other is located about 35 km southeast of the above-mentioned circular structure, distributed in the Upper Cretaceous volcanic rocks (geological unit: Ksv). Diameter of the outer cliff is 3 km.

11) The Senguerr area

[Geological unit]

Rocks and sediments distributed in this area were classified into 21 geological units (Fig. II-2-33 and Table II-2-12). Six of them were comparable to the Jurassic to Tertiary sedimentary rocks, and another six to the Jurassic to Quaternary volcanic rocks. Four geological units can be compared to the unconsolidated or semi-consolidated sediments of the Quaternary. In addition, one geological unit is mainly comparable to the Paleozoic schist while three units are compared to the intrusive rocks generated in the Cretaceous. One unit was judged to be an alteration zone.

[Alteration zones]

In this area 12 alteration zones in total were extracted in the Jurassic to Cretaceous volcanic rocks (geological units: Jms, Kiv and Ksv) and the Cretaceous sedimentary rocks (geological unit: Kis2), both of which are distributed in the central zone (Fig. II-2-33 and Table II-2-25). On the assumption that a sporadic zone is regarded as one alteration zones and that plural zones located at a horizontal distance of 1 to 2 km among them are also regarded as one alteration zone, alteration zones on the whole can be divided into the following four zones. They can be summarized according to the relation among locations of distribution and geological units:

(1) Group of four alteration zones recognized in the Jurassic to Cretaceous volcanic rocks (geological unit: Jmv, Kiv and Ksv) distributed in the northeast

(2) Group of four alteration zones recognized in the Cretaceous volcanic rocks (geological unit: Kiv) distributed to the north of the Lago Fontana

(3) One alteration zone recognized in the Cretaceous volcanic rocks (geological unit: Kiv) distributed to the south of the Lago Fontana

(4) Group of three alteration zones recognized in the Cretaceous volcanic rocks (geological unit: Kiv) distributed to the east of the Lago Fontana

Morphology of individual alteration zone is generally ellipsoid or irregular amoebic. The largest one is an alteration zone to the south of the Lago Fontana whose longer axis is about 2 km. Alteration zones recognized in volcanic rocks distributed to the north of the Lago Fontana are all located inside or on the periphery of circular structures.

[Lineament]

A slight difference is generally seen in the distribution and direction of lineaments interpreted and extracted, among the eastern, central and western regions of this area.. The following characteristics of each region are observed (Fig. II-2-33):

(1) Eastern region

This region is roughly divided into two parts, that is the northeast mainly consisting of the Jurassic to Quaternary volcanic rocks, and the southeast consisting of Quaternary unconsolidated sediments and the Tertiary sedimentary rocks. Lineaments of four systems, that is N-S, NE-SW, NW-SE and WNW-ESE orientations, were extracted. Areas with high concentration are seen in places from the southwest to northwest of this region. In each place, lineaments of the four systems are complicatedly entangled. The longest lineament is in the NE-SW direction and extends over 10 km.

In the southeast region, two lineaments were extracted that develop in the NW-SE direction in parallel to the Quaternary unconsolidated sediments. An area between these lineaments is covered by the Tertiary sedimentary rocks (geological unit: Tss). Because both sides of this area is bounded by lineaments, a distribution range of the Tertiary sedimentary rocks shows a morphology similar to the graben structure. Lineaments were not extracted in other areas.

(2) Central region

The geology of this region is mainly composed of the Jurassic volcanic and sedimentary rocks in the north and south, and the Cretaceous volcanic and sedimentary rocks in the central. Lineaments of five systems, that is WNW-ESE, E-W, NE-SW, NW-SE and N-S, are complicatedly entangled. Lineaments are highly concentrated in areas from the central to northern side where the Jurassic and Cretaceous volcanic rocks occur, and in areas in the south where the Jurassic sedimentary rocks occur. In the former area, lineaments of systems, that is WNW-ESE and E-W are dominant. In the latter area, lineaments of two systems, that is NW-SE and N-S, are dominant. Extension of lineaments is generally 5 to 7 km, while the longest extension of some lineaments is more than 30 km. There are few lineaments around alteration zones.

