

سازمان برنامه و بودجه

زلزله‌های سال ۱۹۷۰ کشور ایران

این مجموعه حاوی زلزله‌هائی است که در سال ۱۹۷۰ در کشور ایران روی داده است و جزئی از کوششی است که ضمن پروژه مشترک این دفتر با دانشگاه صنعتی آریامهر و امپریال کالج دانشگاه لندن برای بررسی زلزله‌های گذشته ایران صورت گرفته است و با این شکل نخستین کاتالگ از کاتالگهائی است که برای زلزله‌های قرن اخیر ایران تهیه خواهد شد. جمع‌آوری و تدوین کاتالگ زلزله‌های سالهای دیگر نیز بتدریج انجام خواهد گرفت و بدون رعایت ترتیب زمانی و بمحض آنکه اطلاعات جمع‌آوری شده برای هر سال قابل انتشار باشد در دسترس گذارده خواهد شد و باین ترتیب بتدریج نتایج مقدماتی درباره زلزله‌خیزی کشور ایران در قرن اخیر جمع‌آوری خواهد گردید.

در تهیه این مجموعه ها هدف ورود در مبحث لرزه شناسی Seismology نبوده و بیشتر استفاده‌های مربوط به مهندسی مورد نظر میباشد لکن از آنجا که تشخیص حدود زلزله‌خیزی نقاط مختلف کشور نمیتواند تنها بر اساس محاسبات پایگاه‌های مختلف جهانی صورت گیرد و تعداد پایگاه‌های لرزه‌شناسی کشور نیز با توجه به نیاز کشور بسیار محدود است بدون استعانت از اطلاعات محلی و روش ماکروسیسمیک نمیتوان مراکز زلزله‌های متوسط و کوچک را مشخص نمود.

در حال حاضر فقط پنج پایگاه لرزه‌شناسی در ایران وجود دارد و این تعداد پایگاه برای بدست آوردن مرکز دقیق زلزله‌های کوچک و متوسط کافی نمیشد، در نقشه شماره یک محل پایگاه‌های ایران و کشورهای همجوار (آنچه در سال ۱۹۷۰ موجود بوده است) مشخص شده است.

از آنجا که تلفیق اطلاعات حاصله از دستگاههای لرزه شناسی و اطلاعات ماکروسیسمیک در محاسبه مراکز زلزله کاربرد دارد تهیه کاتالوگهای از زلزله های ایران که اطلاعات کسب شده از دستگاههای لرزه شناسی در سطح جهانی و در سطح منطقه را با اطلاعات محلی تلفیق دهد میتواند برای بررسی زلزله های گذشته ایران مفید واقع گردد .

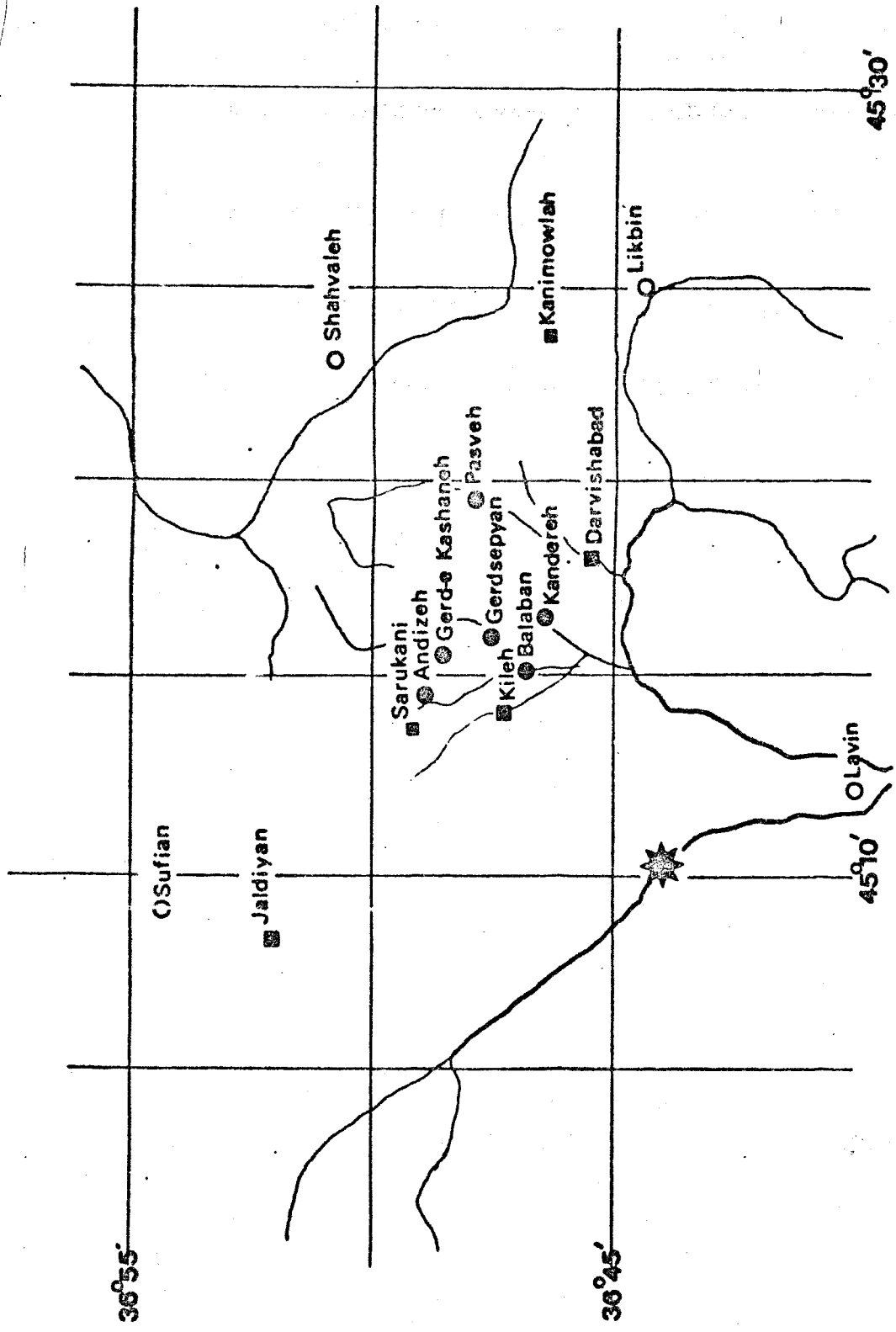
این مجموعه از آنجا که در سطح بین المللی مورد استفاده قرار میگیرد بر حسب ماه و سال میلادی و بزبان انگلیسی تهیه گردیده و زمان وقوع زلزله نیز بوقت گرینویچ با ساعت و دقیقه و ثانیه داده شده — و اوردیکه ثانیه یا دقیقه ذکر نشده است مربوط به زلزله هائی است که تنها از طریق ماکروسیسمیک و اطلاعات محلی از وقوع آن زلزله ها اطلاع حاصل شده و اطلاعات مربوط به دستگاه لرزه شناسی از پایگاهها بدست نیآمده است با این حال وقت محلی در این قبیل زلزله ها نیز تبدیل به وقت گرینویچ گردید .

در این کاتالوگ برای هر یک از زلزله ها مراکز جغرافیائی زلزله و عمق کانون (بر حسب کیلومتر) با استفاده از بولتن های پایگاههای مختلف با ذکر نام پایگاه که با حروف خاص مشخص شده داده شده است و چنانچه اختلافاتی در باره ای از گزارشها باشد این اختلافات نیز با ذکر نام پایگاه مربوط درج شده است ، در کلیه موارد عددی که برای بزرگی (Magnitude) ذکر شده متوسط ارقامی است که توسط پایگاههای مختلف گزارش گردیده است . ارقام بزرگی K که بوسیله پایگاههای کشور شوروی گزارش شده با رابطه $K = 1.8(M_g) + 4.3$ برگردانده شده است و باین ترتیب مقدار M_g بدست آمده است که معمولاً در بیشتر حالات رقم بدست پائینی است .

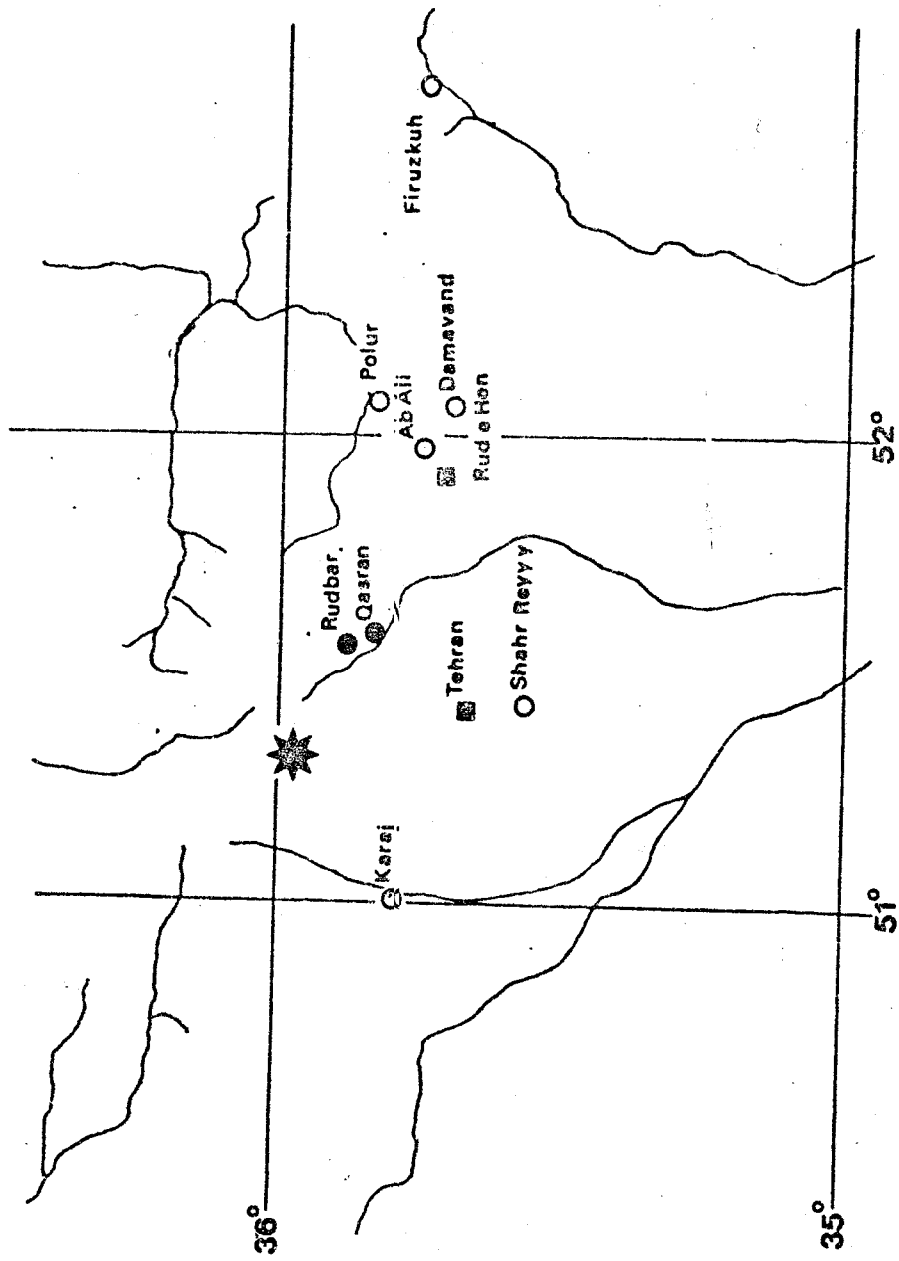
ارقام مربوط به شدت (Intensity) در حوالی مرکز وقوع برحسب مقیاس اصلاحی مرکالی و شعاع احساس (برحسب کیلومتر) در موارد یکسه میسر بوده است تعیین و در کاتالوک درج شده است و علامت ستاره بر روی پاره ای از این ارقام نمودار این است که این ارقام کمترین میزانی است که تشخیص داده شده ، گرچه تهیه نقشه های هم شدت برای زلزله ها مورد نظر نبوده است ولی در این مجموعه ۱۰ نقشه برای ۱۰ زلزله نسبتاً "بزرگتر" سال ۱۹۷۰ تهیه گردیده است که در آنها واحد و اختلاف شدت (Intensity) را در نقاط مختلف تعیین میکند در این نقشه ها میزان شدت نسبی با علامات مختلف نمایانده شده و علامات مختلف در نقشه شماره ۳ در برابر حروف a و b و c و d رسم گردیده که بترتیب از شدت زیاد تر تا شدت کم تر میباشد . در این نقشه ها مرکز زلزله و همچنین پس لرزه ها (after shocks) به ترتیب با علامت ستاره توپر و ستاره توخالی نمایانده شده است .

