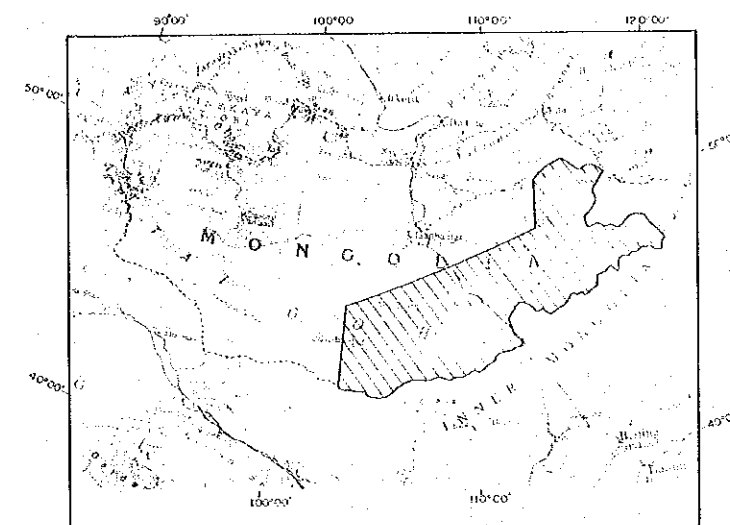


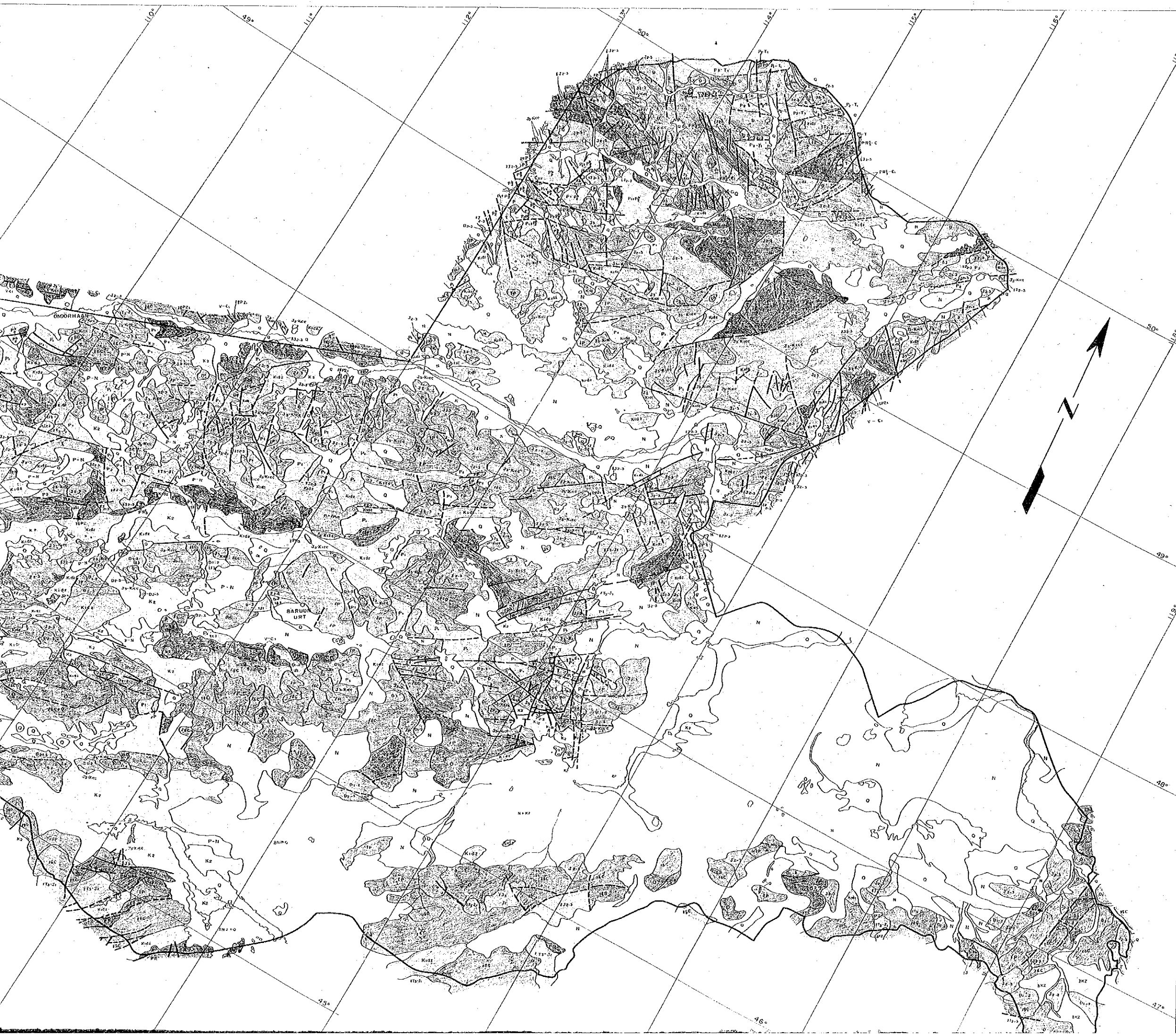
MINERAL EXPLORATION
IN
UUDAM - TAL AREA
THE MONGOLIAN PEOPLE'S REPUBLIC

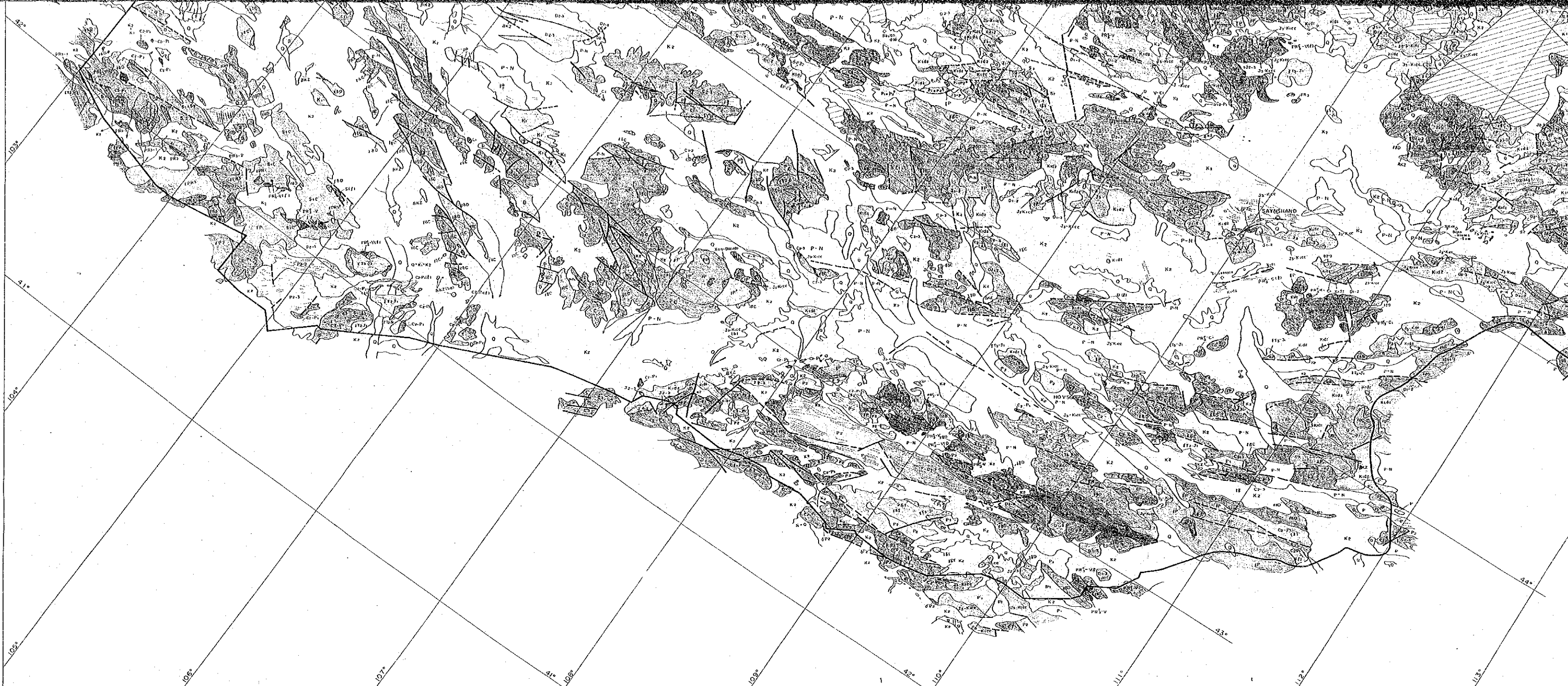
GEOLOGICAL INTERPRETATION MAP
OF LANDSAT IMAGERY



JAPAN INTERNATIONAL COOPERATION AGENCY
METAL MINING AGENCY OF JAPAN

JANUARY 1992





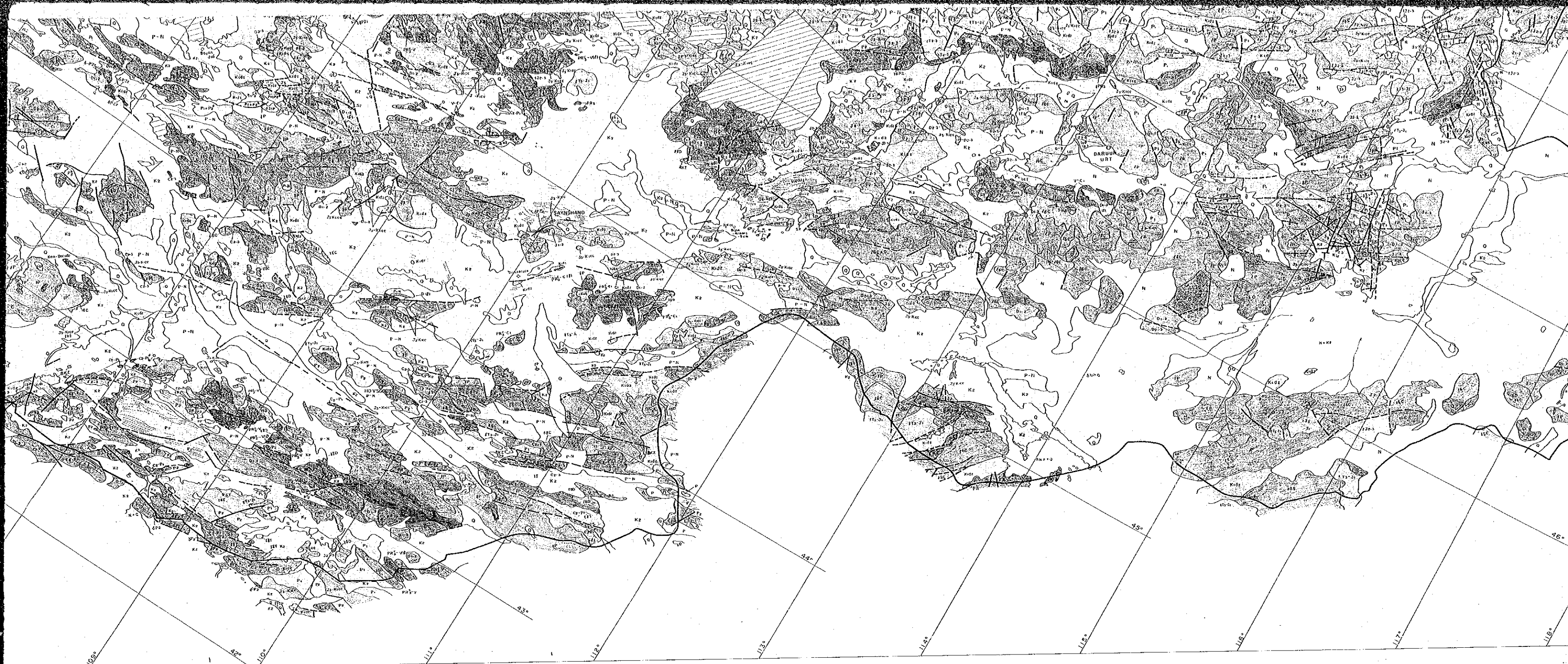
LEGEND

Erathem	System	Series or Subsystem	Rock Types	
Cenozoic	Quaternary	Q1	basaltic rocks	
		Q2	gravel, sand, loam, sandy loam, clay, mud, volcanic loam	
		Q3	basaltic rocks	
	Tertiary	Neogene	clay, sand, silt, gravel, conglomerate, marl, tuffs, limestone	
		Paleocene	clay, silt, sand, sandstone, conglomerate	
	Cretaceous	U. Cretaceous	K1	siltstone, argillite, clay, sandstone, conglomerate, sand
			K2	grey sandstone, clay, silt, conglomerate, clay shale, coal (trace)
		L. Cretaceous	K3	dark greenish grey clay, clay, silty, silty shale
