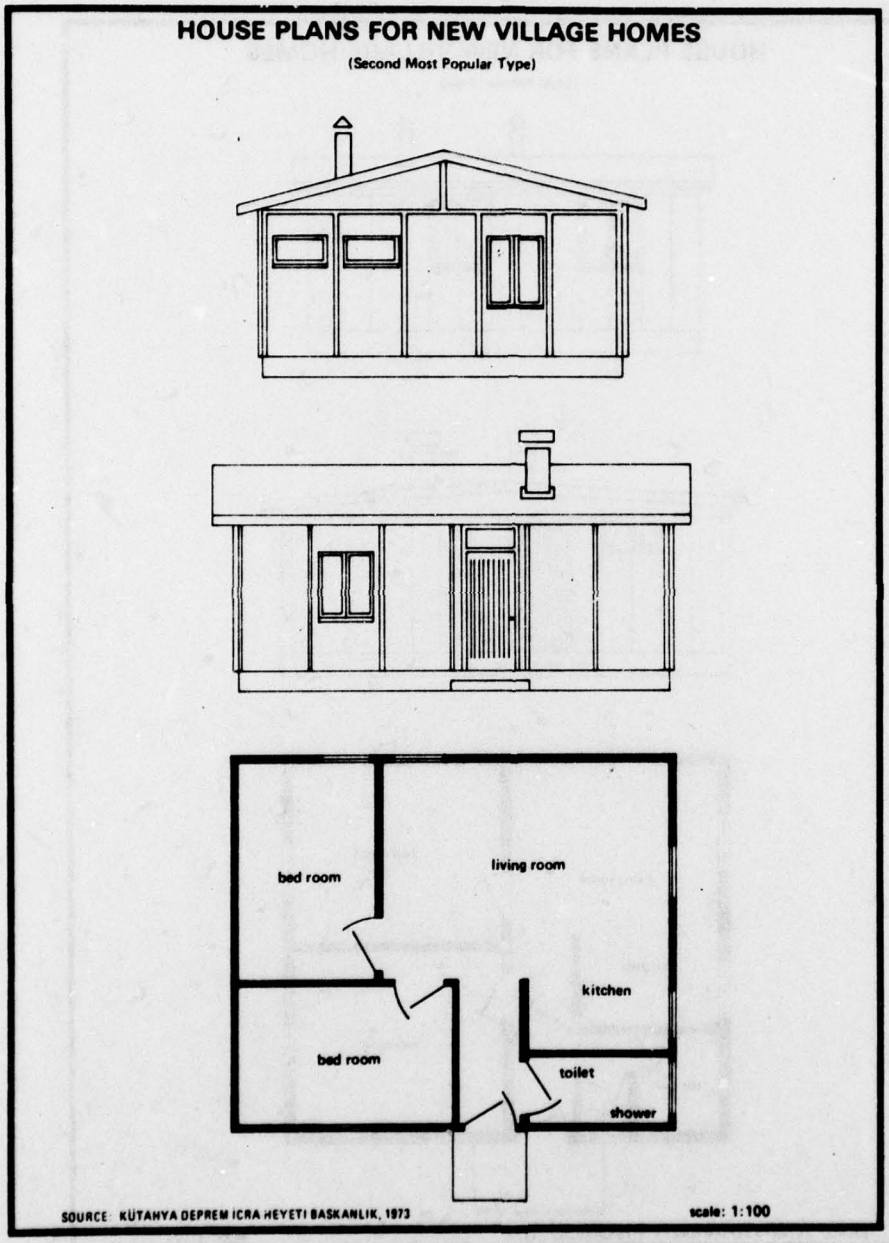
(Most Popular Type)





SOURCE: KUTAHYA DEPREM ICRA HEYETI BASKANLIK, 1973. scale: 1:100

FIGURE A-7


HOUSE PLANS FOR NEW VILLAGE HOMES
(Second Most Popular Type)
bed room
living room
kitchen
bed room
toilet
shower
SOURCE: KÜTAHYA DEPREM ICRA HEYETI BASKANLIK, 1973
scale: 1:100

FIGURL A-8

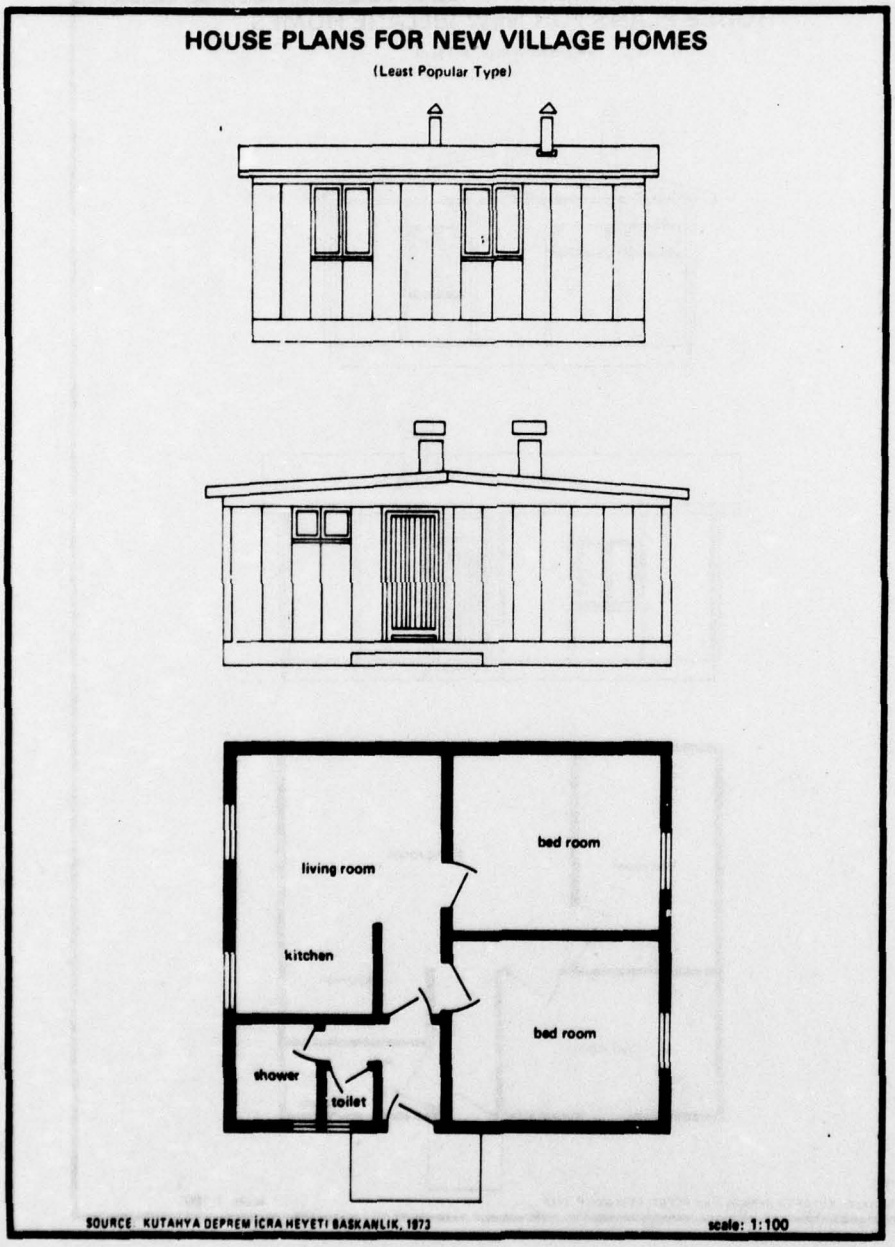

HOUSE PLANS FOR NEW VILLAGE HOMES
(Least Popular Type)
living room
bed room
kitchen
bed room
shower
toilet
SOURCE: KUTAHYA DEPREM İCRA HEYETİ BASKANLIK, 1973
scale: 1:100

FIGURE A-9

APPENDIX B

OLD GEDIZ (1970-1978)

APPENDIX B

OLD GEDIZ (1970-1978)

B-1 A house of hybird construction on a precarious site in old Gediz (1978)

B-2 This house in old Gediz was "patched up" after the disaster and is still lived in.

B-3 This house in old Gediz was badly damaged but is now lived in (1978).

B-4 Inhabited houses in old Gediz (1978)

B-5 Several construction techniques are seen clearly in this house in old Gediz.

B-6 A combination of construction techniques in old Gediz

B-7 Three months after the disaster the market place temporarily shifted to the southern edge of the town. Note the tents in the background.

B-8 Construction continues in old Gediz (1978).

B-9 A main street in old Gediz. Note patched house on the left.

B-10 The center of old Gediz in 1978

B-11 A new Friday prayer mosque constructed in old Gediz (1977). Compare this mosque with figure 15 and C-10.