با توجه به کافی نبودن اطلاعات لرزه نگاری و دقیق نبودن اطلاعات محلی مسلم است که چنین مجموعه ای نمیتواند خالی از اشتباه باشد انتظار دارد متخصصین فن و علاقمندان بمنظور تکمیل این مجموعه و تصحیح خطاهائی که احیاناً بوجود آمده است همکاری فرموده و هرگونه نظری دارند به این دفتر اطلاع فرمایند که موجب سپاسگزاری است .

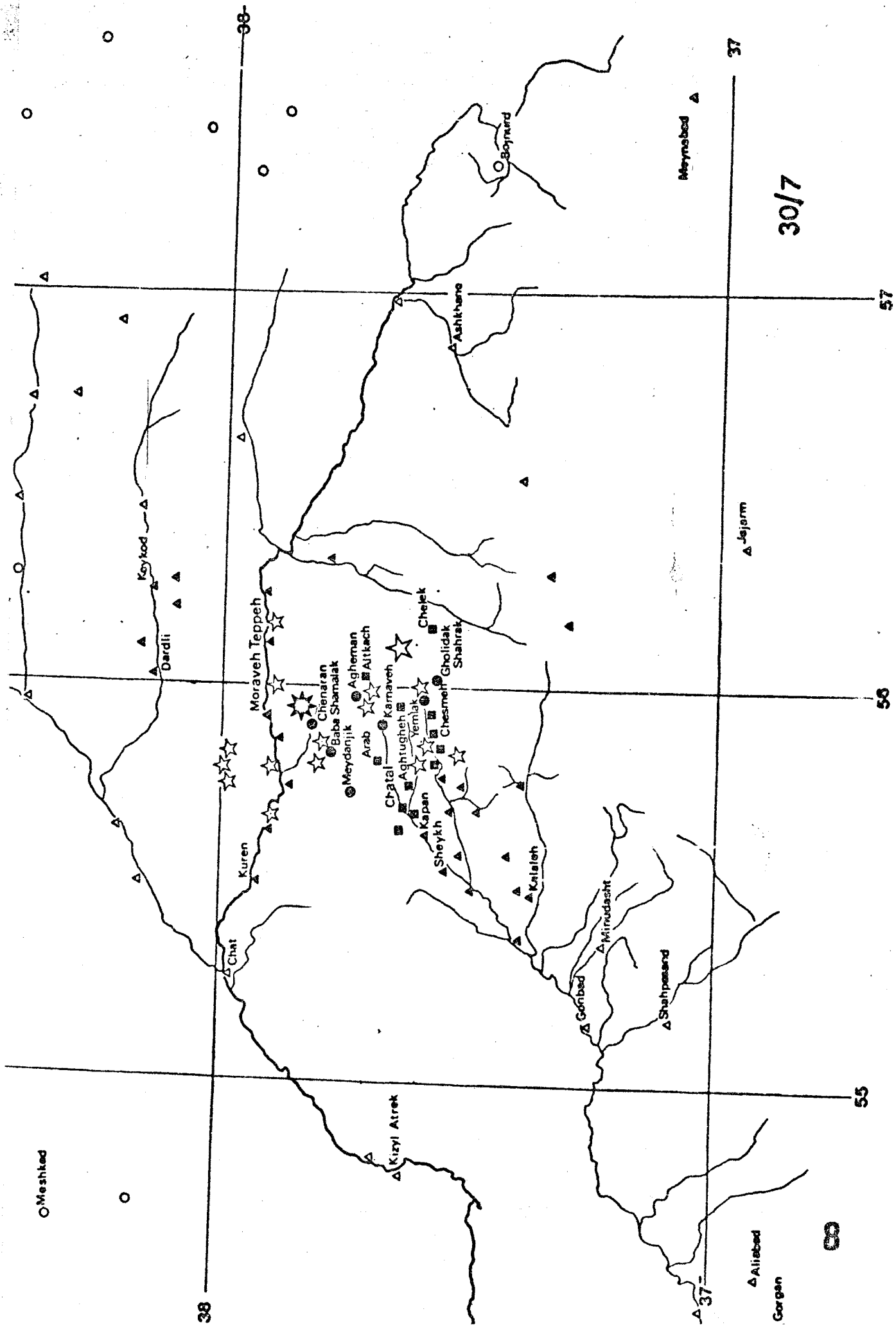
دفتر تحقیقات و استانداردهای فنی



25/10



3/10



○ Meshked

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37

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30/7

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56

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△ Alirebad