			K4	greyish grey and light grey sandstone, clay, siltstone, conglomerate (trace), marl, basalt, andesite, rhyolite
		Mesozoic	Jurassic	conglomerate, sandstone, clay, tuffs, siltstone
M. U. Jurassic			rhyolite, tuff, basalt, andesite, tuffaceous conglomerate, tuffaceous sandstone	
Triassic		L. Triassic	sandstone, conglomerate, siltstone, clay shale, silty shale, coal, basalt, tuffs, rhyolite	
		U. Permian	andesite, basalt, rhyolite, tuff	
Permian		P	andesite, dacite, rhyolite, tuff, tuffaceous conglomerate, tuffaceous sandstone, sandstone, conglomerate, siltstone	
		U. Permian	andesite, dacite, basalt, tuff, tuffite, tuffaceous conglomerate, sandstone, siltstone, conglomerate	

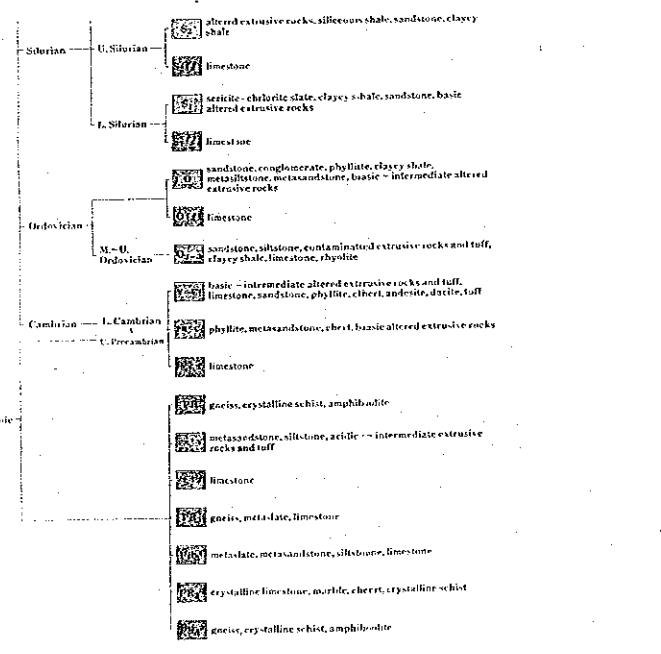
Erathem	System	Series or Subsystem	Rock Types
Paleozoic	Carboniferous	M. U. Carboniferous	sandstone, conglomerate, carbonaceous clay shale, coal, argillite, siltstone, andesite, dacite, tuff
		L. M. Carboniferous	sandstone, siltstone, argillite, conglomerate (trace), andesite, dacite, rhyolite, tuff
	Devonian	L. Devonian	sandstone, siltstone, conglomerate, limestone (trace), carbonaceous clay shale, coal, tuffite, jasper
		M. U. Devonian	sandstone, siltstone, argillite, conglomerate (trace), andesite, dacite, rhyolite, tuff
	Silurian	L. Silurian	rhyolite, andesite, tuff, sandstone, siltstone, conglomerate, limestone
		M. U. Silurian	andesite, dacite, rhyolite, tuff, sandstone, conglomerate, siltstone, clay shale, silty shale, jasper, altered extrusive rocks
	Cambrian	L. Cambrian	silty shale, argillite, tuff, andesite, dacite, rhyolite, tuff, tuffaceous conglomerate, sandstone, clay shale, siltstone, conglomerate
		M. U. Cambrian	silty shale, argillite, tuff, andesite, dacite, rhyolite, tuff, tuffaceous conglomerate, sandstone, clay shale, siltstone, conglomerate