(3) Western region

This region mainly consists of the Cretaceous granite, Jurassic volcanic rocks and Quaternary unconsolidated sediments. Lineaments of five systems, that is NW-SE, NNE-SSW, ENE-WSW, NE-SW and E-W, are complicatedly entangled. Lineaments are highly concentrated in areas where the Cretaceous granitic rocks occur. Lineaments of two systems, that is NE-SW and ENE-WSW, are dominant there. In the Cretaceous granitic rocks distributed in the south, there is development of two lineaments in parallel to the NW-SE

Table Ⅱ-2-12 Characteristics of photogeologic units of the Senguerr area

Unit	Photo-Characteristics		Mophologic Expression					Superficial Cover		Probable lithology
	Tone	Texture	Drainage		Rock	Section	Bedding	Vegetation	Cultivation	(Correlation with available Geologic Map)
			Pattern	Density	Resistance					
Qa	gray, purplish red, green	very fine	meandering	very low	very low		none	partly dense	partly intense	Unconsolidated sediments composed of gravel, sand, silt and clay (Holocene : Recent alluvial deposits)
Qt	gray	very fine	meandering	very low	very low		none	none	partly	Unconsolidated sediments composed of gravel, sand, silt and clay (Holocene : Recent talus deposits)
Qis2	light gray	medium	sub-parallel	low	low		none	none	none	Glacial deposits (Pleistocene : Gracial deposits)
Qis1	purplish	fine	sub-parallel	low	low		very gentle	rare	none	Unconsolidated sediments composed of gravel, sand, silt and clay (Pleistocene : Fluvial, talus deposits)
Qivb	reddish brown	rough	radial	medium	low		none	none	none	Basic volcanic rocks (Pleistocene : Basalt, pyroclastic rocks)
Tss	brown	fine	sub-parallel	low	low		rare	none	none	Continental sedimentary rocks (Miocene : Collon Cura Formation)
Tmv	brown	coarse	sub-dendritic	medium	medium		massive	partly	partly	Mainly pyroclastic rocks (Miocene :Pyroclastic rocks, basalt, andesite)
Tiv	dark brown	coarse	sub-dendritic	medium	medium-high		massive	dense	partly	Andesitic volcanic rocks(Eocene : Andesite, basalt and pyroclastic rocks)
Tis	brown	coarse	sub-dendritic	high	medium		partly	medium	partly	Coarse grained sedimentary rocks (Paleocene : Sandstone, conglomerate, mudstone, limestone and gypsum etc.)
Kss	gray	fine-medium	pinnate	medium	low-medium		bedded	partly	none	Fine to medium grained sedimentary rocks (Upper Cretaceous : Sandstone, mudstone, conglomerate)
Ksv	brown	medium	sub-dendritic	medium-high	medium-high		none	partly	none	Basic volcanic rocks (Upper Cretaceous : Tres Picos, Prieto Formations)
Kis2	brown	fine-medium	sub-parallel	medium-high	medium-high		well bedded	partly	none	Cretaceous : Sandstone, mudstone, gypsum, limestone etc.)
Kis1	brown	medium	sub-parallel	medium-high	medium-high		well bedded	partly	none	Cretaceous : Lutite, limestone, fanglomerate, mudstone, sandstone)
Kiv	dark gray	coarse	sub-dendritic	high	high		rare	partly	none	Volcanic rocks (Upper Cretaceous : Intermediate volcanic rocks (Devisadero Formatin etc.)
Jss	brown	fine-medium	sub-parallel	medium-high	medium-high		well bedded	partly	none	Medium grained sedimentary rocks (Upper Jurassic : Conglomerate, sandstone, shale, limestone, gypsum)
Jis	brown	medium	sub-parallel	medium	medium		partly	partly	none	Sedimentary rocks (Lower Jurassic : Sandstone and dacitic to rhyolitic tuffs)
Jiv	brown	medium-coarse	sub-dendritic	medium	medium-high		rare	partly	none	Volcanic rocks (Lower Jurassic : Dacitie and andesite with mudstone, conglomerate)