Gorgan

00

△ Shahpasand

△ Gorbud

△ Mirudasht

△ Kalateh

△ Kizyl Atrek

△ Chat

△ Kuren

△ Moraveh Teppah

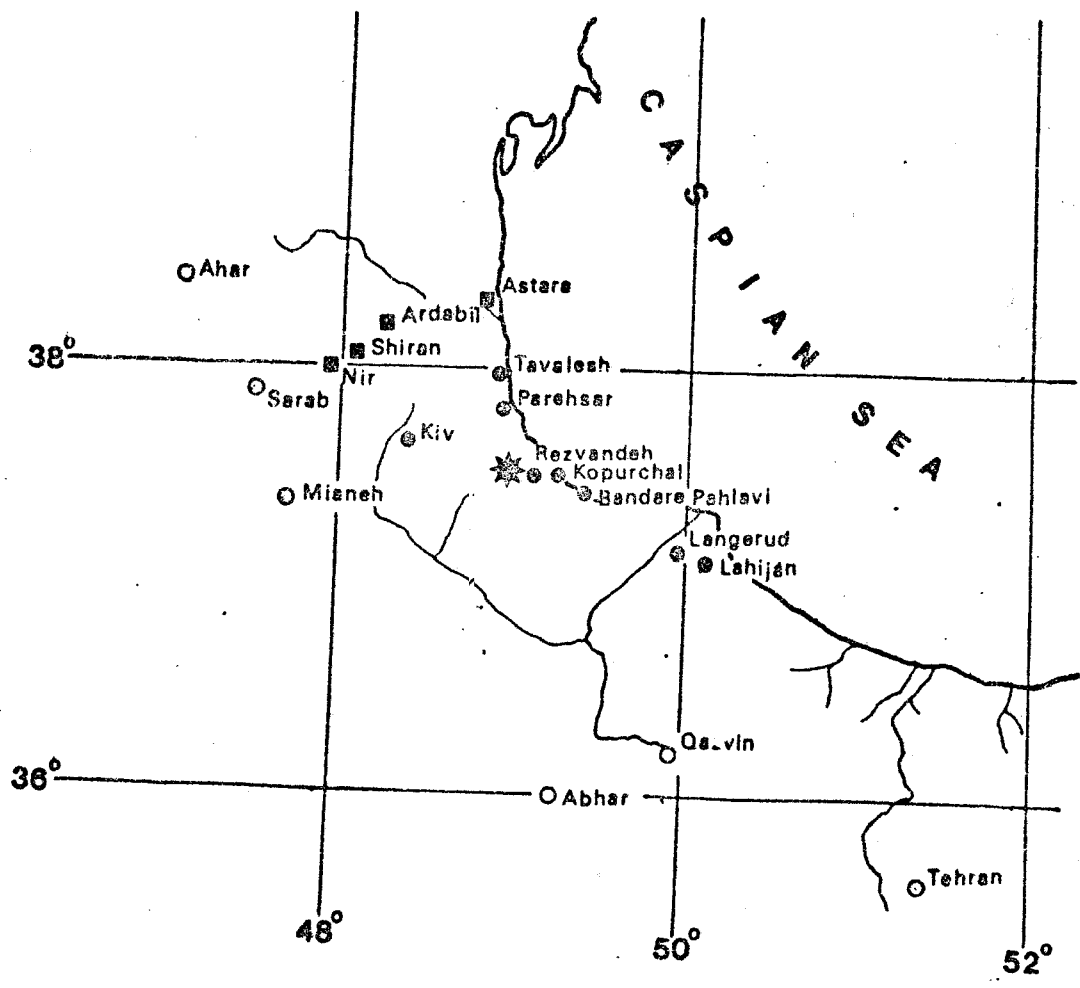
△ Dardli

△ Keykod

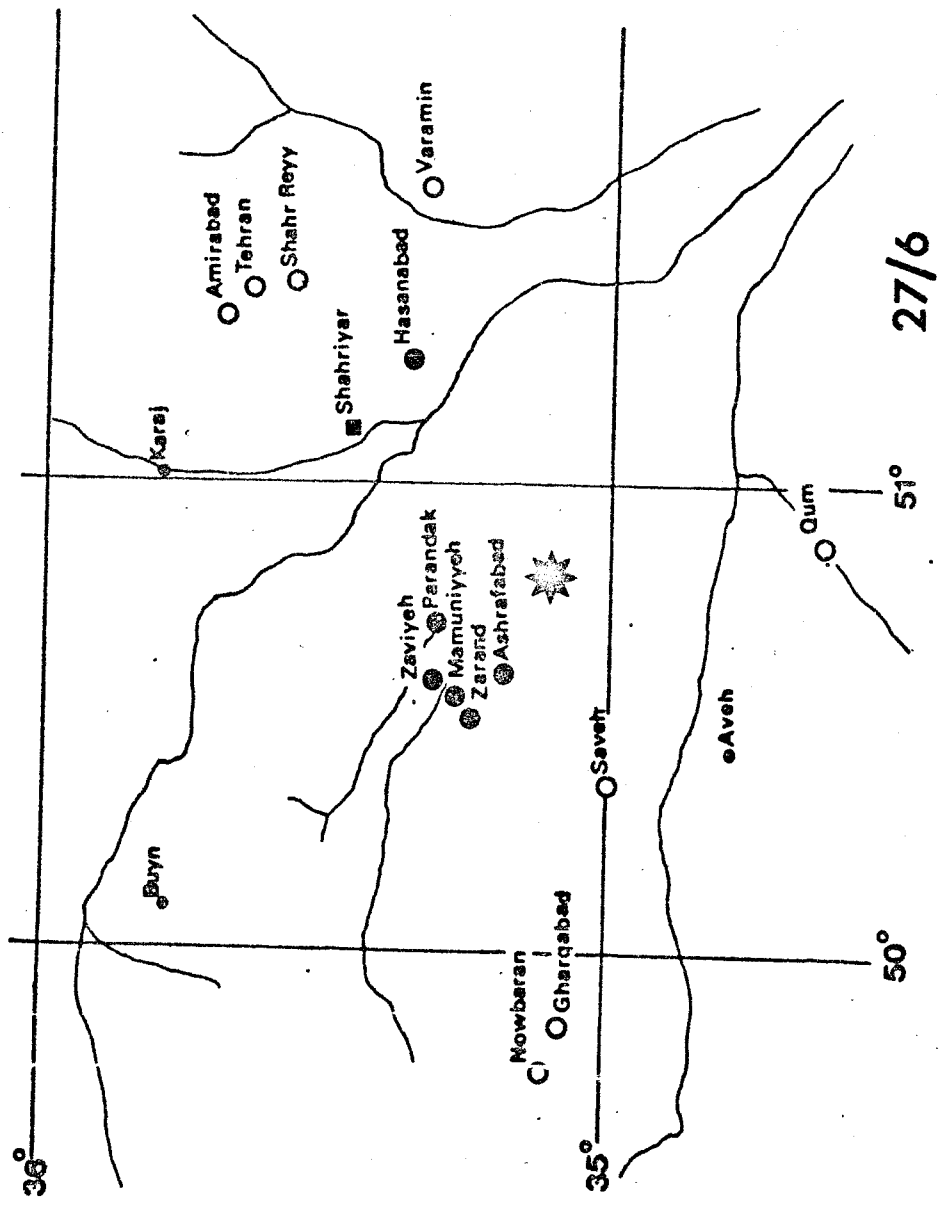
△ Ashit-hare

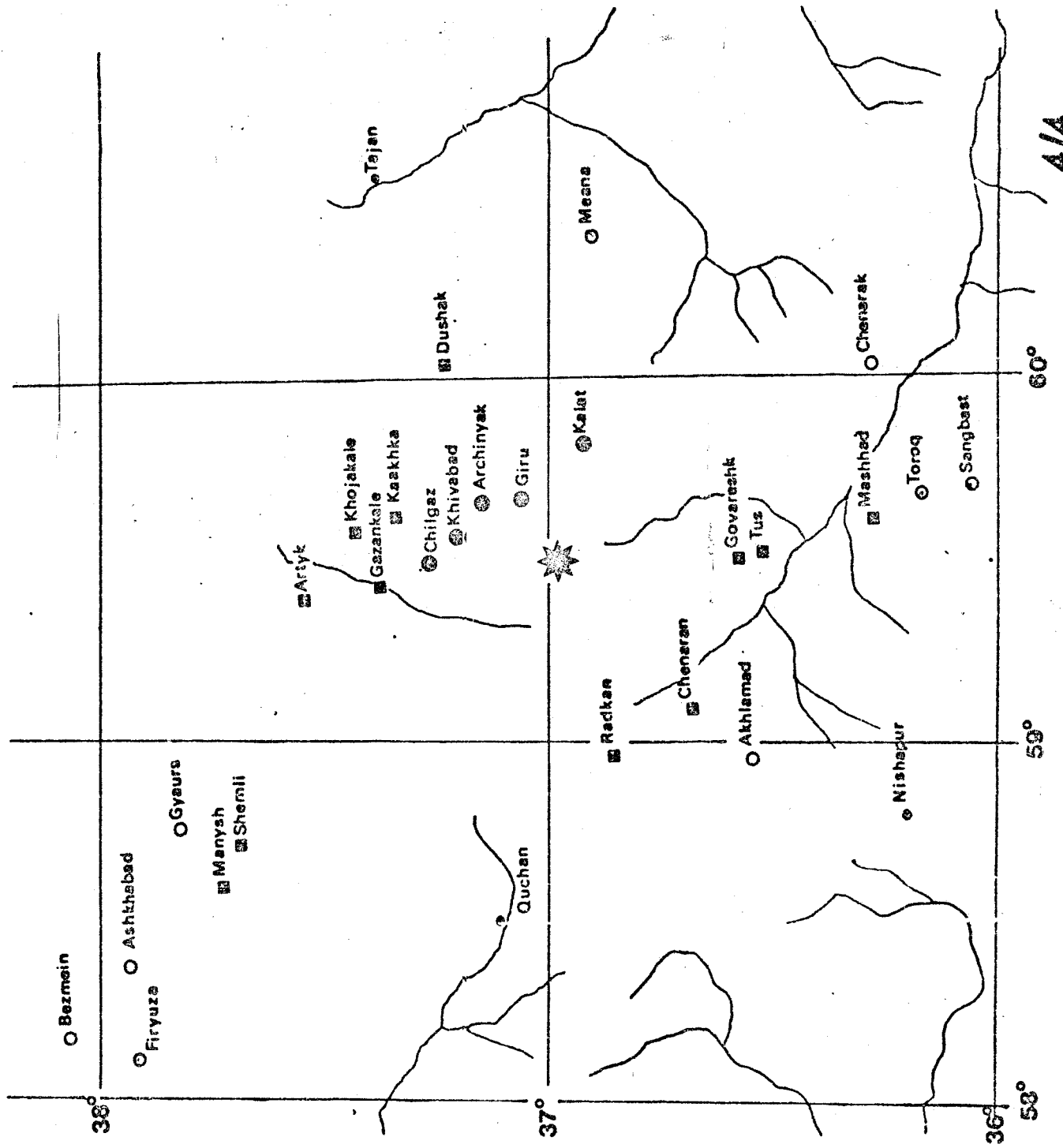
△ Meynabad

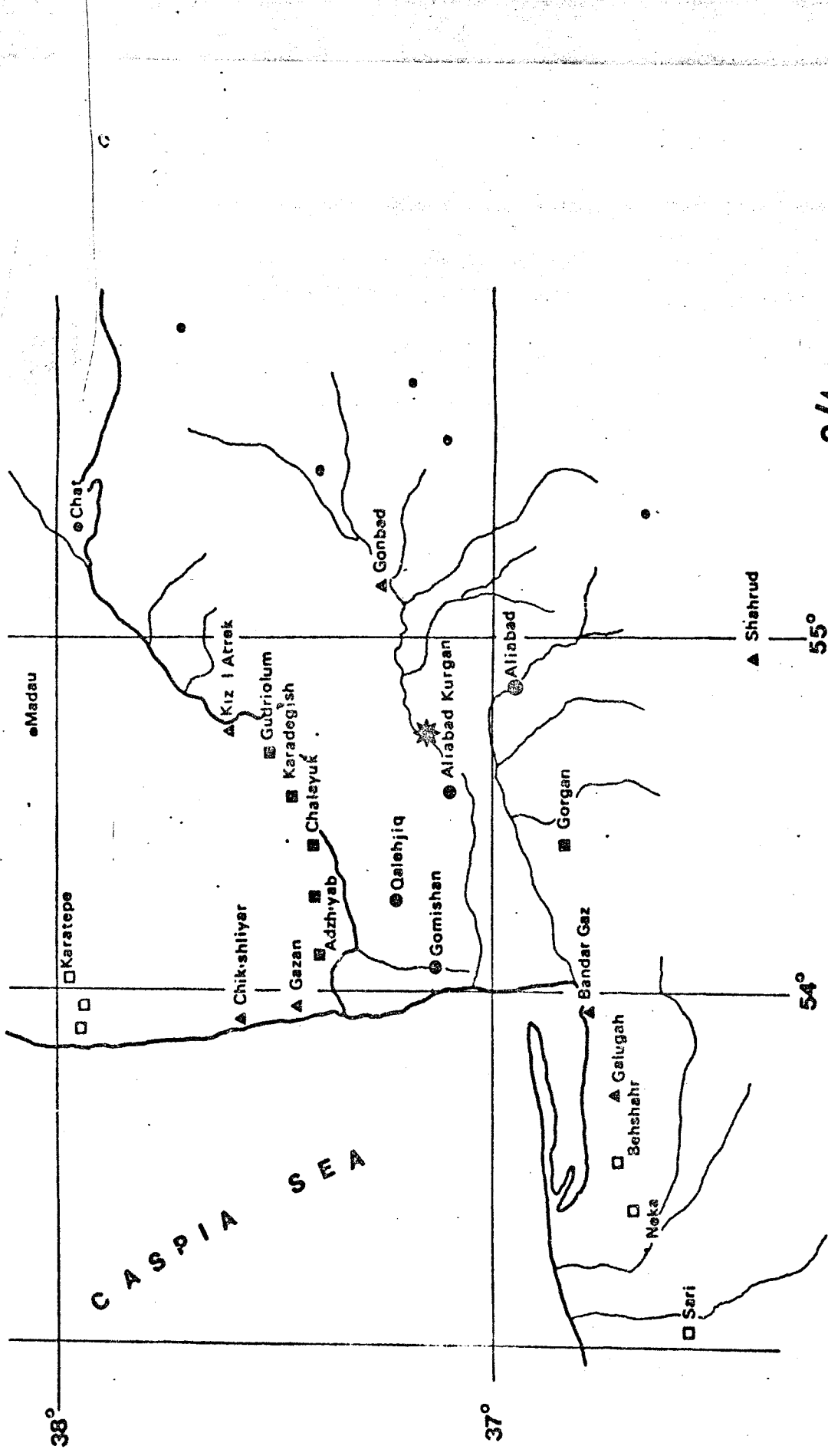
△ Jejarm



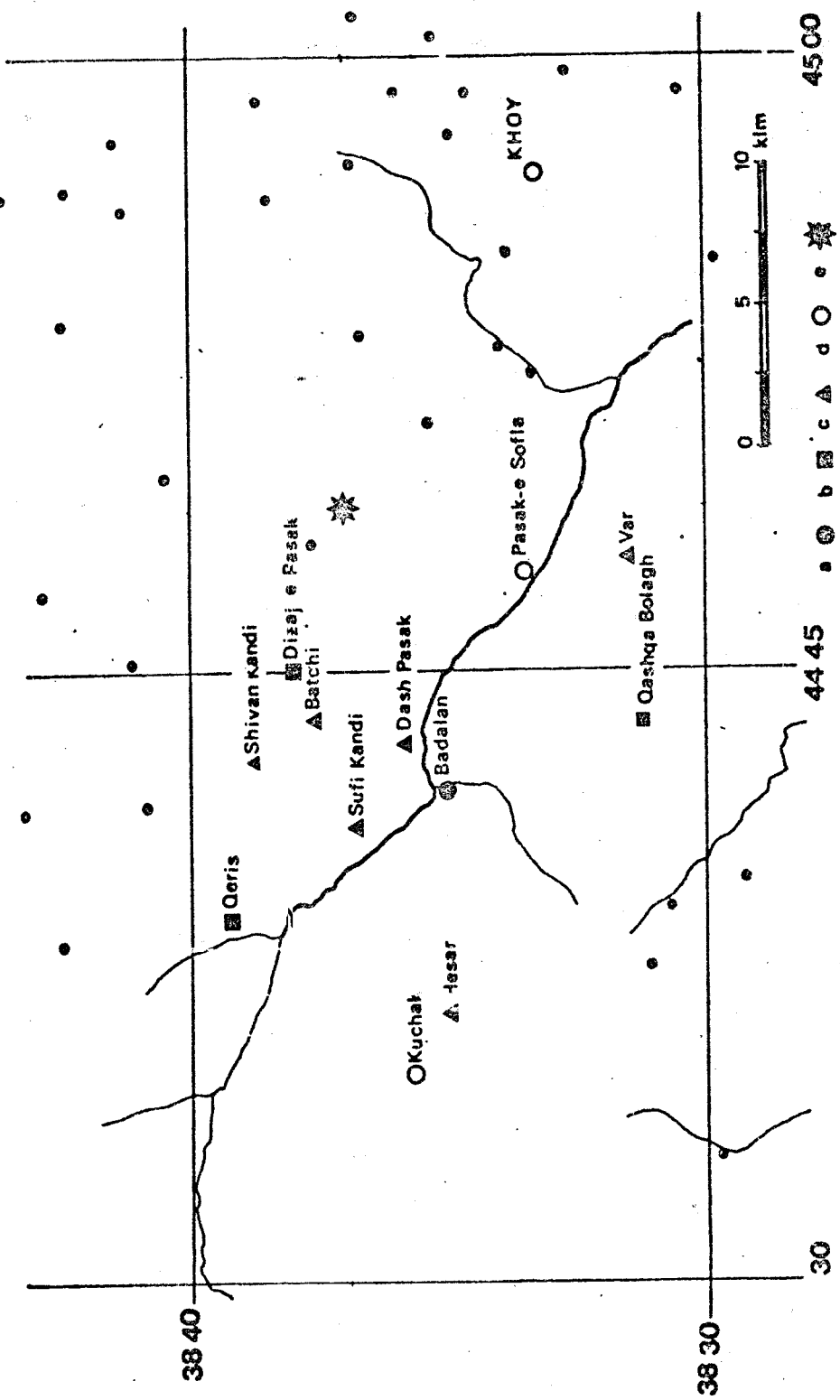
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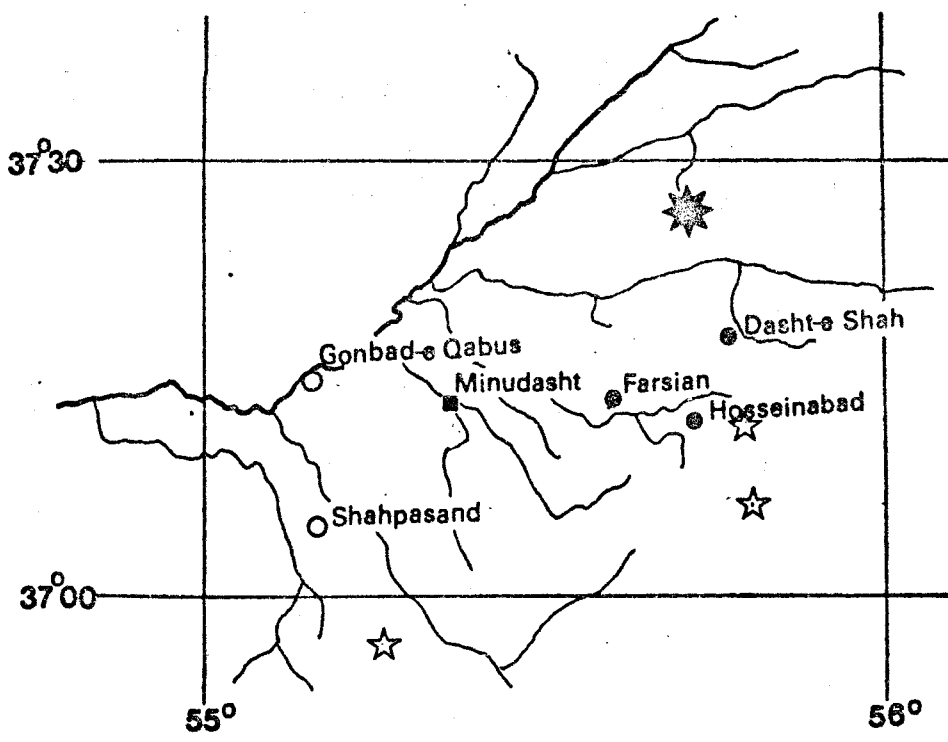






3/4

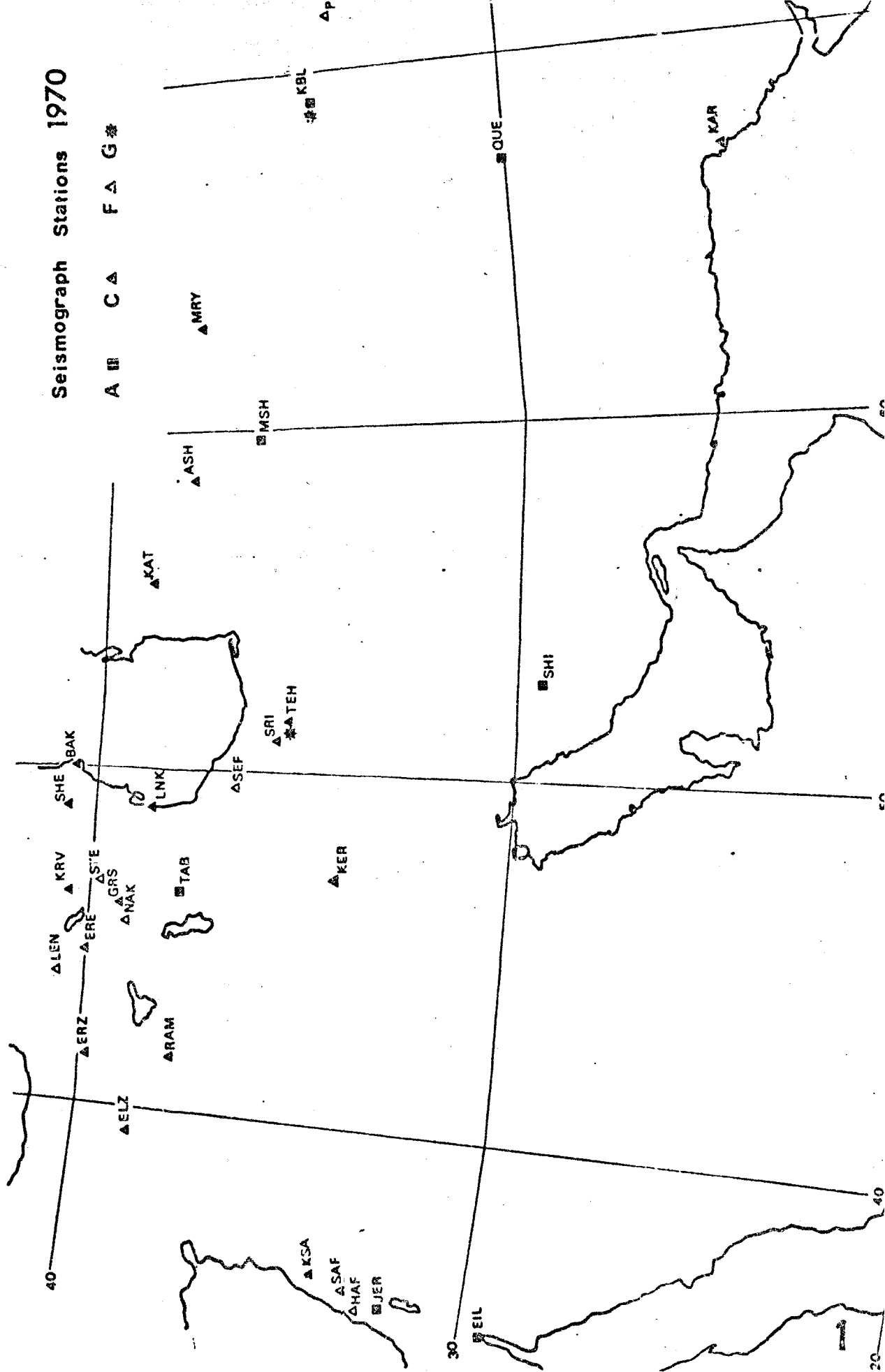




25/2

Seismograph Stations 1970

A B C A F A G *



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- TCHALENKO J., AMBRASEYS N. (1973)
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- BC = Bureau Central International de Sismologie, Strasbourg.
IC = International Seismological Centre, Edinburgh, Scotland.
HF = Hagfors, Observatory, Stockholm.
LA = LASA Centre, Lincoln Laboratory, MIT Lexington, Mass., USA.
NEP = Institute Physics of the Earth, Acad.Sci. Turkm.SSR, Ashkhabad.
PAP = Instituté bf Geophysics AN Gruz.SSR; Seism. Institute Azarb.SSR.
QU = Geophysical Institute, Quetta.
SL = Central Seismological Observatory, Shillong, Assam.
UR = Moscow Institute Physics of the Earth, Acad.Sci. USSR, Moscow.
US = US Coast and Geodetic Survey, Science Centre, Maryland, USA.