FIGURE B-1

A house of hybrid construction on a precarious site in old Gediz (1978)

FIGURE B-2

This house in old Gediz was "patched up"
after the disaster and is still lived in

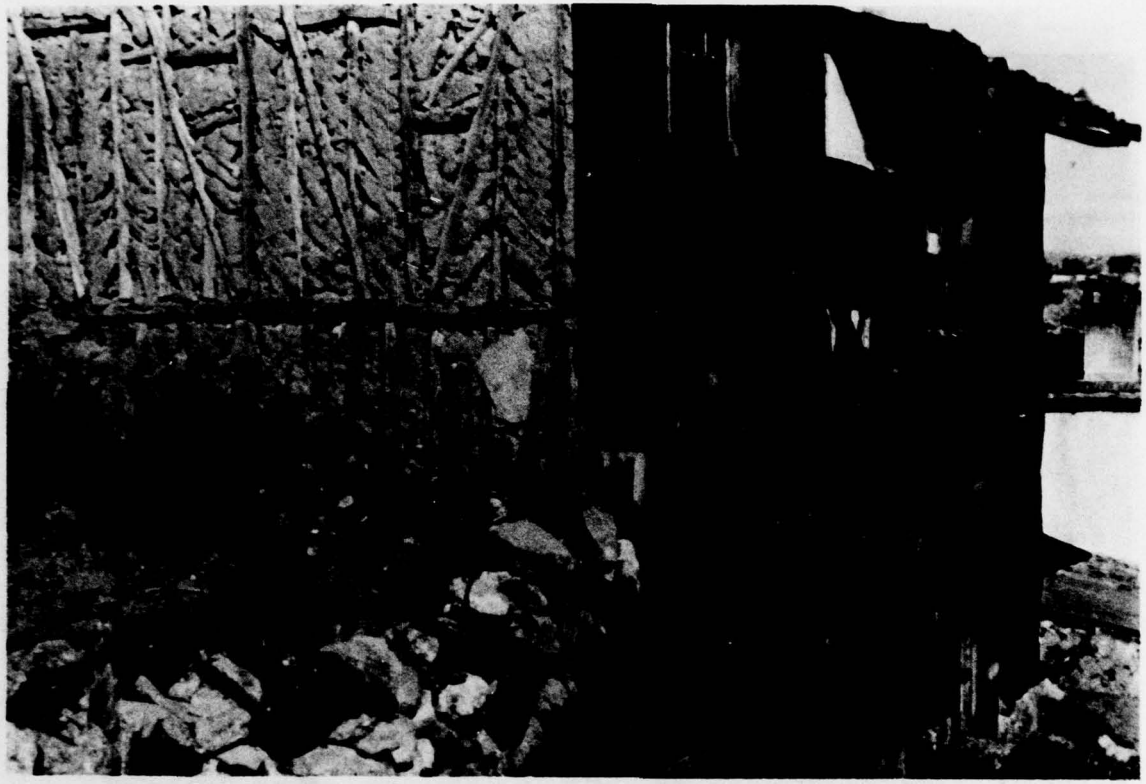


FIGURE B-3

This house in old Gediz was badly damaged
but is now lived in (1978)

FIGURE B-4

Inhabited houses in old Gediz (1978)