Erathem	System	Series or Subsystem	Rock Types
Proterozoic	Silurian	U. Silurian	altered extrusive rocks, silty shale, sandstone, clay shale, limestone
		L. Silurian	sericite - chlorite slate, clay shale, sandstone, basic altered extrusive rocks
	Ordovician	M. U. Ordovician	sandstone, conglomerate, phyllite, clay shale, meta-siltstone, meta-sandstone, basic - intermediate altered extrusive rocks
		L. Ordovician	sandstone, siltstone, contaminated extrusive rocks and tuff, clay shale, limestone, rhyolite
	Cambrian	L. Cambrian	basic - intermediate altered extrusive rocks and tuff, limestone, sandstone, phyllite, altered andesite, dacite, tuff
		M. U. Cambrian	rhyolite, meta-sandstone, chert, basic altered extrusive rocks
	Pre-Cambrian	U. Pre-Cambrian	gneiss, crystalline schist, amphibolite
		M. U. Pre-Cambrian	meta-sandstone, siltstone, schist - intermediate extrusive rocks and tuff
	Proterozoic	L. Proterozoic	gneiss, meta-slate, limestone
		M. U. Proterozoic	meta-slate, meta-sandstone, siltstone, limestone
Proterozoic	L. Proterozoic	crystalline limestone, marble, chert, crystalline schist	
	M. U. Proterozoic	gneiss, crystalline schist, amphibolite	

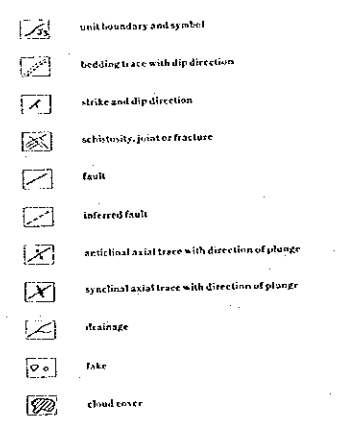
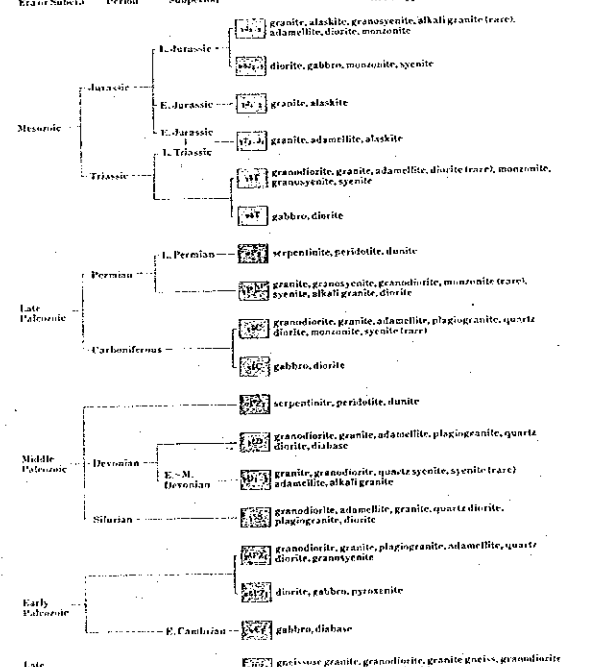
Erathem	System	Series or Subsystem	Rock Types
Intrusive Rocks	Mesozoic	Jurassic	granite, alkali, granosyenite, alkali granite (rare), adamellite, diorite, monzonite
		Triassic	granite, andesite, diorite, gabbro, monzonite, syenite
	Late Paleozoic	Permian	serpentine, peridotite, dunite
		Carboniferous	granulite, granosyenite, granodiorite, monzonite (rare), syenite, alkali granite, diorite
	Middle Paleozoic	Devonian	granodiorite, granite, adamellite, plagiogranite, quartz diorite, monzonite, syenite (rare)
		Silurian	gabbro, diorite
	Early Paleozoic	Devonian	serpentine, peridotite, dunite
		Silurian	granulite, granite, adamellite, plagiogranite, quartz diorite, diorite
	Early Paleozoic	Devonian	granite, granodiorite, quartz syenite, syenite (rare), adamellite, alkali granite
		Silurian	granodiorite, adamellite, granite, quartz diorite, plagiogranite, diorite
Early Paleozoic	Devonian	granodiorite, granite, plagiogranite, adamellite, quartz diorite, granosyenite	
	Silurian	diorite, gabbro, pyroxenite	
Early Paleozoic	Devonian	granulite, granite, plagiogranite, adamellite, quartz diorite, granosyenite	
	Silurian	gabbro, diorite	

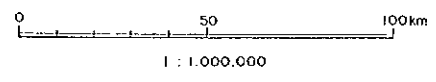













conglomerate, rhyolite, andesite, tuff
 sandstone, conglomerate, siltstone
 siltstone, sandstone, conglomerate
 siltstone, carbonaceous clayey shale, coal
 shale, dacite, tuff
 rhyolite, conglomerate (trace), andesite
 conglomerate, limestone (trace),
 shale, coal, tuffite, jasper
 clay shale, jasper, andesite, tuff
 marl, chert, siltstone shale
 limestone, clayey shale, conglomerate
 jasper, andesite, tuff
 sandstone, siltstone, conglomerate,
 shale, tuff, sandstone, conglomerate,
 siltstone shale, jasper, altered
 rocks
 siltstone, clayey shale, jasper,
 altered rocks