STATION REPORTS

- KER = Kermanshah Seismological Station
MAS = Mashhad Seismic Station
TAB = Tabriz Seismic Station
TEH = Tehran Geophysical Institute

PRESS REPORTS

- et = Ittila't, Tehran
ay = Ayendegan
ke = Keyahan, Tehran
pr = local press and weekly Tehran journals, including foreign press.
RLS = Red Lion and Sun Organisation damage and relief report, mainly from local RLS agencies.

Dec. 22	053637	27.15 - 56.20	.	3.2	(NEP)
23	070158	36.3 - 56.3	.	4.2	(NEP)
	152539	36.7 - 57.0	.	3.2	(NEP)
	173130	38.71 - 48.68	.	3.7	Felt at Lenkoran (V MSK) (IC, UR, PAP)
24	024556	38.2 - 45.6	.	2.6	(PAP)
26	195205	27.77 - 57.88	4.8	.	(IC, US, QUE, UR)

Date	Time	Lat	Long	M	Depth (km)	Location	Remarks
Nov.	26	064647	38.0 - 58.1	2.5	.	(NEP)	
	28	095211	38.0 - 58.1	2.5	.	(NEP)	
	29	001145	36.3 - 58.5	2.6	.	(NEP)	
		155444	37.4 - 56.1	3.2	.	(NEP)	
		173744	39.87 - 54.80	4.6	4.6	(IC, US, UR, NEP)	34
		190200	39.3 - 46.0	3.2	.	(NEP)	
Dec.	1	0821	-	.	.	Iran-Iraq border (?) (KERM)	
	2	074008	38.0 - 58.1	2.5	.	(NEP)	
	5	090804	37.7 - 55.4	2.6	.	(NEP)	
	6	192613	38.00 - 55.74	4.1	3.3	(IC, UR, NEP)	
	8	095618	38.0 - 58.1	2.5	.	(NEP)	
	11	0915	-	.	.		A comparatively strong earthquake at Khash (28.2 - 61.3) lasting 4 seconds, caused panic. (et/21 Azr).
	12	111610	37.7 - 55.99	4.5	4.1	(IC, US, UR, NEP)	46
	13	125535	39.1 - 55.2	4.0	.	(NEP)	
	13		-	.	.		An earthquake in Maku caused panic (et/23 Azr).
	14	103651	38.0 - 45.2	2.6	.	(PAP)	
	18	110239	38.0 - 58.1	2.5	.	(NEP)	
		224940	37.6 - 56.4	3.2	.	(NEP)	
		+	-	.	.		Strongly felt at Salneh (Salneh ?) causing concern (et/28 Azr).

Seismic moment $M_0 = 2.6 \times 10^{24}$ dyn.cm,
 Thrust 100°E North (1973).

Nov.	10	005506	38.9	-	44.1	.	3.2	(PAP)
		1714	-	-	-	.	.	Strong shocks in Naqadeh causing panic. (et/20 Aban).
	11	091029	38.0	-	58.1	.	2.5	(NEP)
	12	043516	38.3	-	57.1	.	3.2	(NEP)
		131005	38.33	-	57.35	4.7	4.8	(IC, US, UR, NEP)
	15	005921	38.8	-	47.6	.	2.6	(PAP)
		142849	37.90	-	55.99	.	4.5	(IC, UR, NEP)
	17	201117	38.0	-	57.2	.	2.6	(NEP)
	19	054634	37.8	-	55.8	.	2.6	(NEP)
		055047	39.8	-	45.2	.	2.6	(PAP)
	20	003951	37.9	-	56.0	.	3.6	(NEP)
	21	083554	39.8	-	48.2	5.1	4.8	Strong at Shemaha (IV-V MSK) (US, PAP)
		114855	37.9	-	56.14	.	4.2	(IC, UR, NEP)
		115709	38.0	-	55.79	.	3.9	(IC, UR, NEP)
	24	.	-	-	-	.	.	Continuous shocks for 48 hours in the Naqadeh region caused panic, particularly in the districts of Siyavaleh, Gard Kashanel, and Balavan-e Naqadeh (et/14 Azr).
	25	021627	37.5	-	57.5	.	3.2	(NEP)

Oct.	29	084926	38.43 - 45.47	.	3.5	59	(IC,UR,PAP)
		113002	38.0 - 58.1	.	2.5		(NEP)
	31	054225	38.4 - 45.3	.	3.2		(PAP)
Nov.	1	.	-	.	.	.	Strong shocks, causing panic in Pasveh, Naqadeh and Jaldiyan (et/11 Aban).
	2	173300	39.5 - 50.8	.	3.7		(NEP)
	3	.	-	.	.	.	Strong shocks caused panic in Avaj, Gavik, Chubineh, Bazin and Sultan Bidagh c.35.6 - 49.0 (et/13 Aban).
	4	.	-	.	.	.	Shocks in Ferdows (et/14 Aban).
	5	162803	37.9 - 56.0	.	3.6		(NEP)
		164052	37.70 - 55.95	.	3.7		(NEP)
		1800	-	.	.	.	Strong shock felt in Kashmir and its district (et/15 Aban).
		2255	-	.	.	.	Stronger shocks in Kashmir ruined six houses without casualties (MASH, et/15 Aban).
	6	081626	37.90 - 55.79	.	4.0	98	(IC,UR,NEP)
		151713	37.7 - 56.0	.	2.6		(NEP)
	7	012450	-	.	.		Felt at Kashmir (MASHD)
		092252	38.0 - 58.1	.	2.5		(NEP)
	8	104318	37.4 - 56.0	.	2.6		(NEP)
	9	174143	29.55 - 56.81	5.4	4.7	114	IV At Sirjan, lasting for 10 sec., caused great panic but not the slightest damage; felt at Sar Cheshmeh. (IC,US,UR,BC,KER,ay/21 Aban, pr/23 - 24 Aban).

Oct.	20	103422	27.59 - 56.67	4.8	.	75	(IC,US,UR,QUE)
		232129	39.2 - 43.9	.	3.2		(PAP)
	21	095756	38.0 - 58.1	.	2.5		(NEP)
	24	041328	37.3 - 56.0	.	2.6		(NEP)
		132055	37.4 - 56.0	.	3.8		(NEP)
	25	112221	36.74 - 45.17	5.3	5.2	44	VI+
						150	
							A destructive earthquake in Azarbayejan. Villages of Kandareh, Balaban, Gerdsepyar Pasveh, Gerd-e Kashaneh and Andizeh were almost totally destroyed or damaged beyond repair. In all 185 houses were destroyed 21 people injured. Another 130 houses were ruined (VI+). The villages of Kanimowlah Darvishabad, Kile-ye Olia, Sarukani and Jaldiyan suffered some damage and a number of houses were ruined (V). The villages of Shahvaleh, Likbin and Lavin suffered minor damage (IV), Figure 10. The shock was of the same intensity at Mahabad, Naqadeh and Oshnuiyeh where many houses cracked. At a few walls collapsed injuring a number of people. (IC,US,UR,BC, et/4-7 Aban, ke/4-7 RLS, pr/5-10 Aban).
	26	1930 ⁺	-	.	.		Strongly felt at Jaldiyan & Naqadeh (ke/5 Aban).
		2230 ⁺	-	.	.		Felt at Naqadeh (ke/5 Aban).
	27	0330 ⁺	-	.	.		Felt at Naqadeh and Jaldiyan (ke/5 Aban)
		0430 ⁺	-	.	.		Felt at Naqadeh and Jaldiyan (ke/5 Aban)
		201108	26.54 - 55.24	4.5	4.5	45	(IC,US,UR)
	28	102717	37.4 - 56.0	.	2.6		(NEP)

Oct.	3	024746	33.90 - 47.56	4.9	4.5	85	IV	Felt at Kangavar (IV) and Kermanshah (III), followed by three aftershocks. (IC, US, UR, KER)
		065703	36.01 - 51.31	4.1	.	78	V	Strongly felt in Tehran and to the northeast of the city. Slight damage at Qasran Rudbar where the shock caused panic (V). Less intense at Rud-e Hen and Tehran where the electricity was cut off. More intense at Shemiran, Narmak, Mehrabad, Arianshahr and Shahr Rey, but only locally. A few old houses cracked at Narmak & Damavand, Ab-e Ali, Polur, Damavand, Firuzkuh and slightly at Karaj (III). Figure 9. (IC, US, KER et/11-13 Mehr, ke/Mehr, pr/12-18 Mehr).
	5	080050	37.3 - 56.5	.	3.9			(NEP)
		183124	37.55 - 56.58	.	2.6			(NEP)
	7	022040	27.90 - 56.56	5.0	4.6	70		(IC, US, UR, BC)
	11	002209	37.9 - 56.6	.	3.8			(NEP)
	11							A comparatively strong shock in Ferdows and its region (et/20 Mehr).
	12	165339	37.9 - 65.6	.	2.6			(NEP)
	13	140945	38.0 - 58.1	.	2.5			(NEP)
	16	073635	37.9 - 58.4	.	2.5			(NEP)
	17	171535	37.55 - 58.10	.	3.2			(NEP)
	18	061042	27.41 - 55.02	4.8	5.0	61		(IC, US, UR, BC)
	19	174117	37.3 - 57.2	.	2.5			(NEP)
		225301	38.3 - 44.4	.	2.6			(PAP)