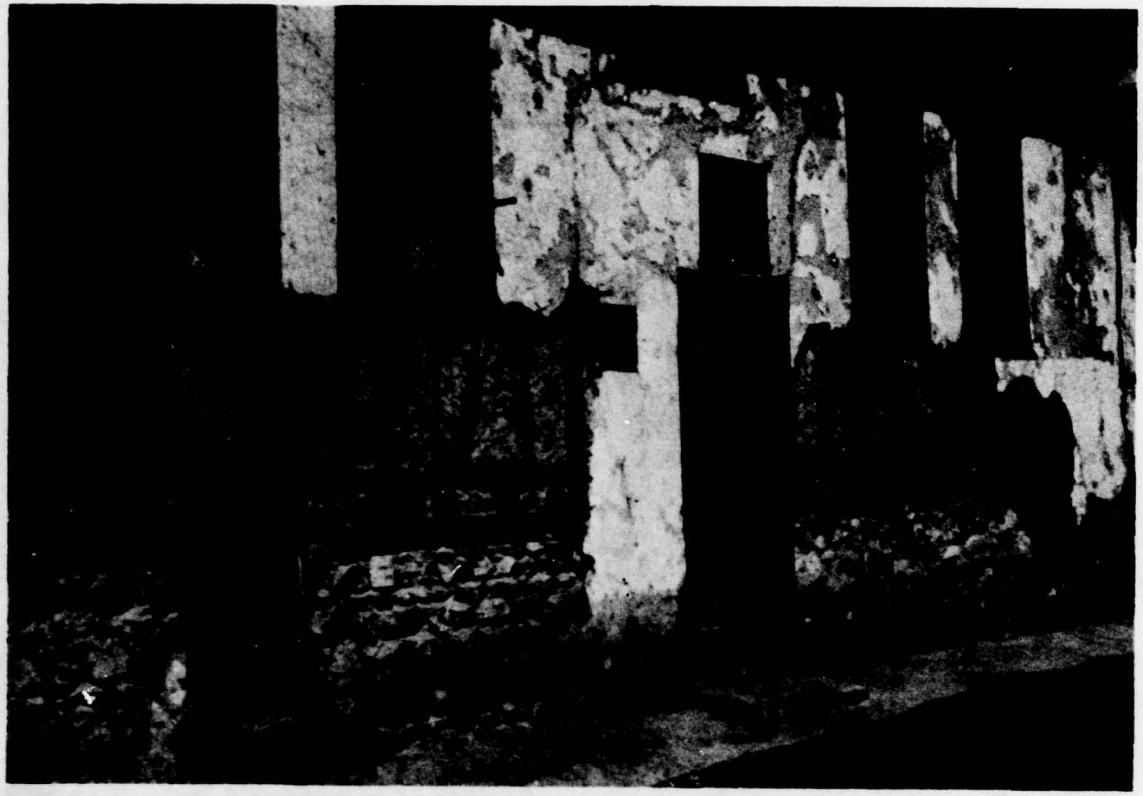


FIGURE B-5

Several construction techniques are seen clearly in this house in old Gediz

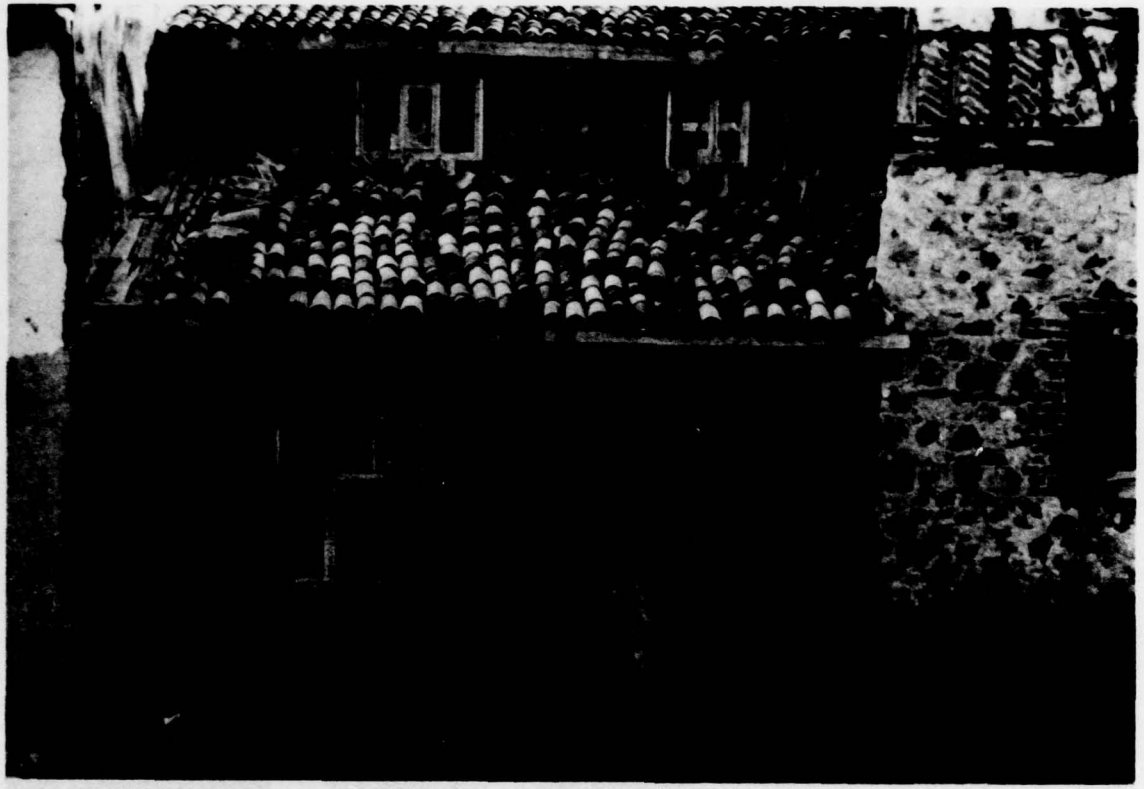


FIGURE B-6

A combination of construction
techniques in old Gediz

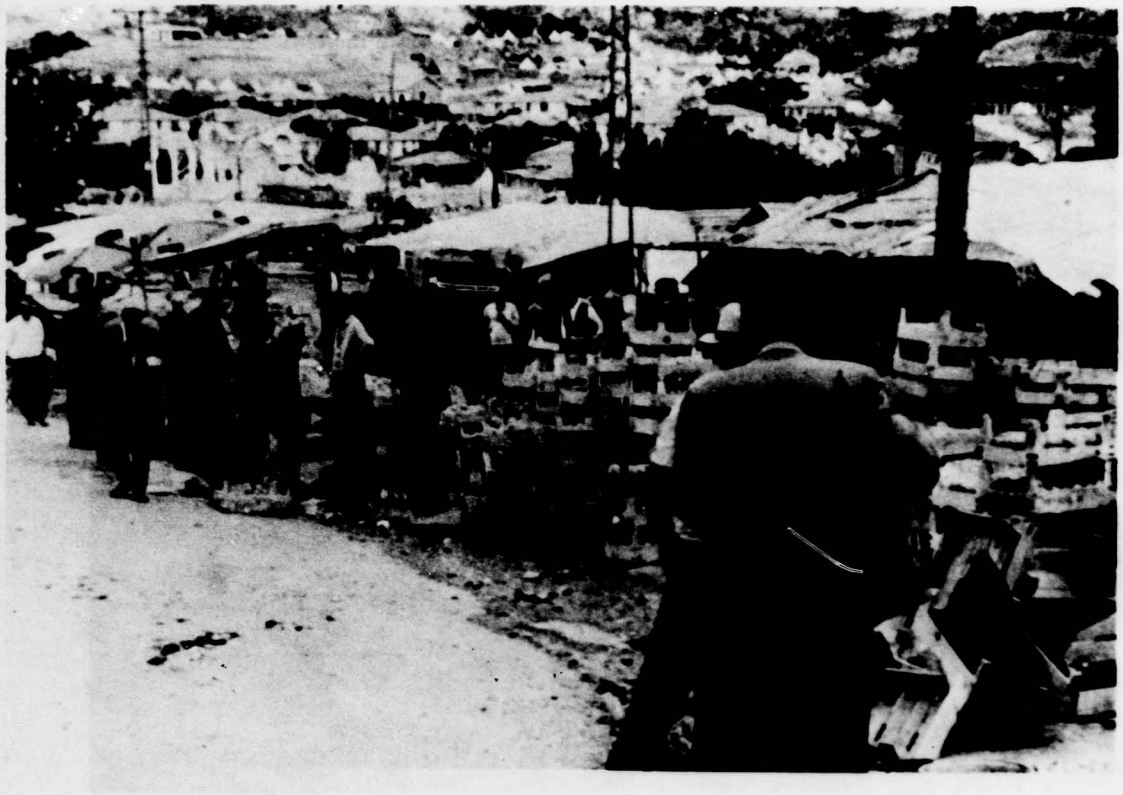


FIGURE B-7

Three months after the disaster, the market place temporarily
shifted to the southern edge of the town.
Note the tents in the background.

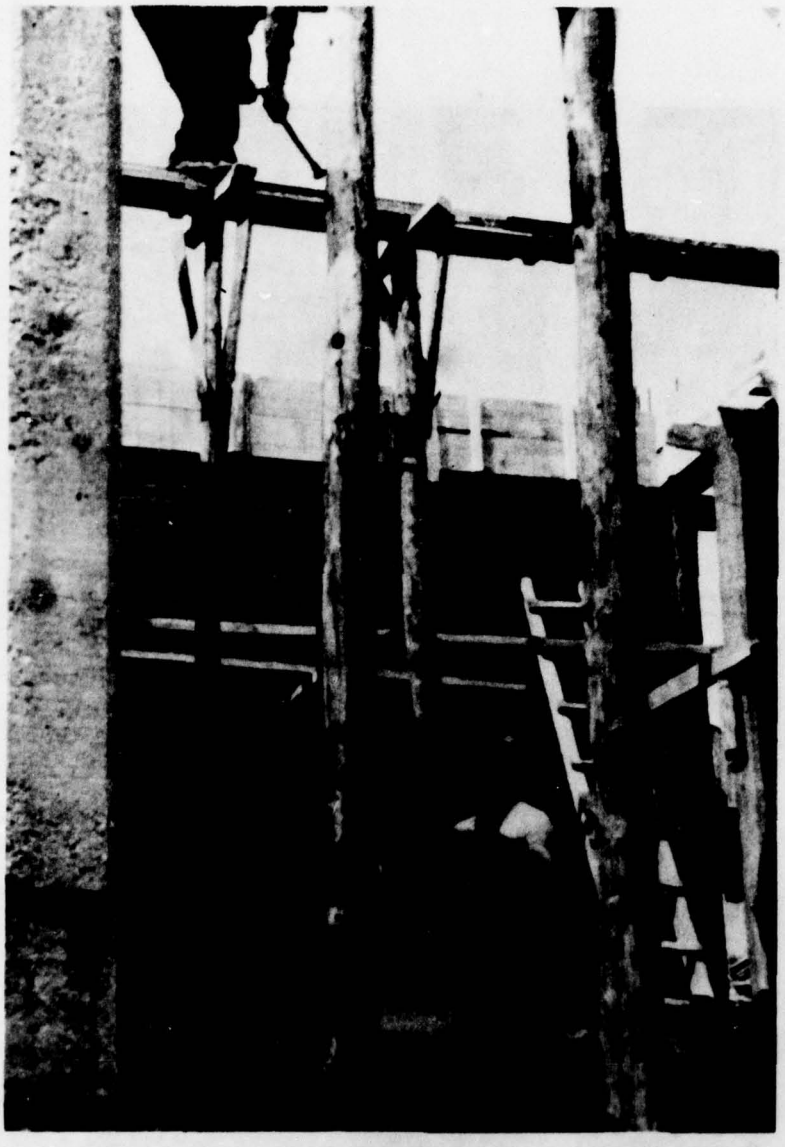


FIGURE B-8

Construction continues in old Gediz (1978)

FIGURE B-9

A main street in old Gediz.
Note patched house on the left.

FIGURE B-10

The center of old Gediz in 1978.

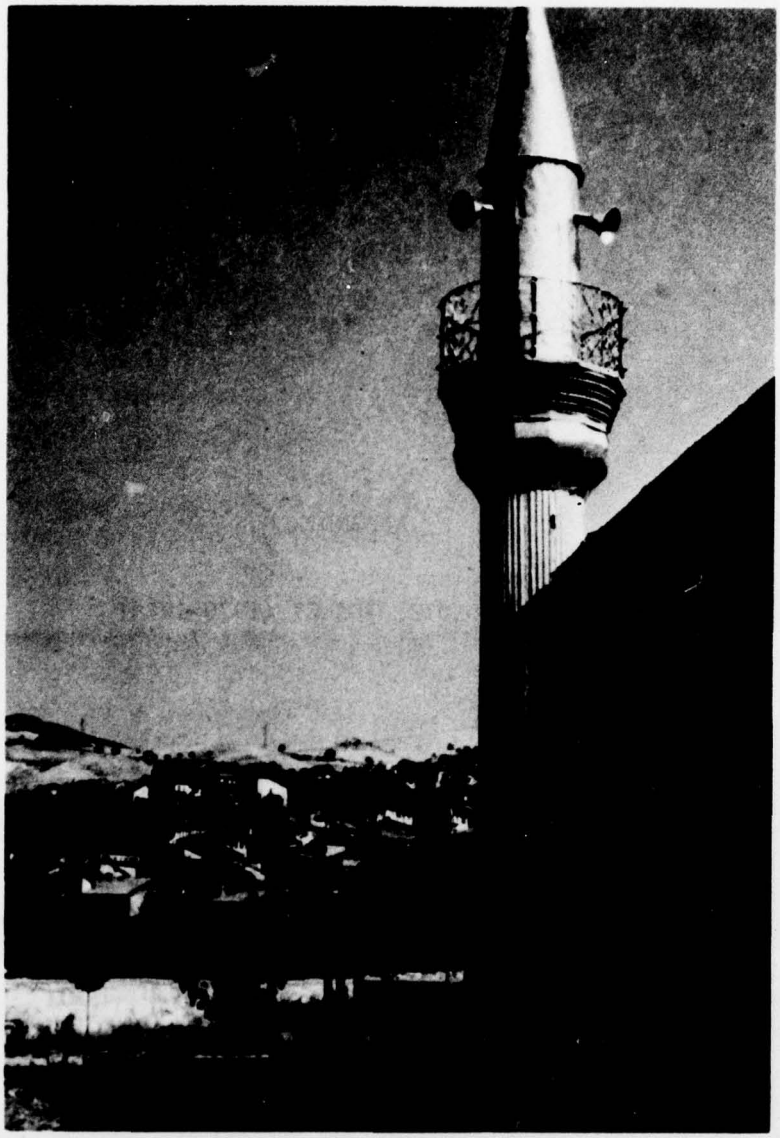


FIGURE B-11

A new Friday prayer mosque constructed in old Gediz (1977). Compare this mosque with Figures 15 and C-10.

APPENDIX C

NEW GEDIZ, TURKEY (1970-1978)

APPENDIX C

New Gediz, Turkey (1970-1978)

C-1 New Gediz three months after the earthquake

C-2 Construction in new Gediz (1977)

C-3 Construction in new Gediz, as in old Gediz, was continuing in 1978.

C-4 A single unit dwelling in new Gediz, built in 1976

C-5 A multi-family apartment complex in new Gediz. Note the television antennae and the storage sheds constructed by the tenants.

C-6 A tri-level apartment complex in new Gediz. This building was five years old in 1978.

C-7 The municipal building in new Gediz

C-8 The state hospital in new Gediz

C-9 The municipal park in new Gediz (1978)

C-10 Friday prayer mosque in new Gediz (1978)

C-11 A shopping complex in new Gediz (drugstore, doctor's office, restaurant, hotel)

C-12 One of many stores in new Gediz

C-13 A drugstore in new Gediz

C-14 Bank in new Gediz

C-15 The bus station in new Gediz

C-16 A shared taxi on its way from new Gediz to old Gediz. Note the new government forestry building in the background. The streets are mostly paved.