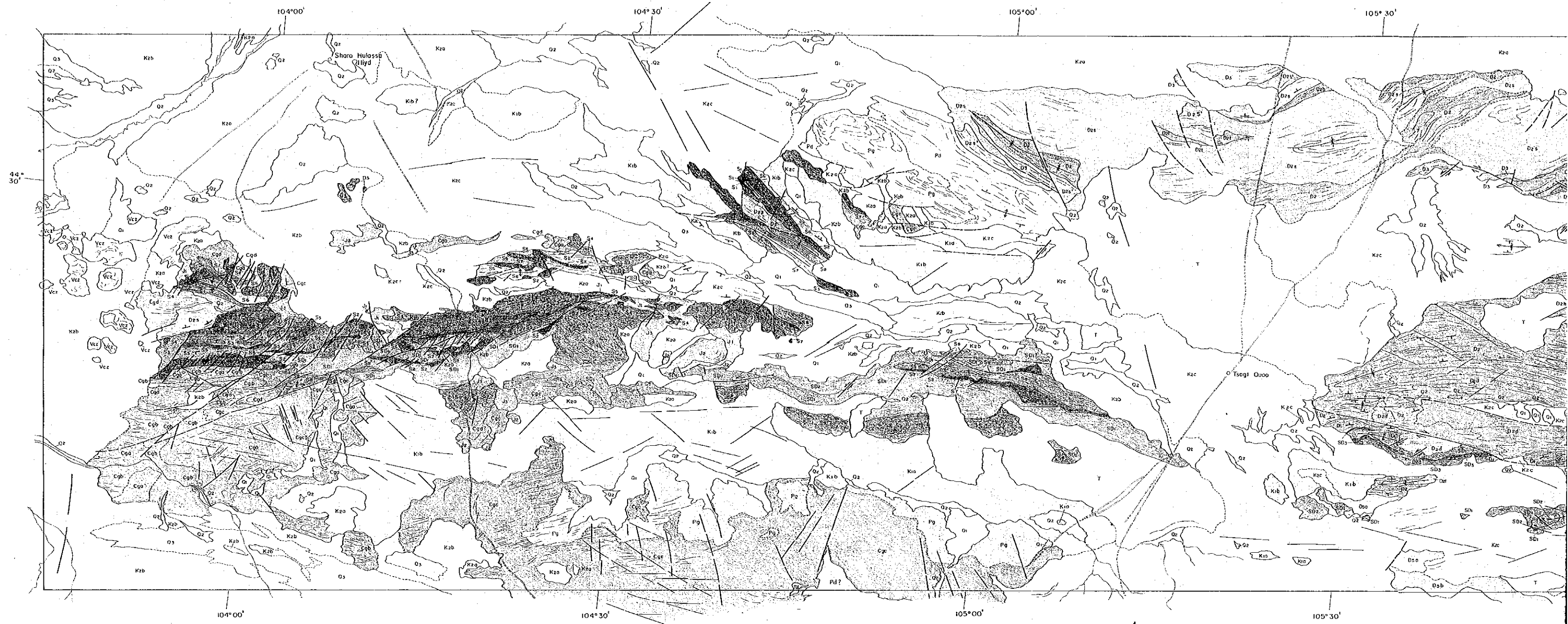


Intrusive Rocks

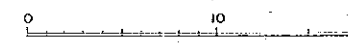




-  unit boundary and symbol
-  bedding trace with dip direction
-  strike and dip direction
-  schistosity, joint or fracture
-  fault
-  inferred fault
-  anticlinal axial trace with direction of plunge
-  synclinal axial trace with direction of plunge
-  drainage
-  lake
-  cloud cover



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LEGEND

Geologic age	Correlation	Typical rock type	Symbol	Symbol	Symbol
Quaternary	Q1	QH-IV sand	[Symbol]	[Symbol]	[Symbol]
	Q2	QH-III gravel, sand	[Symbol]	[Symbol]	[Symbol]
	Q3	QH-II gravel	[Symbol]	[Symbol]	[Symbol]
Tertiary	Vez	shale - andesite	[Symbol]	[Symbol]	[Symbol]
	T	P-N sand, silt, gravel	[Symbol]	[Symbol]	[Symbol]
Late Cretaceous	K20	sandstone, siltstone	[Symbol]	[Symbol]	[Symbol]
	K21	sandstone	[Symbol]	[Symbol]	[Symbol]
	K22	siltstone	[Symbol]	[Symbol]	[Symbol]
Early Cretaceous	K23	shale, siltstone	[Symbol]	[Symbol]	[Symbol]
	K24	limestone and basaltic tuff	[Symbol]	[Symbol]	[Symbol]
Jurassic	J1	andesite	[Symbol]	[Symbol]	[Symbol]
	J2	tuff	[Symbol]	[Symbol]	[Symbol]
Devonian	D1	granodiorite, diorite, gabbro	[Symbol]	[Symbol]	[Symbol]
	D2	granite, gran-diorite	[Symbol]	[Symbol]	[Symbol]
Carboniferous	C1	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	C2	shale, siltstone	[Symbol]	[Symbol]	[Symbol]
Sturlian	S1	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	S2	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D3	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D4	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D5	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D6	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D7	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D8	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D9	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D10	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D11	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D12	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D13	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D14	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D15	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D16	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D17	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D18	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D19	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D20	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D21	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D22	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D23	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D24	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D25	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D26	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D27	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D28	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D29	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D30	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D31	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D32	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D33	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D34	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D35	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D36	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D37	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D38	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D39	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D40	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D41	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D42	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D43	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D44	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D45	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D46	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D47	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D48	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D49	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D50	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D51	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D52	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D53	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D54	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D55	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D56	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D57	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D58	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D59	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D60	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D61	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D62	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D63	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D64	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D65	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D66	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D67	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D68	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D69	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D70	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D71	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D72	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D73	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D74	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D75	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D76	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D77	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D78	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D79	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D80	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D81	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D82	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D83	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D84	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D85	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D86	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D87	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D88	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D89	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D90	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D91	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D92	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D93	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D94	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D95	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D96	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D97	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D98	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
Devonian	D99	shale, sandstone	[Symbol]	[Symbol]	[Symbol]
	D100	shale, sandstone	[Symbol]	[Symbol]	[Symbol]