Sep.	13	120455	38.0 - 58.1	.	2.5	(NEP)
	14	051128	37.50 - 55.85	.	2.6	(NEP)
	15	022126	37.7 - 55.8	.	3.8	(NEP)
		073226	38.0 - 58.1	.	2.5	(NEP)
		115829	38.0 - 58.1	.	2.5	(NEP)
	17	130807	37.50 - 56.05	.	3.8	(NEP)
	18	141517	37.8 - 55.9	.	3.2	(NEP)
		154028	38.0 - 55.5	.	2.6	(NEP)
		212223	37.4 - 56.0	.	2.6	(NEP)
	19	115536	37.5 - 56.0	.	3.2	(NEP)
	22	122134	37.4 - 56.0	.	2.6	(NEP)
	23	204527	36.5 - 56.9	.	3.0	(NEP)
	25	113340	38.0 - 58.1	.	2.5	(NEP)
	26	112900	38.0 - 58.1	.	2.5	(NEP)
		211800	38.3 - 55.4	.	2.6	(NEP)
	27	235945	39.6 - 51.0	.	2.6	(NEP)
	28	072819	39.3 - 44.2	.	4.0	(PAP)
	29	001058	37.8 - 55.9	.	3.2	(NEP)
	30	171034	37.1 - 44.3	.	84-	(IC, UR)
		172049	37.8 - 57.0	.	2.5	(NEP)

Aug.	23	162433	37.6 - 56.0	.	3.2	.	(NEP)
		163132	37.6 - 56.0	.	2.6	.	(NEP)
		172057	37.90 - 55.68	4.5	4.3	33	(IC, UR, NEP, TAB)
	24	052448	37.60 - 55.90	.	3.2	.	(NEP)
		130935	37.60 - 55.80	4.5	4.0	33	(IC, UR, NEP, TAB)
		232559	37.8 - 55.3	.	2.6	.	(NEP)
	25	052705	37.8 - 55.3	.	2.6	.	(NEP)
	26	175519	37.5 - 56.0	.	3.2	.	(NEP)
	28	165920	38.0 - 58.1	.	2.5	.	(NEP)
	30	123136	30.95 - 57.12	.	4.5	62	(IC, UR)
		161731	37.65 - 56.10	5.0	4.7	33	(IC, US, UR, NEP, TAB)
	31	102405	37.4 - 56.0	.	2.6	.	(NEP)
Sep.	2	221605	37.5 - 55.9	.	2.6	.	(NEP)
	3	223809	39.97 - 53.60	4.4	3.9	36	(IC, US, NEP)
	5	011450	37.5 - 55.5	.	2.6	.	(NEP)
		072553	37.7 - 56.5	.	2.5	.	(NEP)
	8	124513	28.57 - 58.85	4.7	.	80	(IC, US, UR)
	10	191124	37.7 - 55.9	.	3.2	.	(NEP)
		201408	37.4 - 56.0	.	3.9	.	(NEP)
		213124	37.30 - 55.95	.	2.6	.	(NEP)

Aug.	8	23	-	-	-	-	-	-	Strongly felt at Ferdows & vicinity. (et/
	120919	38.0	-	57.5	.	2.6		(NEP)	
	9	02	-	-	.	.		Series of shocks at Rivand & vicinity, ca panic (et/17 and 19 Mcr.)	
	161351	38.0	-	58.1	.	2.5		(NEP)	
	213536	37.6	-	55.9	.	3.9		(NEP)	
10	113043	38.0	-	58.1	.	2.5		(NEP)	
	191717	37.4	-	56.7	.	2.6		(NEP)	
12	094904	37.6	-	56.0	.	4.3		(NEP)	
13	185702	37.4	-	56.0	.	2.6		(NEP)	
14	033843	37.0	-	56.9	.	3.2		(NEP)	
16	200123	38.8	-	44.0	.	3.7		(PAP)	
	234114	38.8	-	44.0	.	3.2		(PAP)	
17	063555	38.0	-	58.1	.	2.5		(NEP)	
19	021451	37.9	-	58.4	.	2.5		(NEP)	
20	113117	38.0	-	58.1	.	2.5		(NEP)	
	152953	29.39	-	51.59	4.8	5.0	28	(IC, US, UR, BC)	
	195345	37.8	-	55.8	.	4.1		(NEP)	
23	010107	37.9	-	55.9	.	3.2		(NEP)	
	122849	38.8	-	55.1	.	3.0		(NEP)	

Aug.	2	171327	37.8	-	55.9	.	3.2	(NEP)
	3	024608	37.7	-	55.9	.	3.0	(NEP)
		030820	37.4	-	56.0	.	3.2	(NEP)
		042120	36.8	-	54.9	.	3.2	(NEP)
		153353	37.55	-	56.00	.	2.6	(NEP)
	4	055936	37.7	-	56.3	.	2.5	(NEP)
		080827	37.7	-	55.9	.	2.6	(NEP)
	5	014137	37.7	-	55.3	.	2.6	(NEP)
		083924	37.6	-	55.8	.	2.6	(NEP)
		110928	38.6	-	44.8	.	2.6	(PAP)
		111307	37.6	-	55.6	.	2.6	(NEP)
	6	134226	37.1	-	56.1	.	2.6	(NEP)
	7	000326	36.2	-	57.4	.	3.2	(NEP)
		011911	37.6	-	56.0	.	3.7	(NEP)
		013955	37.8	-	56.0	.	3.0	(NEP)
		195505	38.0	-	56.0	.	2.6	(NEP)
	8	101931	38.3	-	57.80	.	4.3	(IC,UR,NEP,TAB)

At Outran, about 7 km from Shahrabad series of shocks causing panic. (et/17 Mor.).

Strongly felt at Rivand (Marivan 36.22 - 57.37) and in the villages of Bahramabad, Tazehabad, Ghalehji, Ghalehkan, Qerkis, Sarvabad, Ahmadabad, Dowrud Razab, and Khanaghah without damage. (NEP, et/19 Mor., pr/20 Mor.).

the mechanism of the event being thrust with a strike of about 100° E.

The earthquake was followed by a relatively small number of aftershocks of low magnitude which, however, lasted for over one year.

There were no properly built houses other than adobe or mud-wall houses. A small number of modern steel and reinforced concrete engineering constructions, located within the epicentral area, suffered almost no damage.

(IC, US, UR, EC, NEP, SHL, MAS, TAB, RLS, Sobou Ayatollah 1970, Ambraseys 1970a,b).

Jul.	30	020202	37.71 - 55.94	4.8	4.3	33	(IC, US, UR, NEP)
		023511	37.52 - 55.87	4.8	4.3	33	(IC, US, UR, TAB)
		132609	37.80 - 55.86	4.3	4.5	33	(IC, US, UR, NEP, TAB)
Aug.	1	114038	37.98 - 55.84	4.9	4.3	33	(IC, US, UR, NEP, TAB)
		142343	37.40 - 55.95	.	2.6		(NEP)
		144412	37.6 - 55.9	.	2.5		(NEP)
		150434	37.5 - 56.3	.	3.2		(NEP)
		181752	37.5 - 56.0	.	2.6		(NEP)
	2	030455	38.0 - 58.1	.	2.5		(NEP)
		051153	37.9 - 58.4	.	2.5		(NEP)
		134341	37.6 - 55.7	.	2.5		(NEP)
		160830	37.9 - 56.0	.	2.6		(NEP)

(NEP)

38.0 - 58.1

2.5

Jul. 29 231810

300

VIII

22

6.7

5.7

37.85 - 55.94

30 005220

Destructive earthquake in eastern Sahra-i Turkman, a rather isolated and thinly populated area south of the river Atrak in northeastern Iran. The shock affected an area of about 7000 square kilometres with a population density of two per square kilometre. The earthquake killed about 200 and injured more than 450 people, destroying 2000 houses in 40 villages.

The largest settlements in the area affected are those of Karnaveh Olia and Sofla, Agheman, Chenaran, Gholidak Shahrak and Yemlak (VII+). A number of smaller settlements such as Baba Shamalak and Meydanjik, situated in the middle of a barren region suffered greater damage (VIII). The villages of Aghtugheh, Arab Ghareh, Altegach, Balkur (Bali Ghayeh), Bishak Tepe, Bog Kojeh, Chatal, Dali, Cheshmeh Ali, Dashliolom, Ghushesh-su, Kapan, Karangi Jangal, Kechik, Pol Cheshmeh, Sharik and Yalchekli were heavily damaged with loss of life (VII).

No known ground deformations of tectonic origin were associated with the earthquake. As a result of the shock many small areas in loess and terraces were intensely fractured and in places large-scale slumping took place particularly near Kechik, Agheman, Golidagh, Kalak Kessen, Dali and Dashliolom.

The shock was strongly felt at Gonbad-e Qabus, Gorgan, Jajarm, Keykod, Kizyl Atrak and Kizyl Arvat. The radius of perceptibility exceeded 300 kilometres, felt at Sari, Semnan, Mashhad and Kazandzhik in the USSR, Figure 8.

Maximum damage was concentrated south-west of the instrumental epicentre and of the alignment of the major aftershocks ($M \geq 4.0$). The seismic moment of the event $M_0 = 1.2 \times 10^{26}$ dyn.cm was calculated by North (1973),

Damaging, widely felt shock at the south-west of the Caspian Sea. At Kopurchal most of the walls of the houses were cracked and the walls of two buildings fell down (VI+). At Bandar Pahlavi a few houses were damaged and the electricity was briefly cut off (VI-). At Rezvandeh, Lahijan, Parchezar, Tavalesn and Langerud several walls fell down and the glass in doors and windows was broken (V). The shock was equally strong at Kiv where it caused great panic (V). In Astara walls and ceilings of several old houses were split; sleepers were weakened in Ardabil and its surroundings, at Mir, Shiran and Mianeh (I). The shock was felt at Abhar, Qazvin, Mianeh Sarab, and Ahar (III). In Tehran the earthquake was felt by few people. The shock was very violent in the Pir Bast Lolaman area, Figure 7.

(IC, US, UR, BC, TAB, et/21-24 Tir, ke/23 Tir, pr/23-26 Tir).

(US, IC)
 (NEP)
 (IC, US)
 (NEP)
 Strongly felt at Lar and vicinity, particularly in the new town of Lar; no damage (et/5 M)
 In Sabzavar the shock caused some panic but damage. It was the second shock to occur in the area in the last three days and the first in their homes.
 (NEP, et/4 Mor).

Jul. 11 224113 37.57 - 49.07 5.2 4.8 47 VI+ 200

12	011614	30.37 - 51.74	.	.	43
13	113311	38.0 - 58.1	.	2.5	
21	103924	29.46 - 52.02	4.6	.	97
24	211051	38.0 - 58.1	.	2.5	
25	1830	-	.	.	
	063421	36.3 - 57.7	.	3.7	

June 26

The earthquake was felt at Marand and Khoy.
(IC,PAP,TAB,et/6 Tir).