C-17 A seller at the weekly market (Saturday) in new Gediz. Old Gediz also has its weekly market on Saturday.

C-18 One of the many specialty sellers at the weekly market in new Gediz

C-19 Vegetables are the most common market items at the weekly market.

C-20 Silver, tin, copper, and brass items are sold at the weekly market.

C-21 The spinning and weaving plant in new Gediz

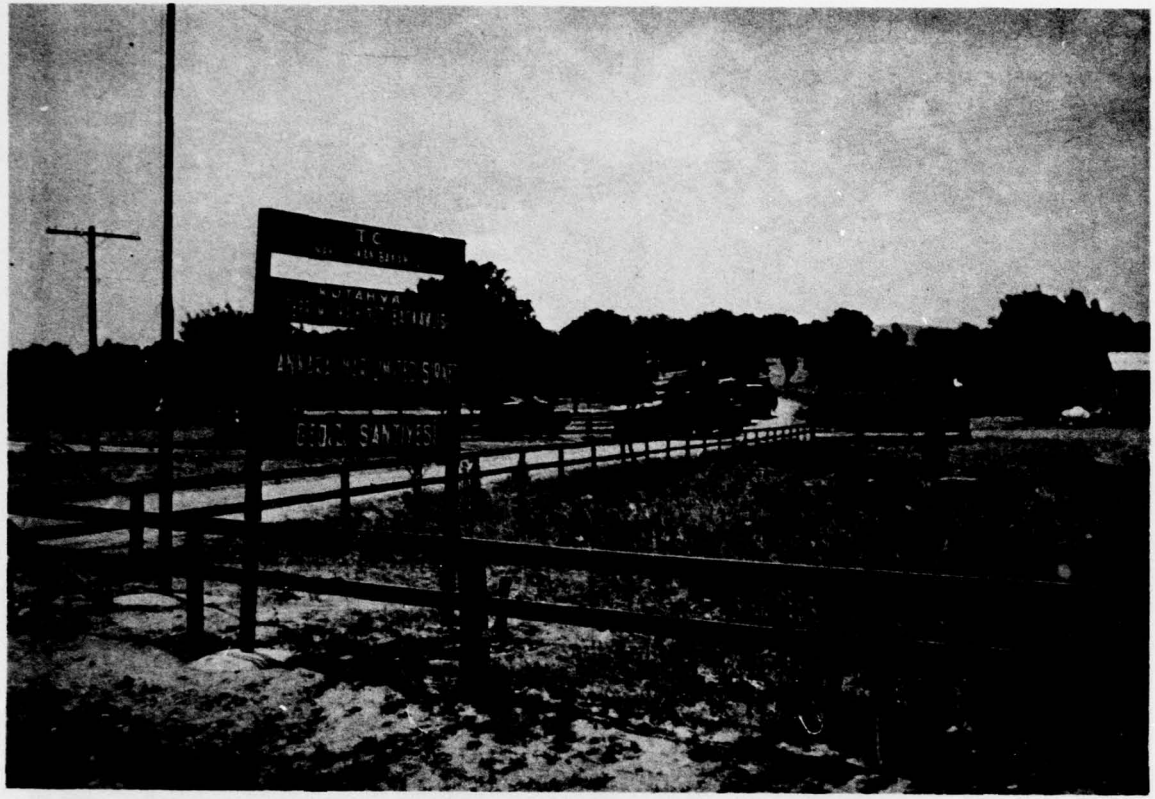


FIGURE C-1

New Gediz three months after the earthquake.

FIGURE C-2

Construction in new Gediz (1977)

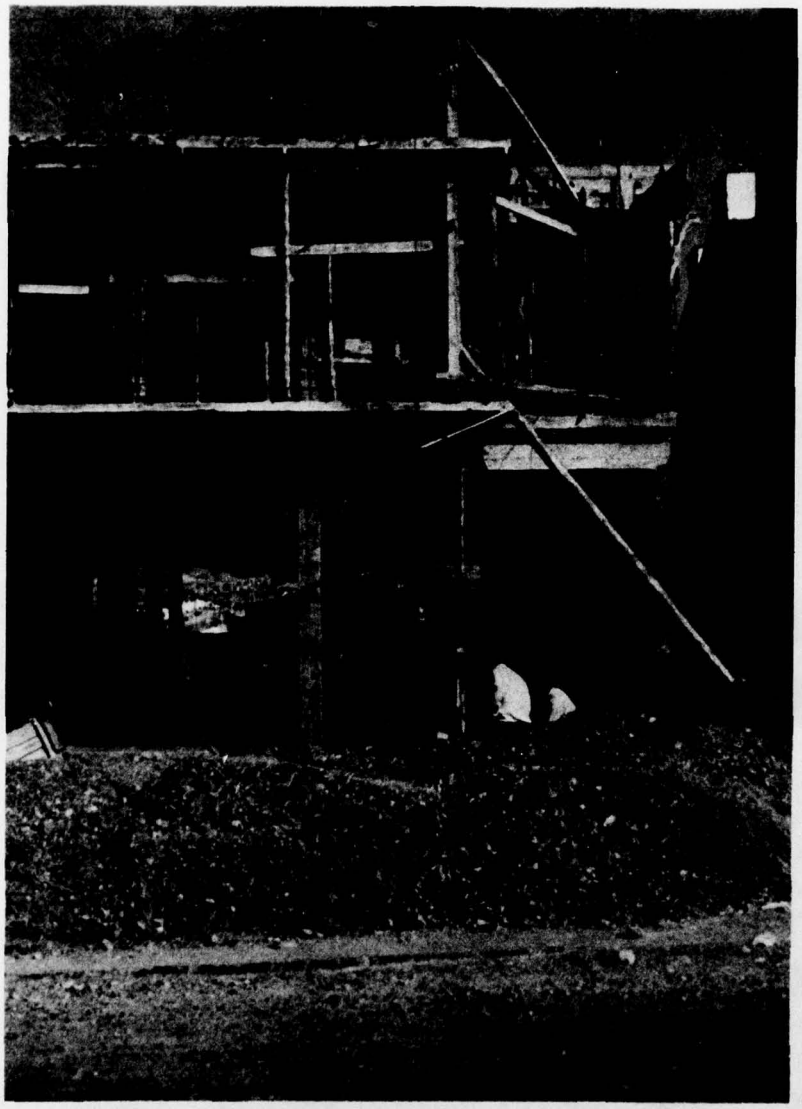


FIGURE C-3

Construction in new Gediz, as in old Gediz, was continuing in 1978.