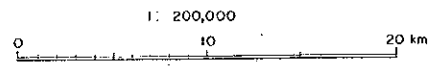
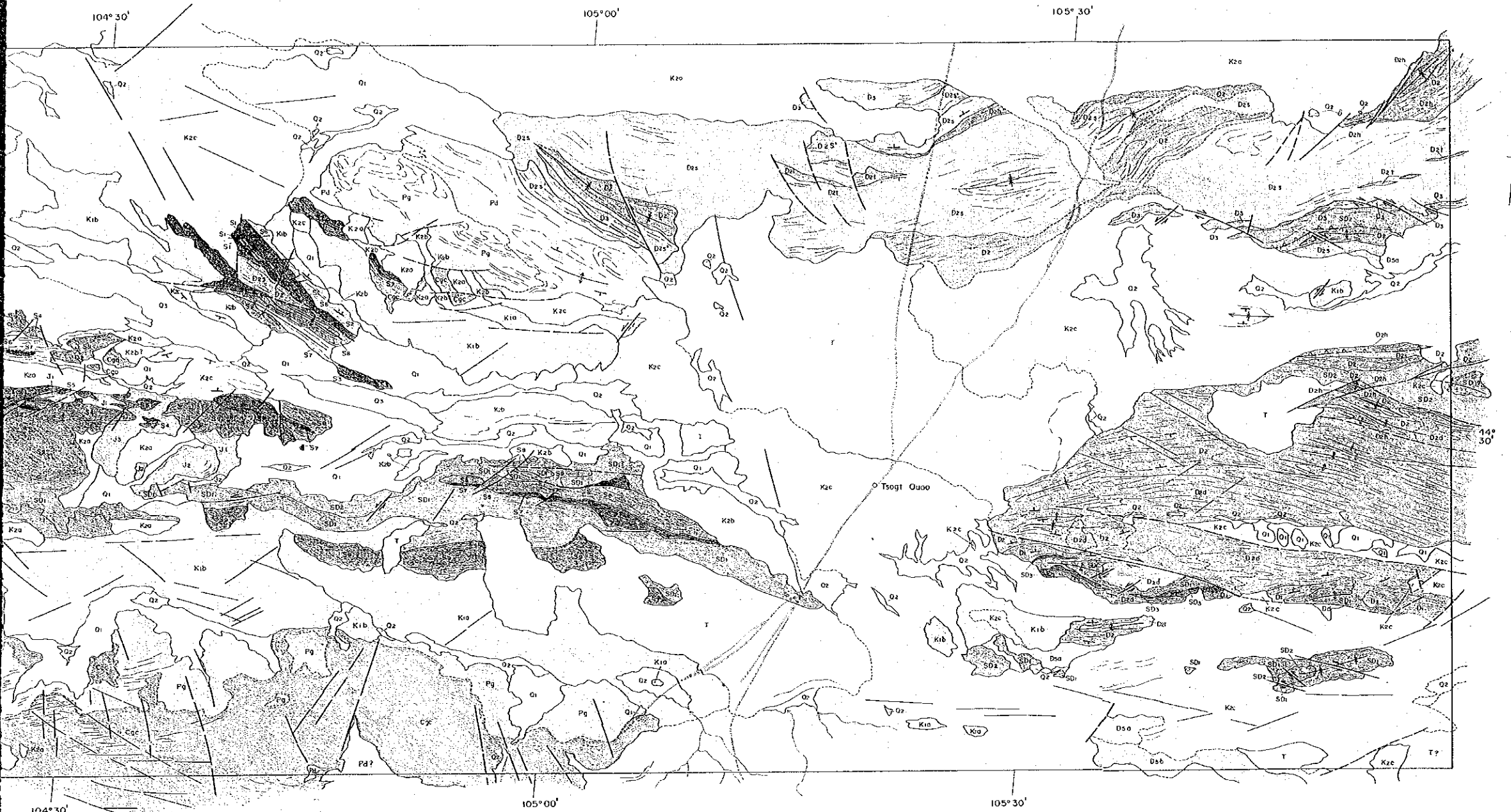
- [Symbol] basalt
- [Symbol] tuff, shale
- [Symbol] shale
- [Symbol] sandstone
- [Symbol] sandstone or limestone
- [Symbol] limestone
- [Symbol] shale, sandstone
- [Symbol] limestone
- [Symbol] shale, sandstone
- [Symbol] unit boundary
- [Symbol] conjectural unit boundary
- [Symbol] bedding trace or schistosity with dip direction
- [Symbol] strike and dip direction
- [Symbol] fault
- [Symbol] inferred fault
- [Symbol] lineament
- [Symbol] anticline
- [Symbol] syncline
- [Symbol] drainage
- [Symbol] road
- [Symbol] village