6

27 075758 35.12 - 50.80 4.8 4.3 52 VI 100

Damaging earthquake southwest of Tehran. Ashrafabad suffered considerable damage and the qanat (water conduit) collapsed cutting off the water supply. At Zaviyeh, Parandak, Mamuniyyeh, Zarand and Hasanabad some walls cracked, more in Zaviyeh where almost all walls and ceilings were cracked, (VI). At Shahriyar there was no damage, although the municipal offices and the Post and Telegraph buildings were badly cracked (V-). The shock was strongly felt at Saveh, Mowbaren, Charqabad, Varamin, Qum, Shahr Rey and Tehran (III+), where it caused panic. At Qum a few walls cracked, and in Tehran water slopping out of a pool was reported. The shock was not felt in northern Tehran, in Semiran, at Karaj and Aveh. Aftershocks for 24 hours, Figure 6.
(IC,US,UR,EC,TAB,KERM,et/6-8 Tir, ke/6-9 Tir, pr/10-12 Tir, RLS).

28 100142 36.2 - 56.0 . 3.2 (NEP)

29 023941 37.8 - 57.3 . 2.5 (NEP)

30 153534 31.5 - 53.6 4.0 . 49 (IC,US)

Jul. 2 035545 39.2 - 44.5 . 2.6 (PAP)

4 233813 26.70 - 54.78 4.4 . 38 (IC,HF)

6 - - - - Slight shock was felt at Taft for 2 seconds (et/16 Tir).

7 004748 39.2 - 44.5 . 2.6 (PAP)

Apr.	20	195143	37.80 - 55.53	.	3.2	(NEP)	
	21	145142	38.7 - 41.5	.	4.0	(PAP)	
	25	124657	32.5 - 56.8	.	.	(IA)	
	26	1153	-	.	.		A strong earthquake was felt at Marand without damage. (TAB, et/8 Ord).
	27		-	.	.		Two shocks felt in Ferdows without damage (et/8 Ord).
May	7	061916	30.6 - 53.7	.	.	(IA)	
	8		-	.	.		Series of earthquakes in the region of Taftan caused damage, particularly in a village of Sangen (28.6 - 61.4) (et/20 Ord).
	9	055221	37.2 - 54.7	.	3.2		Strongly felt northeast of Gorgan, located Aliabad, Kurdabad, Amalak and Shirinabad (36.88 - 54.95) with an intensity IV+ (NPE, et/ Ord).
	11	031221	28.61 - 52.31	5.1	4.4	(IC, US, UR, BC, QUE)	
	12	235912	27.27 - 57.21	4.7	4.4	(IC, UR)	
	13	180747	38.5 - 56.7	.	2.5	(NEP)	
	15	000211	28.5 - 56.4	.	.	(HF)	
		000422	39.7 - 48.9	.	.	(HF)	
June	24	0115					At 0445 series of shocks caused panic Meshginshahr (38.4 - 47.6); no damage (et/4 Tir).
	26	015616	38.7 - 45.1	4.5	3.2		Damaging shock at Shahpur and vicinity a number of old houses collapsed and suffered some damage (VI).

Apr.	4	145943	36.7 - 58.8	.	3.7		(NEP)
		155000	36.6 - 58.8	.	3.2		(NEP)
		162521	36.6 - 58.8	.	3.2		{NEP}
		175652	36.94 - 55.26	.	4.3	33	(IC, UR, NEP)
	5	061617	36.7 - 57.3	.	3.2		(NEP)
		162649	36.50 - 58.55	.	3.8		(NEP)
	6	165221	36.6 - 55.5	.	3.2		(NEP)
	8	023056	36.9 - 55.5	.	2.6		(NEP)
	12	155126	37.0 - 56.6	.	2.6		(NEP)
	13	0200	-	.	.		
	15	183307	37.8 - 57.0	.	3.2		Felt in the region of Kalat-e Naderi (36.7 - 59.7) (MASD). (NEP)
		185206	37.8 - 57.0	.	2.6		(NEP)
	16	012651	38.82 - 48.70	4.9	4.0	66 V+ ⁺	Causing panic at Meshkinshahr. Strongly felt in the Garasu valley as well as at Ahar (V) and Lenkoran (V). (IC, US, UR, TAB, PAP)
	18	083212	38.0 - 58.1	.	2.5		(NEP)
	19	205228	38.8 - 48.5	.	3.2		Felt at Lenkoran (III) (PAP)
	20	122714	37.70 - 55.65	.	3.2		(NEP)
		155136	39.83 - 44.72	.	2.6		(PAP)
		161843	38.6 - 44.9	.	3.2		(PAP)

Apr. 2	084414	36.3 - 57.1	.	2.6	.	.	.	.	.	.	.	.	.
	2	-	.	.	.	.	.	.	.	.	.	.	.
	3	113122	38.0 - 58.1	.	2.5	.	.	.	.	.	.	.	.
	3	205350	37.13 - 54.74	5.0	4.8	8	VI	130					
	4	105808	36.99 - 59.47	4.8	5.3	8	VI+	130					

Caused panic in Sabzavar and around; people kept in the open at nights. (NEP, et/15 Fary.)

Comparatively strong shocks at Mugab (et/15 Fary.)

(NEP)

A very strong earthquake in the lower Atrék. The earthquake caused panic at Aliabad, Aliabad Kurgan, Qaiehnjiq, Gomislan and at Karadetish in the USSR.

Minor damage was reported from this area.

The shock was felt strongly, with an intensity not exceeding V (MM) at Gorgan, Adzhiyab, Chalayuk, Shahman, Deleli, Gudriolum, Akaylen, Chatli and Uden. It was perceptible at Bander Gaz, Shairud, Gonbad-e Kabus, Babol, Sari, Behshahr, Gulugh, Meka, Kizyl Atrék, Gazan, Chlilshliyar, Karatepe Okarem and Prichal. It was not felt east of Gonbad and north of Chat and Madau, see Figure 4. (IC, US, UR, NEP, et/15 Fary. ke/Fary, pr/15-19).

A very strong earthquake on the Iran-USSR borders. It caused panic at Ghilgaz, Khivabad, Archinyak, Arabkaleh Giru and Kalat where a number of walls cracked. It caused also damage in the region between Kalat, Chenaran and Radkan. The shock was felt with an intensity IV at Manysh, Shemli, Artyk, Khojakale, Gazankale, Kaakhka, Dushak in the USSR, and in Iran at Radkan, Chenaran, Govaresk, Tus and in Mashhad where the big clock was set chiming, adding to the panic. The more distant places in which the earthquake was felt were Bezmeim, Akhlamad, Meana and Sangbast, see Figure 5. (IC, US, UR, MASH, NEP, et/15 Fary., RLS, pr/18 Fary.)

and Dogu-Bayazit in Turkey with an intensity IV- (MM).

(IC, US, UR, BC, RLS, et/23-29 Isf, ke/24-26Isf.S, pr/24-30 Isf).

Felt in Khoy more strongly than main shock, causing great panic (PAP, IA, et/24 Isf).

(PAP, et/25 Ist) Felt in Baclan region.

(PAP)

(PAP)

A strong shock was felt in M-sjid-e Sulaiman and the villages around it, causing water to slop in pools and all the doors and windows to rattle. (IC, US, et/24 Isf).

(NEP)

(IC, US, UR, QU)

(IC, US, UR, QU)

(NEP)

(NEP)

(NEP)

(NEP)

(NEP)

(IC, US, UR)

(NEP)

Mar.	14	020042	38.5 - 44.6	4.3	3.2				
		172302	38.7 - 44.7	.	2.6				
		172611	38.7 - 44.7	.	2.6				
		191854	38.6 - 44.8	.	2.6				
	15	151038	32.1 - 49.0	.	.	37			
	16	094220	36.70 - 57.75	.	3.2				
	17	231944	34.01 - 59.74	4.9	5.4	25			
	21	132316	27.89 - 54.55	4.7	4.5	52			
	26	002240	37.2 - 55.8	.	3.2				
		212954	38.0 - 58.1	.	2.5				
	28	024656	37.2 - 56.6	.	2.6				
		050310	37.30 - 56.62	.	2.6				
		073427	38.0 - 58.1	.	2.5				
Apr.	1	235406	27.98 - 56.69	5.1	4.9	65			
		180955	38.5 - 44.7	.	2.6				

Mar.	2	232031	38.0 - 58.1	.	2.5			(NEP)
	5	203700	37.0 - 54.7	.	2.6			(NEP)
	6	194007	28.25 - 57.43	4.6	.	71		(IC, US, UR, EC)
	10	220625	28.20 - 57.38	4.7	.	75		(IC, US)
	11	214432	36.4 - 57.5	.	3.2			(NEP)
	12	033148	39.4 - 45.9	.	2.6			(NEP)
	14	015148	38.62 - 44.80	5.3	5.2	50	VII	160

Destructive in the Dehestan of Firuraq. The village of Badalan was totally destroyed and 4 people were killed together with a number of beasts of burden. The villages Dizaj-e Pasak, Qeris, and Qashqa Bulagh were very heavily damaged with more than 60% of houses destroyed and animals killed. Although there were no fatalities, the villages of Batchi, Var, Dash, Pasak, Hesar, Shiran Ka and Sufi Kandi were ruined with 30 to 60% of the houses destroyed or damaged beyond repair. In Khoj, the walls of several houses and buildings, amongst them the Humayun Hotel, collapsed but there was no loss of life. Badalabad (Beddavar) near Khoj, suffered a minor damage. The villages of Kuchek and Pasak-e Sofla suffered some damage, mainly through the collapse of roofs, Figure 5.

The shock was strongly felt at Alamda Qorqor, Shahpur, Bostan, Qareh Diya ad-Dir causing panic and reportedly very minor damage. At Siyah Cheshmeh and Tasuj people were warned and in Julfa many were frightened. The shock was felt sharply at Bozorgan, Sofian-e Bor Maku, Poldasht, Zonuz and Marand. It was reported from Goris in the USSR where it was felt with an intensity V (MSK), and from J

Feb. 26 1508 - - - - - Felt in the Mazanderan (et/10 Isf).

153506 40.0 - 49.5 (PAP)

27 21 - - - - - V
Strong shock at Sahneh caused panic. The ground opened up in many places near the village and deep cracks were formed. (TAB et/10 Isf).

28 112639 28.2 - 61.5 (HF)

28
Destructive at Kuhneh Kharab where 5 houses were ruined; strongly felt throughout Laristan, particularly in the district of Aliabad (Iar). The shock was stronger at Kuhakh 'Ali and Maluyeh (?); it was followed by three strong aftershocks. (IC,US,UR,BC,QU, et/10 Isf)

1955848 27.81 - 56.33 5.5 5.2 41 VII
Seismic moment $M_0 = 3.4 \times 10^{24}$ dyn.cm, Thrust $82^\circ E$, dip 40° (NORTH).