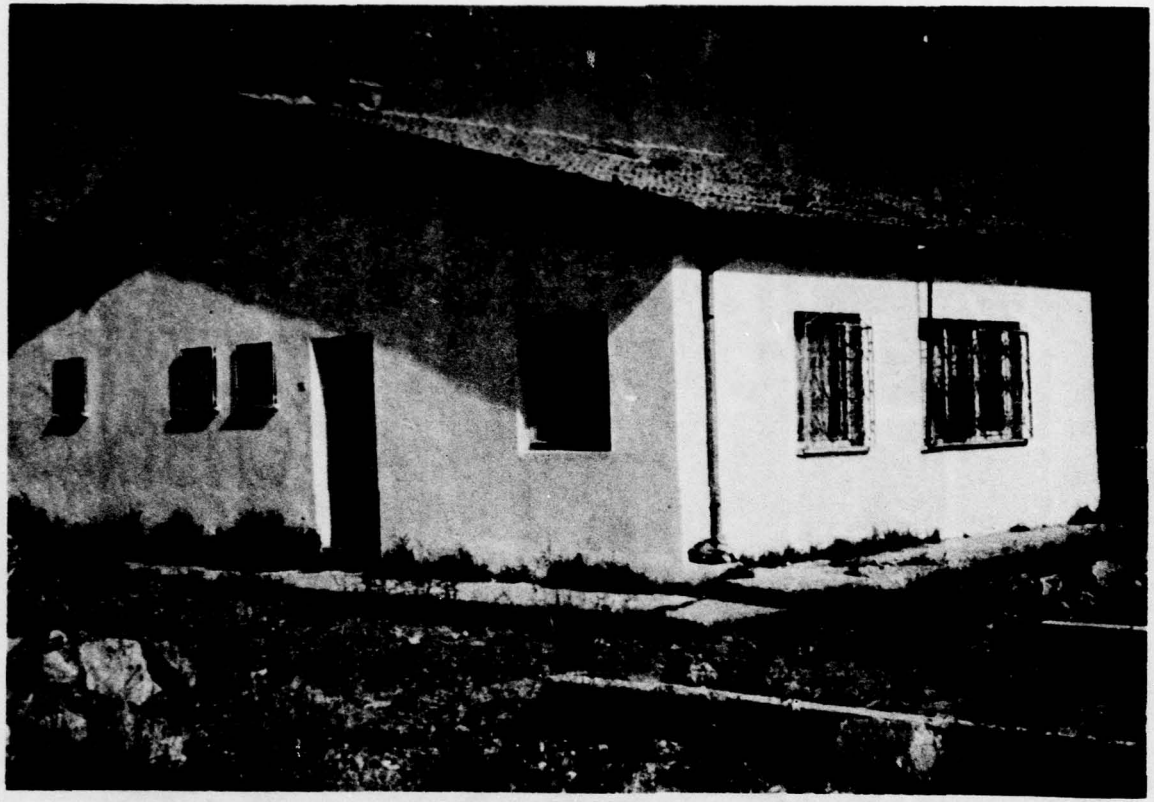


FIGURE C-4

A single unit dwelling in new Gediz built in 1976

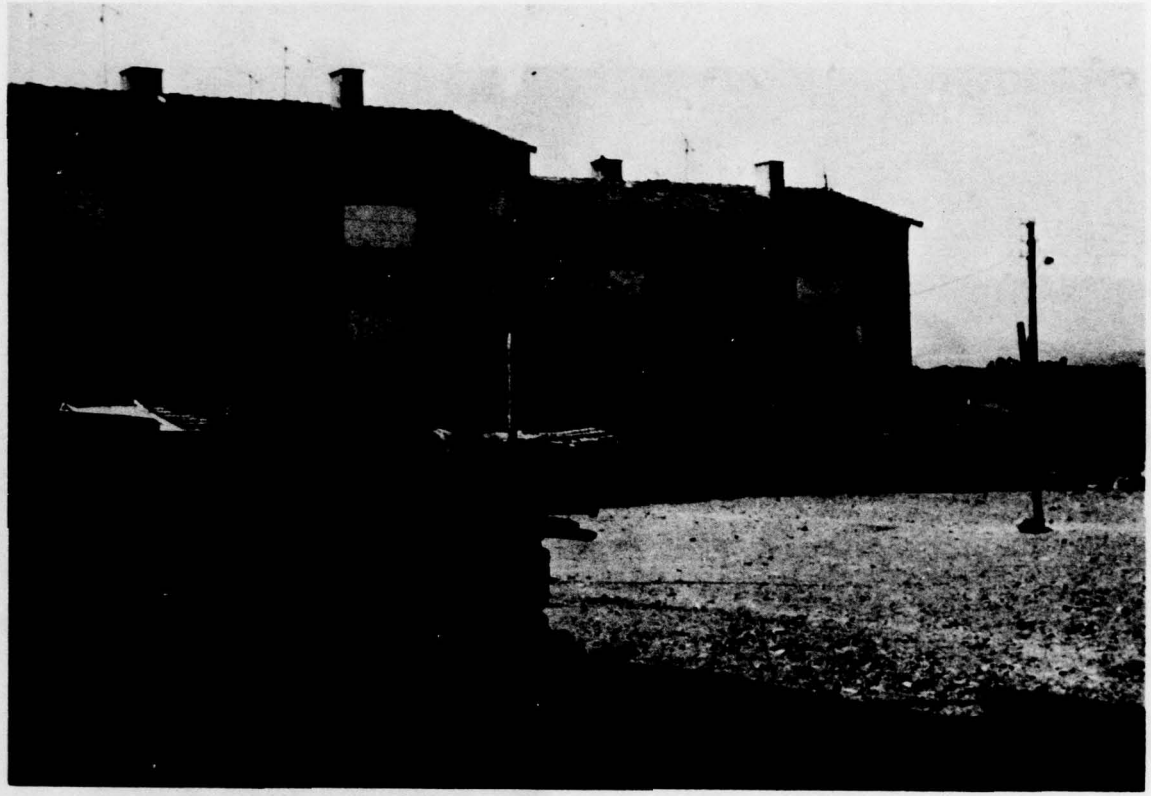


FIGURE C-5

A multi-family apartment complex in new Gediz.
Note the television antennae and the storage
sheds constructed by the tenants.

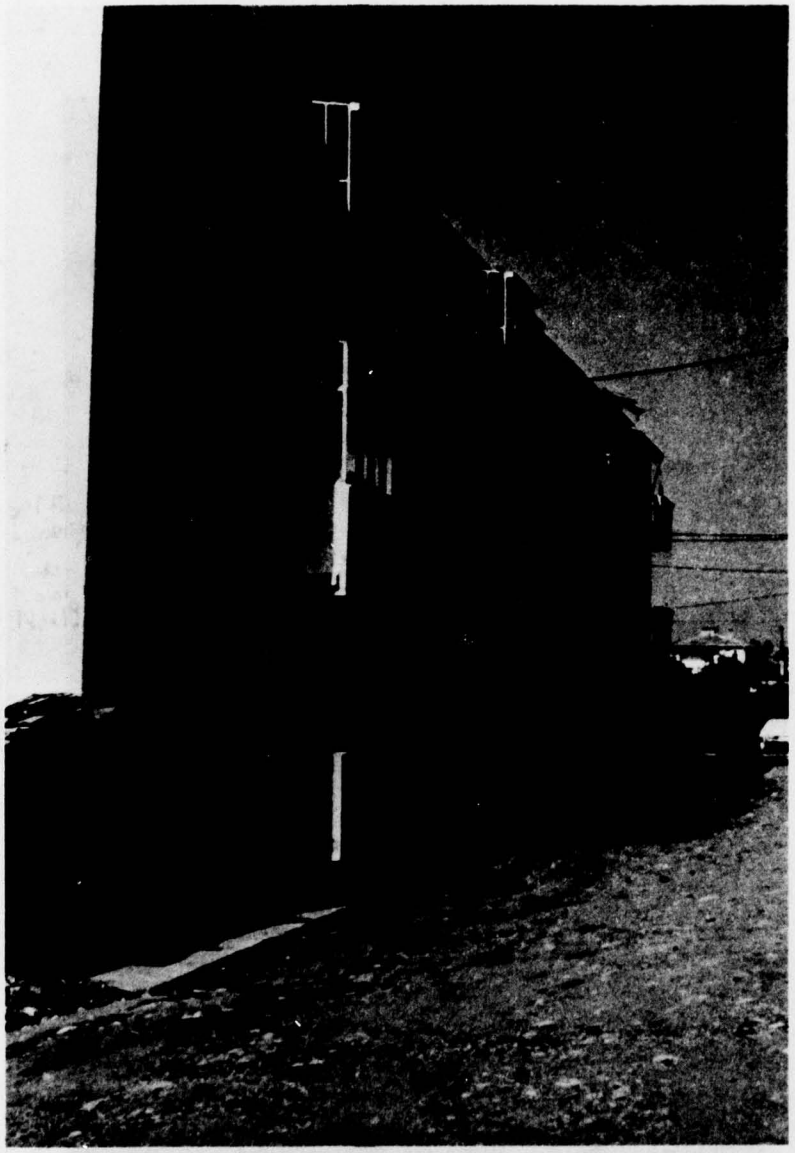


FIGURE C-6

A tri-level apartment complex in new Gediz. This building was five years old in 1978.

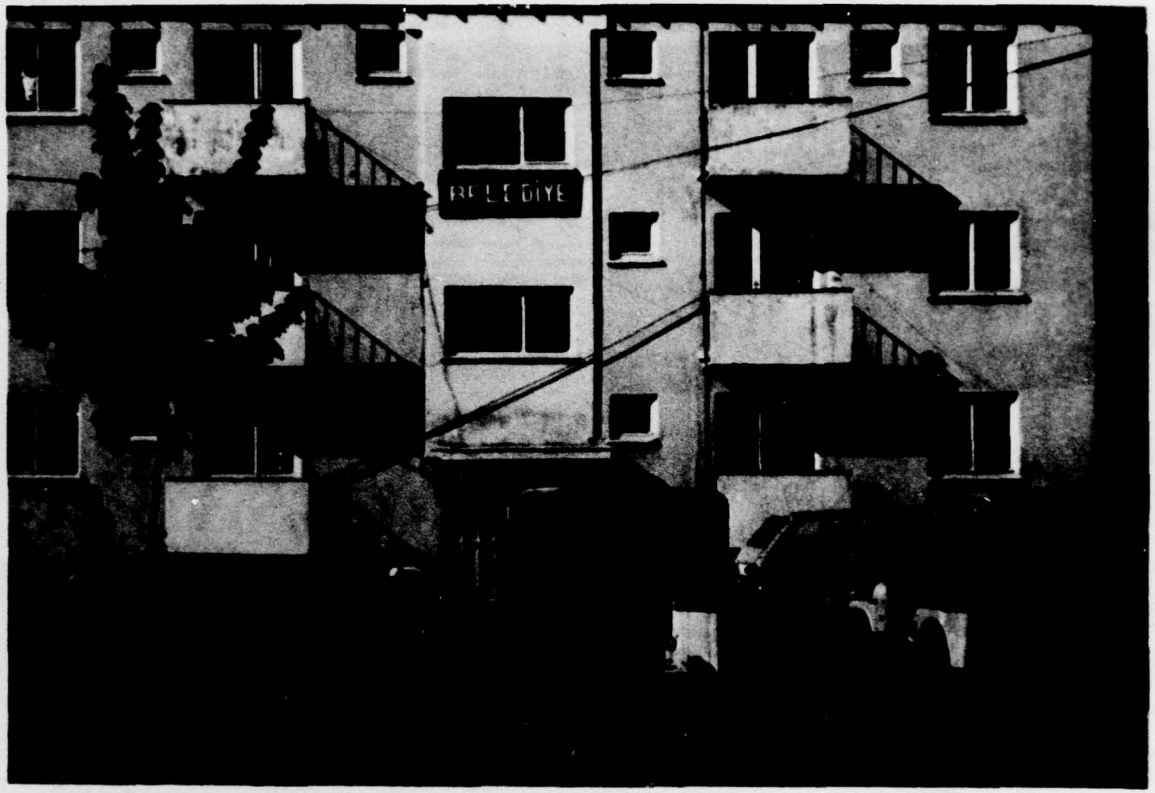


FIGURE C-7

The municipal building in new Gediz.