MINERAL EXPLORATION
IN
UUDAM-TAL AREA
THE MONGOLIAN PEOPLE'S REPUBLIC

GEOLOGICAL INTERPRETATION
OF LANDSAT IMAGERY
OF ULZIIT AREA

JAPAN INTERNATIONAL COOPERATION AGENCY
METAL MINING AGENCY OF JAPAN

JANUARY 1992



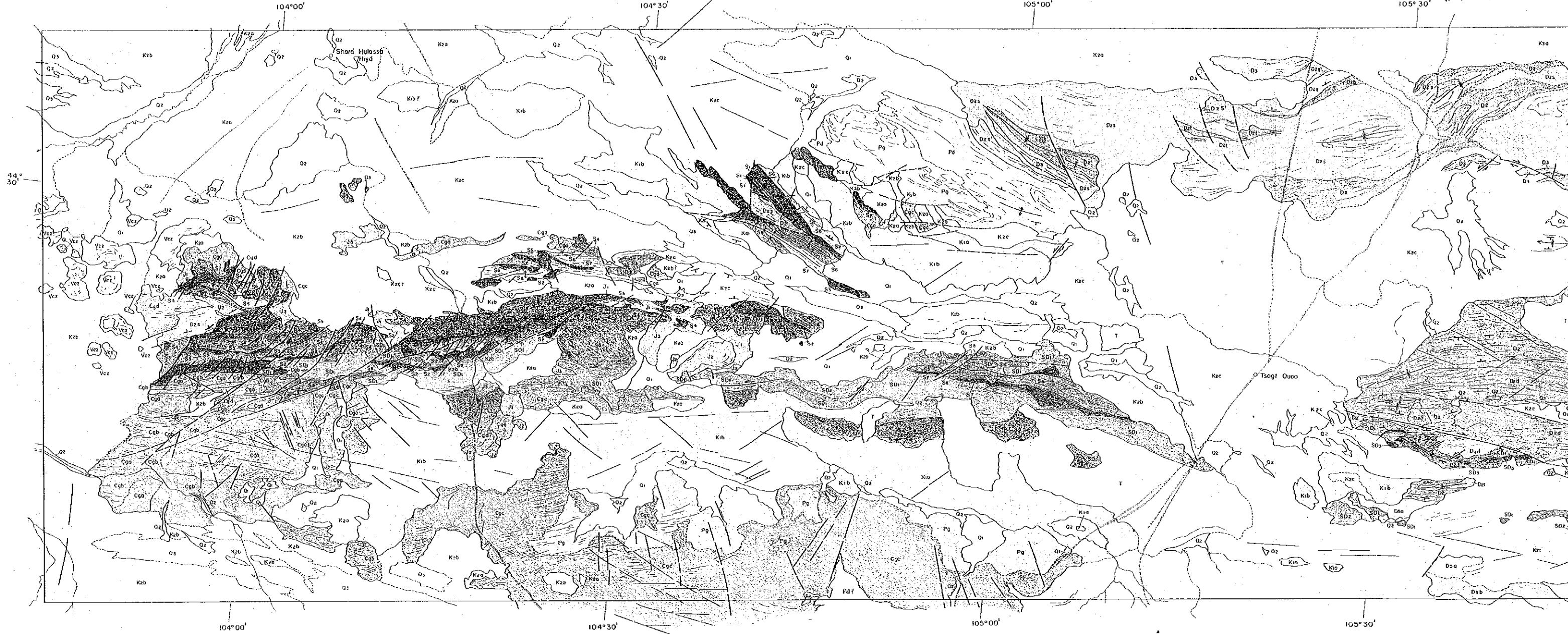
	tuff		basalt		lineament
	shale, sandstone		tuff or shale		anticline
	shale, sandstone		shale		syncline
	limestone		sandstone		drainage
	sandstone, shale		sandstone or limestone		road
	rhyolite		limestone		village
	shale		shale, sandstone		
	shale		limestone		
	sandstone		shale, sandstone		
	shale, sandstone		limestone		
	rhyolite - dacitic tuff		shale, sandstone		
	limestone				
	shale, slate				
	basalt, sandstone				

Situation

	unit boundary
	conjectural unit boundary
	bedding trace or schistosity with dip direction
	strike and dip direction
	fault
	inferred fault

Devonian
Silurian

H₁₋₅
H₁₋₂
S₁
S₂



1: 200,000
0 10

LEGEND

Geologic age	Correlation	Possible rock type	Symbol	Geologic age	Possible rock type	Symbol
Quaternary	Q ₁	QIII-IV	sand	Devonian	D ₁₋₃	shale, sandstone
	Q ₂	QIII-IV	gravel, sand		D ₁₋₂	shale
	Q ₃	QIII-III	gravel		D ₁₋₁	shale, sandstone
Tertiary	Ver	K	diarite - andesite	Saurian	S	basalt
	T	P-N	sand, silt, gravel		S	tuff or shale
Late Cretaceous	K _{1b}	K _{1b}	sandstone, siltstone	S	shale	
	K _{1a}	K _{1a}	sandstone	S	siltstone	
Early Cretaceous	K _{2b}	K _{2b}	siltstone	S	sandstone or limestone	
	K _{2a}	K _{2a}	siltstone	S	limestone	
Jurassic	J ₁	J ₁	shale, siltstone	S	shale, sandstone	
	J ₂	J ₂	basalt and basaltic tuff	S	limestone	
Permian	P	J ₂ , K _{2c}	andesite	S	shale, sandstone	
	P	P	tuff	S	limestone	
Carboniferous	C	P	granulite, felsite, syenite	S	shale, slate	
	C	C	granite, granulite	S	basalt, andesite	