Mar. 1 201242 34.05 - 58.95 5.0 5.0 15
Damaging at Soltan & Gonabad where a number of old and new houses cracked. The houses built after the destructive earthquake of 1968 at Kakhk, Ostad, Binataj, Dasht-e Bayaz and Gonabad were slightly damaged and window panes broken. Damage was most serious in Kherzri. The Northern Cooperative which groups the villages of Khezri, Miam & Feyzabad rebuilt after the 1968 earthquake, suffered some damage. Many of the 350 new housing units cracked at the corner where the reinforced concrete columns join the brick walls (TA). The shock was felt at Ghain, Ferdows, Torbat-e Heidarieh and Bijistan rather strongly. Aftershocks continued for five days. (IC,US,UR,IC,QU,KERM, et/11-15 Ist, ke/Isf pr/12-16, RLS).

Feb. 19	073219	38.0 - 58.1	.	2.5	(NEP)	
21	113817	38.0 - 58.1	.	2.5	(NEP)	
	200129	35.0 - 46.4	.	.		V ⁺
				51		
22	104518	32.55 - 48.61	.	.		27
23	11228	27.83 - 54.52	5.2	5.7		36 VII
25	150747	37.44 - 55.71	5.0	4.3		4 VII 150
	181728	37.1 - 55.8	.	3.6		
26	092130	38.0 - 58.1	.	4.5		.

Felt over a comparatively large area; at Oshnuiyeh it caused panic and a few houses in the town and surrounding villages were cracked; strongly felt at Paveh without damage. (IC, HF, et/5 Isf, RLS).

(IC, US)

Damaging shock at Kuhneh Aliabad and Debkuiyeh, without casualties. Strongly felt at Lar and Aliabad and with slight damage at Biriz and Bizeh. (IC, US, UR, SL, BC, KOR, et/10 Isf, ke/5 Isf).

Seismic moment $M_0 = 8.9 \times 10^{24}$ dyn.cm, Thrust $86^\circ N$, dip 40° (NORTH).

Damaging shock, without casualties at Hosseinabad-i Qabus and Dasht-i Shah. Slight damage, causing great panic at Shahpasand, Farsian, Minudasht. The shock was felt in Bojnurd, Gonbad. (IC, US, UR, BC, NEP, et/8-10 Isf) Figure 2.

Aftershocks felt at Hosseinabad and Dasht Shah causing additional damage, rendering shops and houses unfit for habitation. (NEP, et/9 Isf).

The area between Bujnurd and Gonbad-e Jab was shaken by an earthquake (NEP, et/10 I

Jan.	30	23545	39.68 - 54.16	.	3.5	65	IV	Felt at Nebitdagh (IV) (39.7 - 54.1) ⁺ (IC, US, NEP).
Feb.	2	052110	37.7 - 56.8	.	3.2	10	V+	Strongly felt at Shahpasand where it caused slight damage; followed by weak aftershocks (UR, NEP et/14 Bah).
	3	2400	-	.	.	.	.	A strong shock in Ferdows cracked the roof of several old houses. The earthquake also shook the region of <u>Sarayan</u> (et/16 Bah).
	5	09	-	.	.	.	.	Felt at Oshnuiyeh (V+) (TAB)
	6	193105	38.4 - 45.8	.	3.0	.	.	At Korkabad a newly built house collapsed; felt at Oshnuiyeh; followed by aftershocks. (PAP, et/18 Bah).
	10	121421	38.0 - 58.1	.	2.5	.	.	(NEP)
	11	080854	38.0 - 58.1	.	2.5	.	.	(NEP)
	13	20	-	.	.	.	.	Strongly felt in the district of Damavand (et/25 Bah).
	14	095020	33.5 - 48.5	4.7	.	.	.	(LA)
		100752	38.0 - 58.1	.	2.5	.	.	(NEP)
	17	025954	38.6 - 43.2	4.9	4.6	35	.	(US, PAP)
		161647	38.6 - 43.1	4.7	4.0	9	.	(US, PAP)
	18	134050	38.0 - 58.1	.	2.5	.	.	(NEP)

Jan. 15									Strongly felt at Shahrud where it caused panic; epicentre reported near Husainaba Kalpus (37.11 - 55.43) about 140 km from Shahrud (et/27 Dim).
17	224737	38.0 - 58.1	•	2.6					(NEP)
18	090243	37.8 - 56.0	•	2.6					(NEP)
19	171929	37.01 - 48.98	4.5	4.0	27				Felt slightly at Zanjam and vicinity, lasting 15 seconds. (IC,US,UR et/30 Dim).
	203200	25.30 - 61.34	4.4	•	33				(IC,US)
20	110018	30.43 - 51.36	4.8	•	73				(IC,US)
21	094642	37.0 - 56.0	•	2.5					(NEP)
22	22	-	•	•					Series of shocks felt at Ferdows and vicinity at 1.30 am. of the 23rd awakin people. (et/5 Bah).
26	05	-	•	•					Shocks widely felt in the region of Ferdows continuing since the 22nd; caused no damage (et/8 Bah).
27	140552	36.86 - 55.14	5.1	4.3	31	V+			Felt over a large area. At Shahrud it caused some panic; slight damage at Bastam & Shahpasand; followed by many aftershocks (IC,US,UR et/12 Bah).
30	041006	38.0 - 58.1	•	2.5					(NEP)
	075316	37.9 - 58.4	•	2.5					(NEP)
	15449	36.5 - 55.4	•	2.6					Felt in Shahrud & Bastam (UR, et/13 Bah)

<u>DATE</u>	<u>TIME</u> G M T	<u>EPICENTRE</u>	M_b	M_s	h	I_o	r_o	<u>MACROSEISMIC EFFECTS - NOTES</u>
Jan. 3	132006	32.71 - 48.93	4.5	.	65	VI ⁺	90 ⁺	Strongly felt in the region between Andimishk and Shahbazan; shock felt by train passengers on route near Shahbazan where railway station was damaged. (IC, US, et 14/Dim., TAB).
3	155754	39.1 - 44.8	.	3.2				(PAP)
3	163549	32.60 - 48.75	5.1	5.0	44	VI ⁺	10 ⁺	Strongly felt in Kuh-i Dasht-i Luristan, particularly at Shahbazan where it caused slight damage. The shock lasted several seconds and caused some concern at Andimishk. (IC, US, UR, EC, QU, TAB et/15 Dim).
7	182337	40.21 - 50.13	4.7	3.2	52			(IC, US, NEP).
9	092305	38.48 - 55.52	4.9	4.3	23	VI		Felt at Sharlouk III (IC, US, UR, NEP) (38.5 - 55.2) ⁺ , (h = 13) ⁺ .
11	115633	38.3 - 55.7	.	3.2				(NEP)
11	043717	38.0 - 58.1	.	2.5				(NEP)
13	180352	37.6 - 56.0	.	2.6				(NEP)
13	180700	37.3 - 56.1	.	2.6				(NEP)
13		-	.	.	.	.	.	Several shocks felt in Bushir without damage (et/24 Dim).
15	13	-	.	.	.	.	.	Strong shock at Baneh (35.9 - 45.9) lasting 3 seconds; it caused no damage (ke).

intensities differed by approximately one unit of intensity rating on an arbitrary scale. No isoseismals were drawn on these figures, as the problem of Intensity assessment in epicentral regions of Iranian earthquakes requires further study. The location of the epicenter and of its major aftershocks are shown by stars, for the latter case open.

In a catalogue like this, almost entirely composed from press reports of doubtful precision and from microseismic data estimated using different methods and instruments, many errors will doubtless be found. Also, with the great number of place names, although we followed the official Village Gazetteer of Iran, mistakes are unavoidable. We shall be most grateful, therefore, for any corrections, or notice of omissions, that could help eventually to produce an earthquake catalogue of Iran for this century that is as accurate and reliable as possible.

A re-location programme based on a joint epicenter determination using macroseismic data is already well advanced.

The purpose of this catalogue is thus to present in an orderly fashion both instrumental data and the related macroseismic information, which material, in combination with field evidence, permits a re-examination of focal estimates, delineation of seismic zones, establishment of recurrence relations and the assessment of seismic risk for engineering purposes.

Entries in this catalogue have been arranged to read as follows. The date and origin time of the event is given in hours, minutes and seconds (GMT). When no seconds or minutes are shown, the time refers to macroseismic information and the time at which the shock was felt locally (GMT). The focal location of the event estimated from instrumental results, i. e the geographical co-ordinates of the epicenter and focal depth in kilometers, is shown and the agency reporting this location is given first in the reference column. Other agencies reporting different focal estimates are also shown. In all cases, magnitude values are the average of those reported by different stations. In the case of k-TKSE magnitudes determined by the Soviet networks (PAF and NEP), these have been converted into M_g using the early conversion formula $k_{\text{TKSE}} = 1.8(M_g) + 4.3$ which in most cases grossly underestimates surface wave magnitudes. The radius of perceptibility r_0 in kilometers and the maximum intensity I_0 (MM), when known are also given. Asterisked entries indicate minimum values.

The location maps prepared for ten of the stronger earthquakes in 1970 show the relative intensity of the event at different localities. Referring to Figure 3, symbols(a) to (b) designate localities at which

As an outgrowth of the Joint Project in Engineering Seismology, initiated early in 1973 by the Technical Research & Standard Bureau of Plan and Budget Organization, the Arya-Mehr University in Tehran and the Engineering Seismology Section of Imperial College, London, the documentation of the seismicity of Iran has now reached the stage which allows the publication of some preliminary results on the distribution of earthquakes in Iran for this country.

This is the first issue of a bulletin to be published by the Technical Research & Standard Bureau of Plan and Budget Organization at irregular intervals which, hopefully, in a short period of time will cover the documentation of all seismic events found to have occurred during the present century. The principle emphasis of this presentation is on the engineering effects of earthquakes in Iran rather than on the purely seismological aspects of the events.

The much needed assessment of earthquake risk in Iran cannot be achieved by relying solely on the local or world-wide seismograph data available. The five first class seismic stations at present existing in Iran, Figure 1, are inadequate to locate with accuracy small to moderate local earthquakes which can be equally as damaging as larger shocks. The identification and assessment of macroseismic effects, therefore, both contributes to the information available and is invaluable, in combination with the instrumental data, in reducing bias in the determination of focal parameters, particularly of focal depth, for earlier events.

IRAN EARTHQUAKES 1970

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