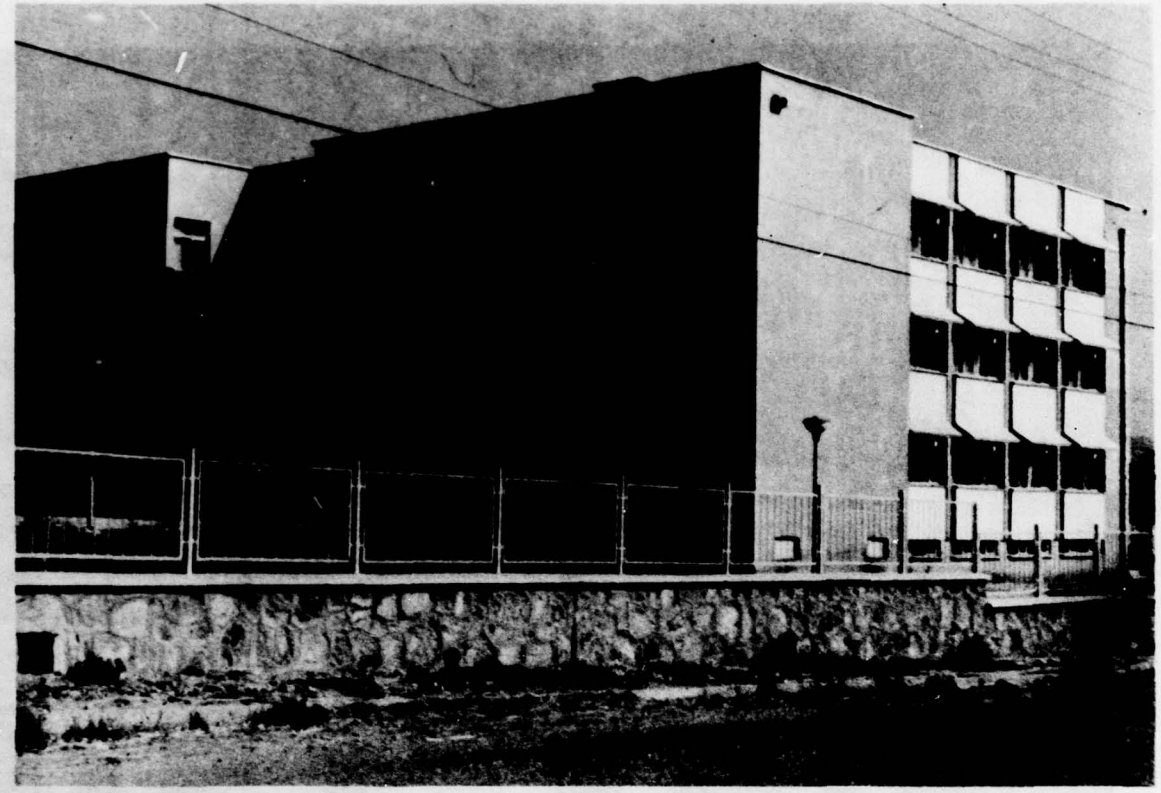


FIGURE C-8

The state hospital in new Gediz.

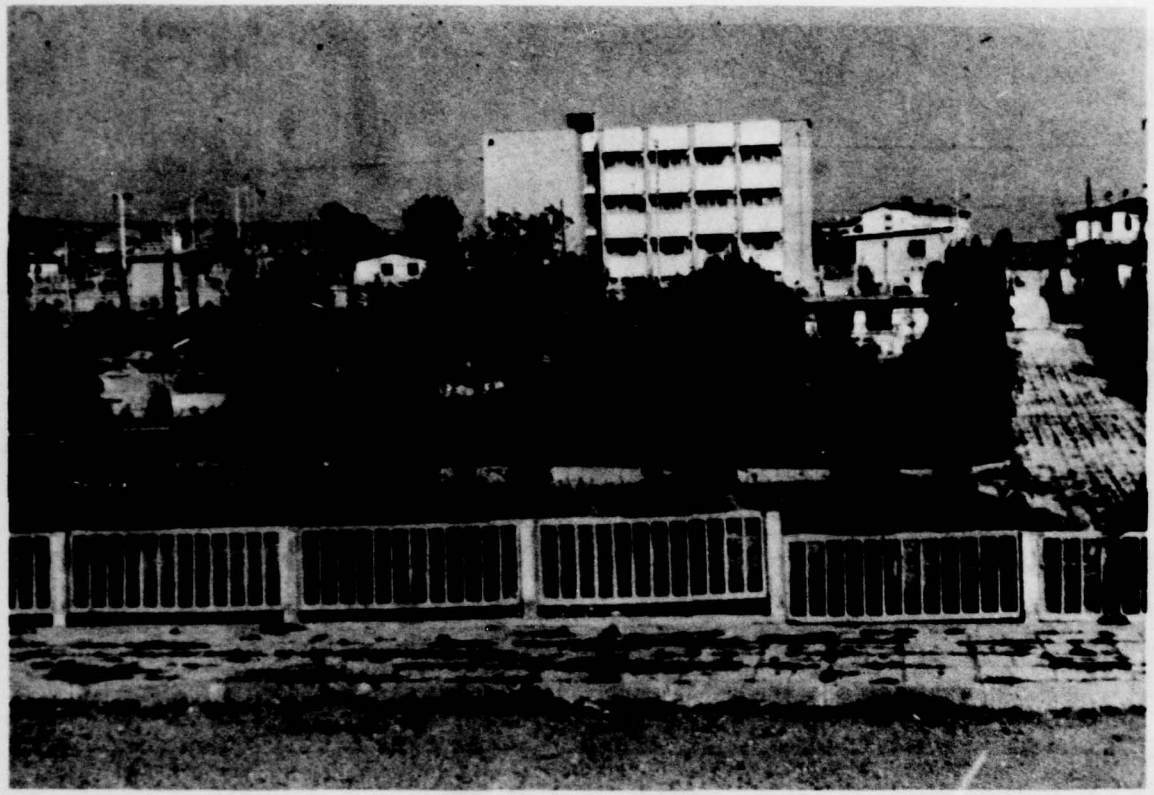


FIGURE C-9

The municipal park in new Gediz (1978)

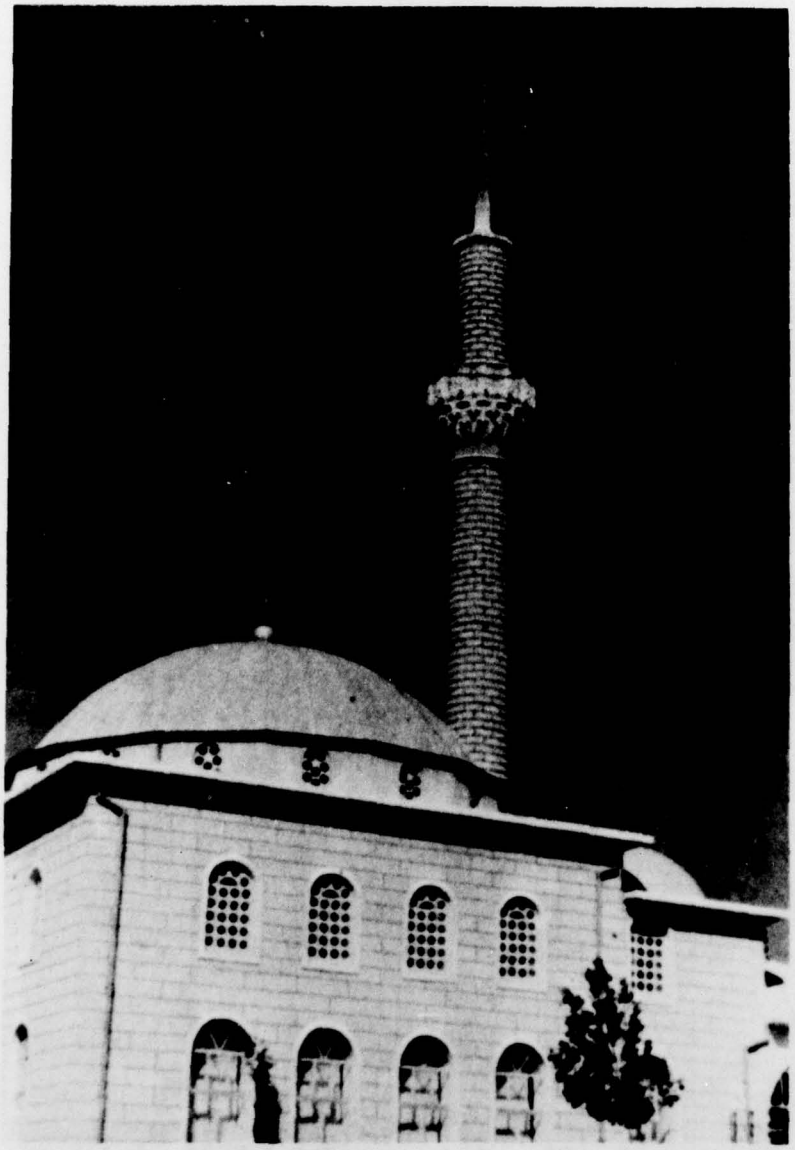


FIGURE C-10

Friday prayer mosque in new Gediz (1978)