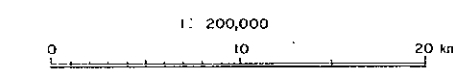
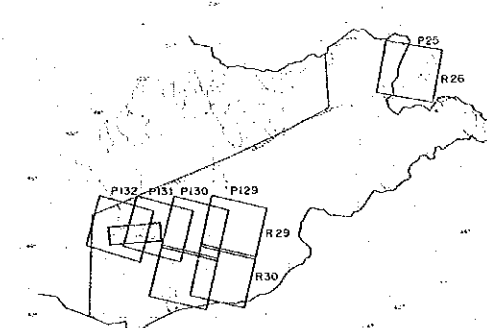
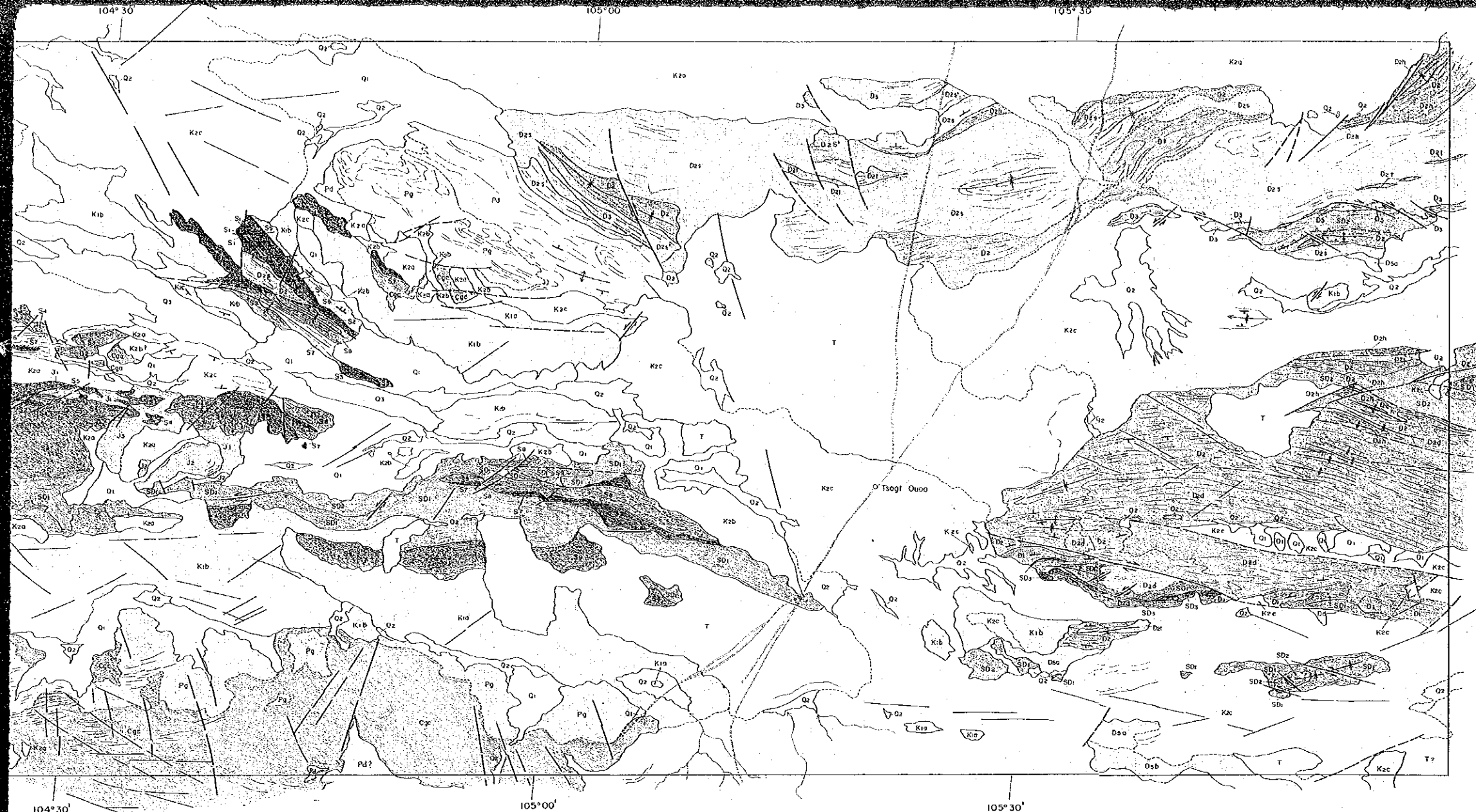
- unit boundary
- conjectural unit boundary
- bedding trace or schistosity with dip direction
- strike and dip direction
- fault
- inferred fault
- anticline
- syncline
- drainage
- road
- village

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JANUARY 1992



	tuff		basalt		lineament
	shale, sandstone		tuff-shale		anticline
	shale, sandstone		shale		syncline
	limestone		sandstone		drainage
	sandstone, shale		sandstone or limestone		road
	flysch		limestone		village
	shale		shale, sandstone		
	shale				
	sandstone		unit boundary		
	shale, sandstone		conjectural unit boundary		
	rhyolite - dacite tuff		leading trace or axis line with dip direction		
	limestone		strike and dip direction		
	shale, slate		fault		
	basalt, andrite		inferred fault		