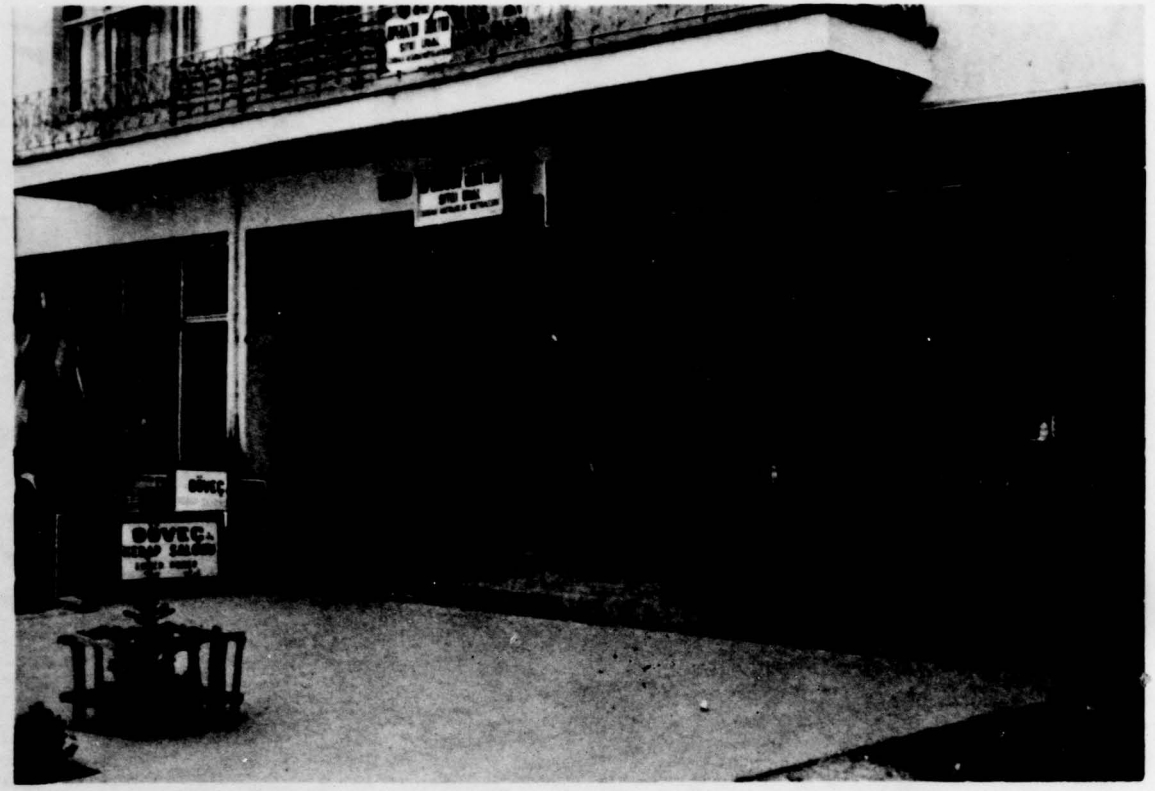


FIGURE C-11

A shopping complex in new Gediz
(drug store, doctor's office, restaurant, hotel)

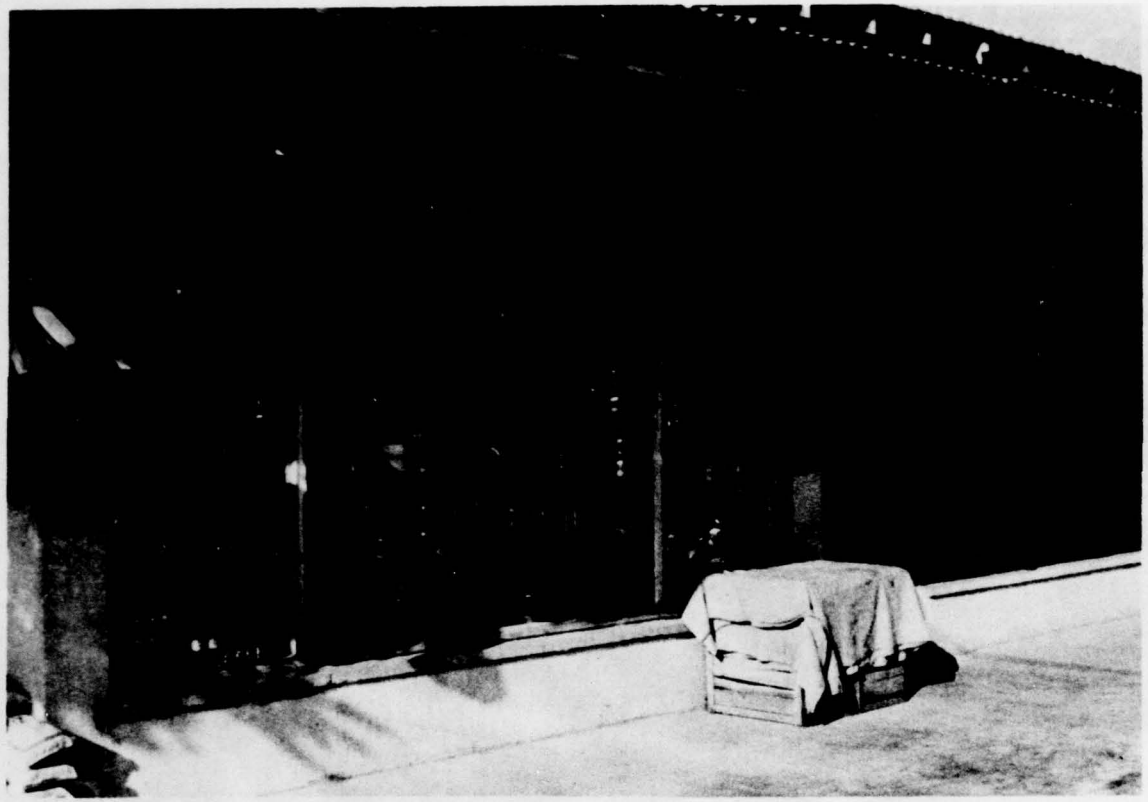


FIGURE C-12

One of many stores in new Gediz.

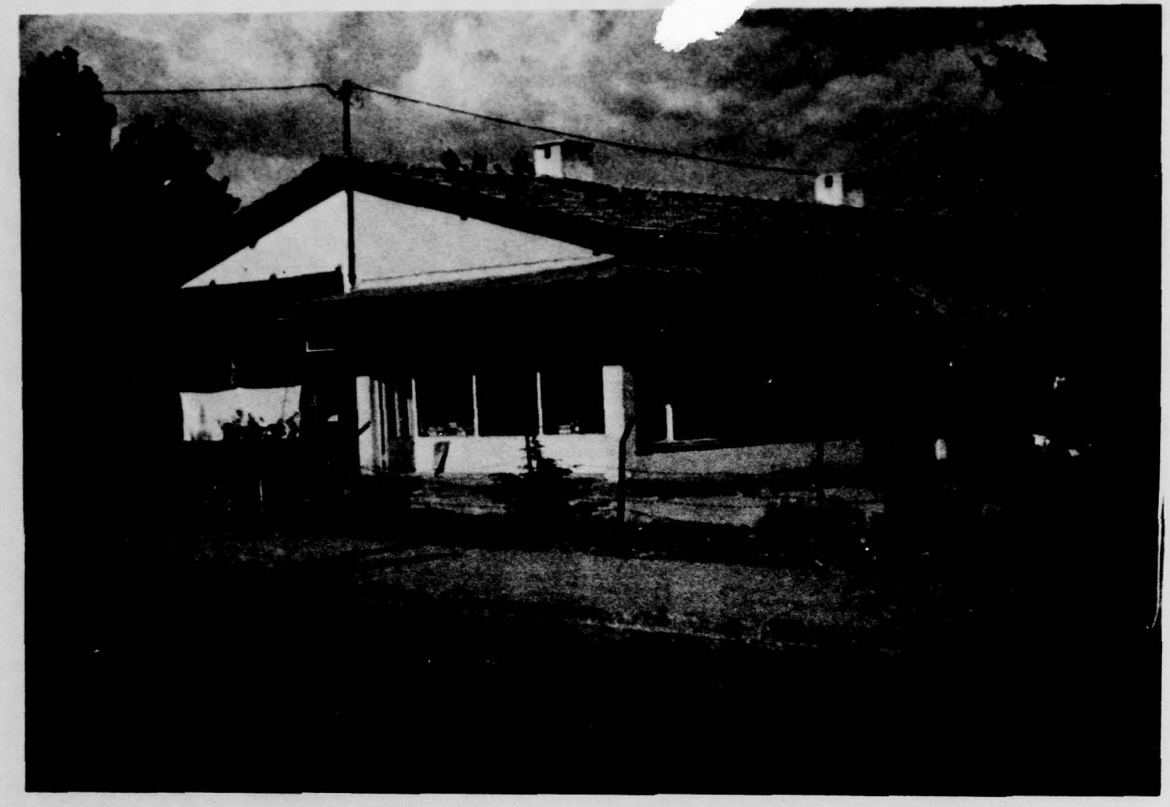


FIGURE C-13

A drugstore in new Gediz

FIGURE C-14

Bank in new Gediz

FIGURE C-15

The bus station in new Gediz

FIGURE C-16

A shored taxi on its way from new Gediz to old Gediz.
Note the new government forestry building in the background.
The streets are mostly paved.

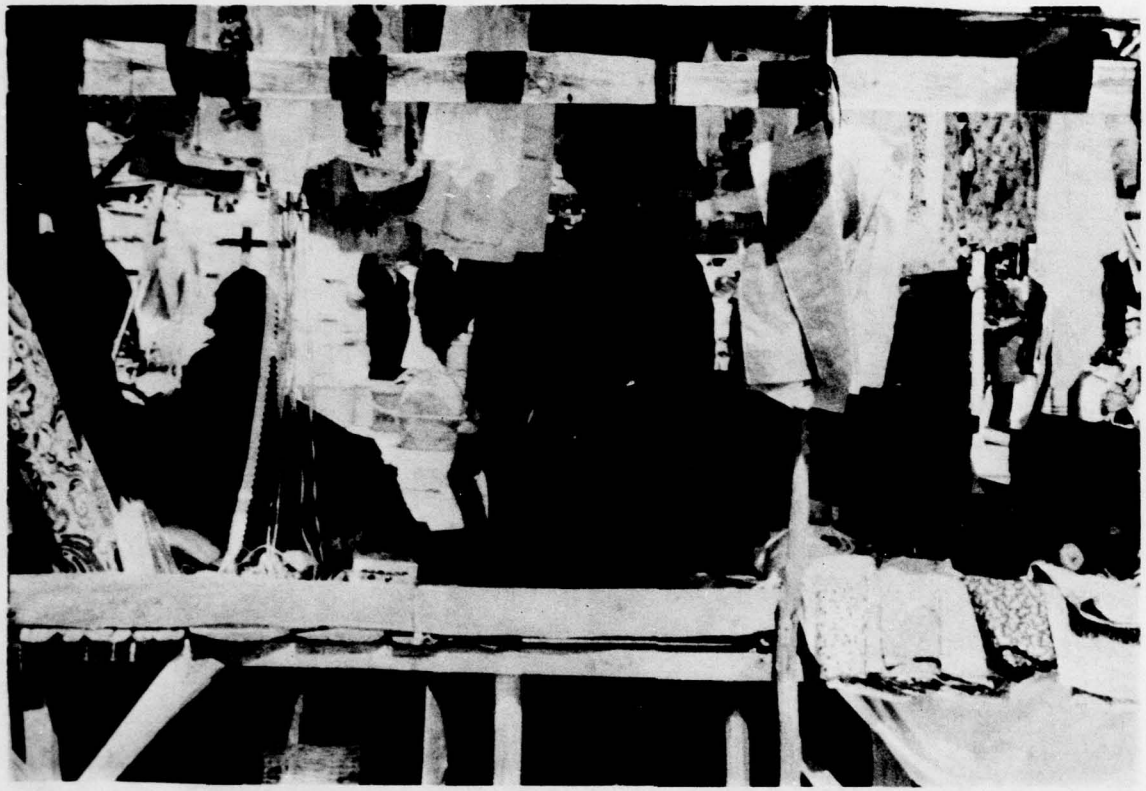


FIGURE C-17

A seller at the weekly market (Saturday) in new Gediz.
Old Gediz also has its weekly market on Saturday.

FIGURE C-18

One of the many specialty sellers at the
weekly market in new Gediz.

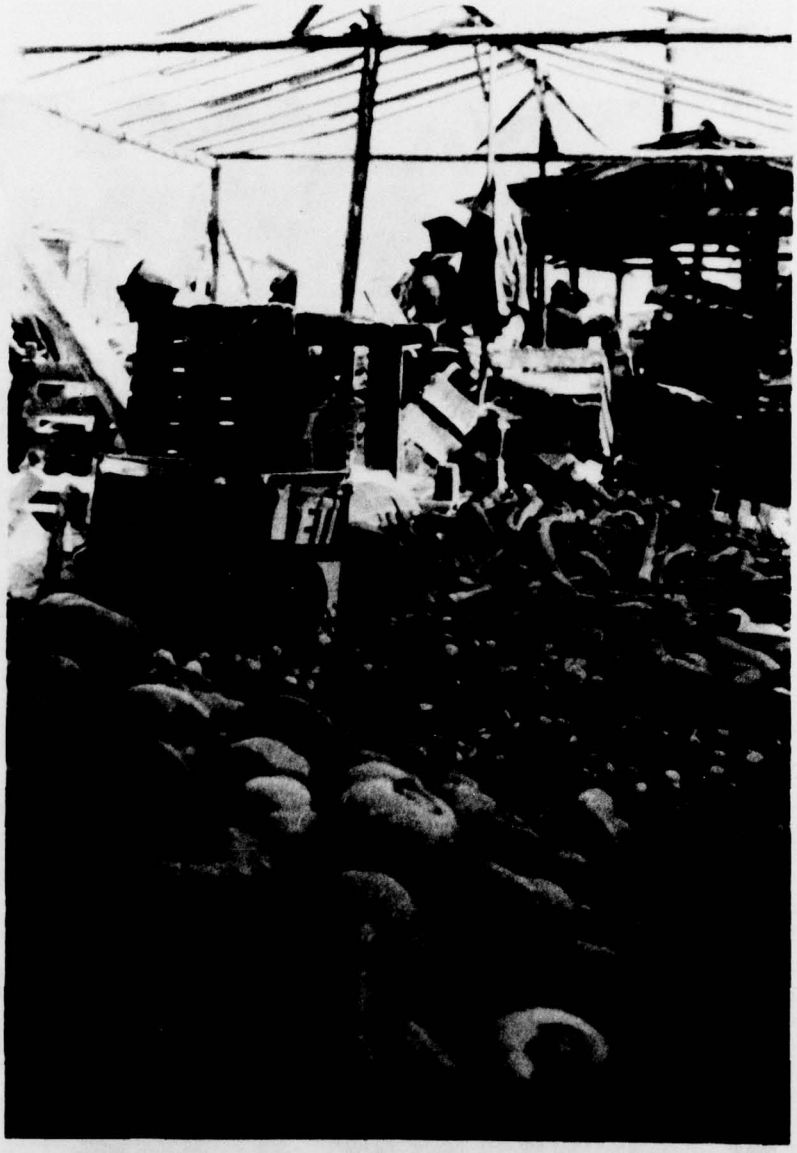


FIGURE C-19

Vegetables are the most common market items at the weekly market.

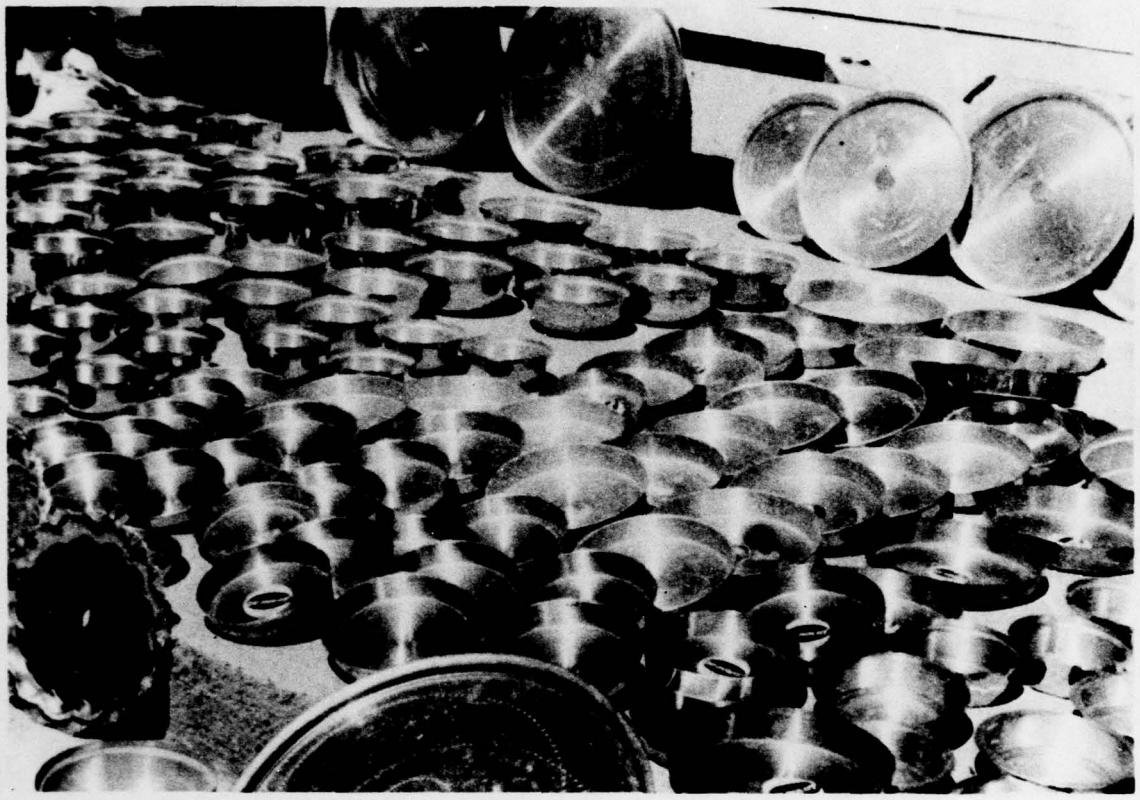


FIGURE C-20

Silver, tin, copper and brass items
are sold at the weekly market

FIGURE C-21

The spinning and weaving plant in new Gediz