Table Ⅱ-2-12 Characteristics of photogeologic units of the Senguerr area

Unit	Photo-Characteristics		Mophologic Expression					Superficial Cover		Probable lithology
	Tone	Texture	Drainage		Rock	Section	Bedding	Vegetation	Cultivation	(Correlation with available Geologic Map)
			Pattern	Density	Resistance					
Ps	dark gray	rough	sub-dendritic	high	high		schistose	none	none	Schistose rocks (Paleozoic : Phyllite, schist, gneiss and migmatite)
αK	brown	coarse	sub-dendritic, rectangular	medium	high		massive	partly	none	Igneous rocks (Cretaceous-Tertiary : Plutonic rocks and hypabyssal rocks)
A	white,pinkish gray	fine	sub-dendritic	low	low		massive	none	none	Alteration zone(Hydrothermal alteration zone)

Senguerr

WRS231/91

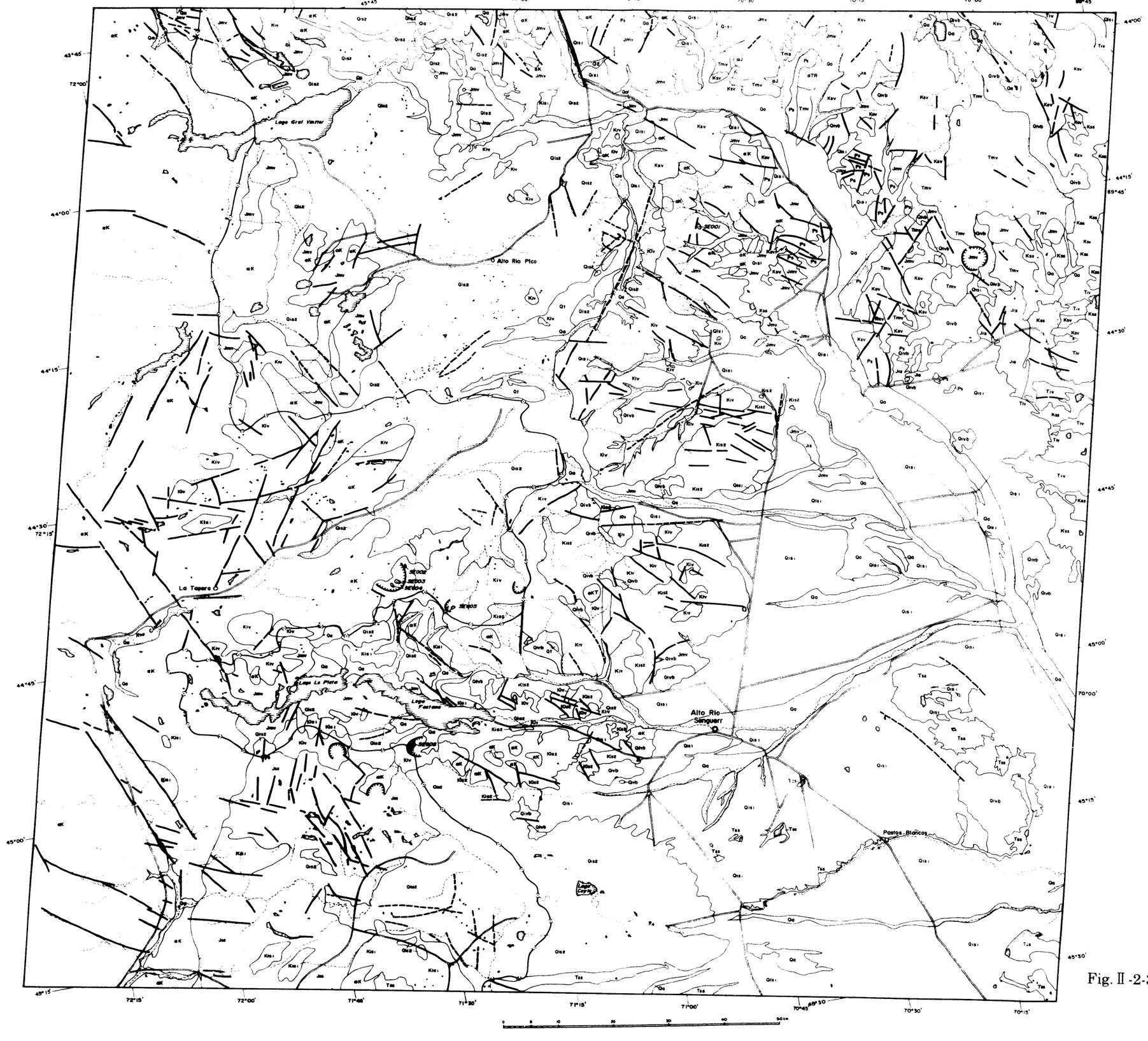


Fig. Ⅱ-2-33 The Senguerr area:
Photogeologic interpretation map

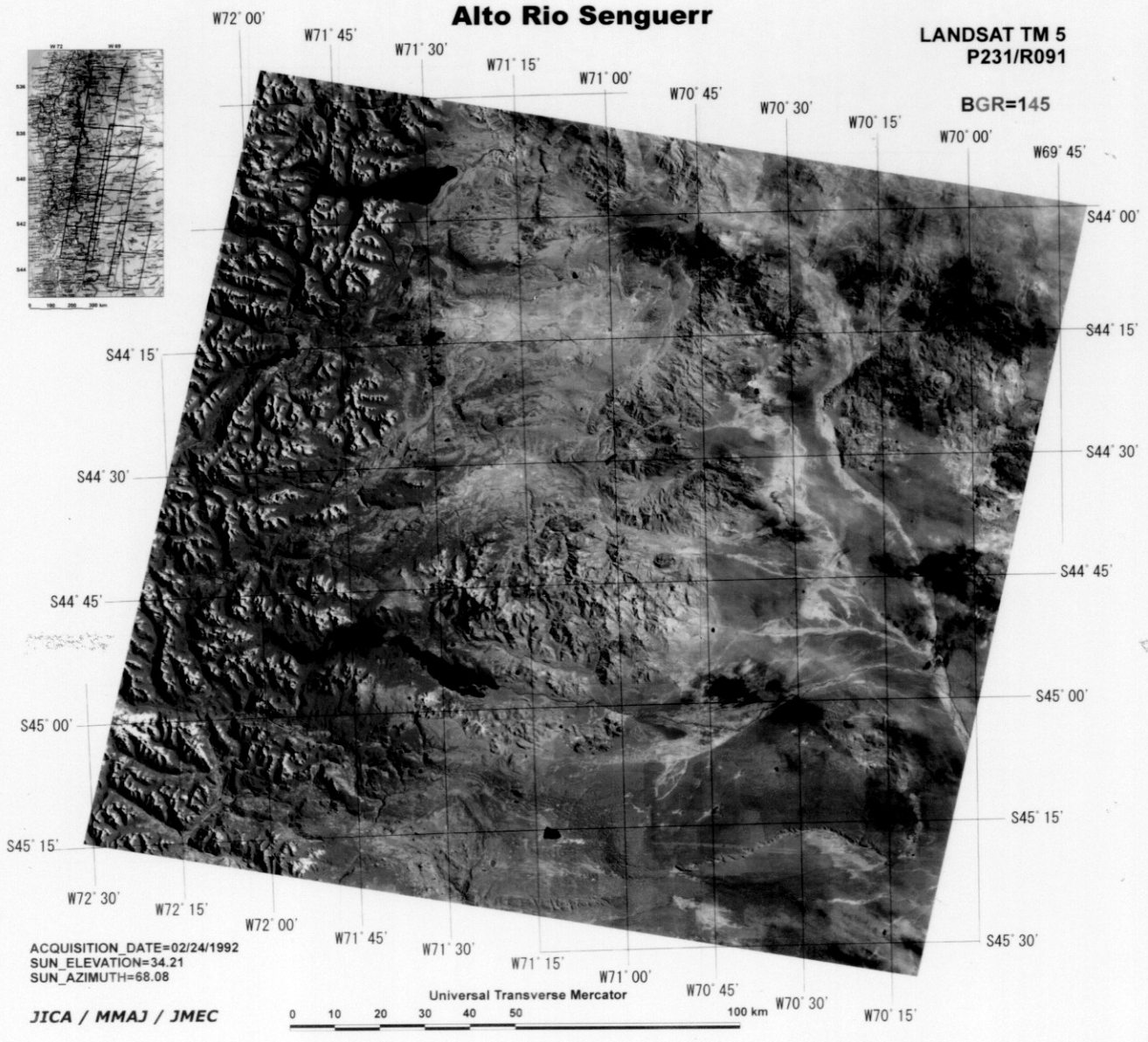


Fig. Ⅱ -2-34 The Senguerr area: Landsat TM false color image

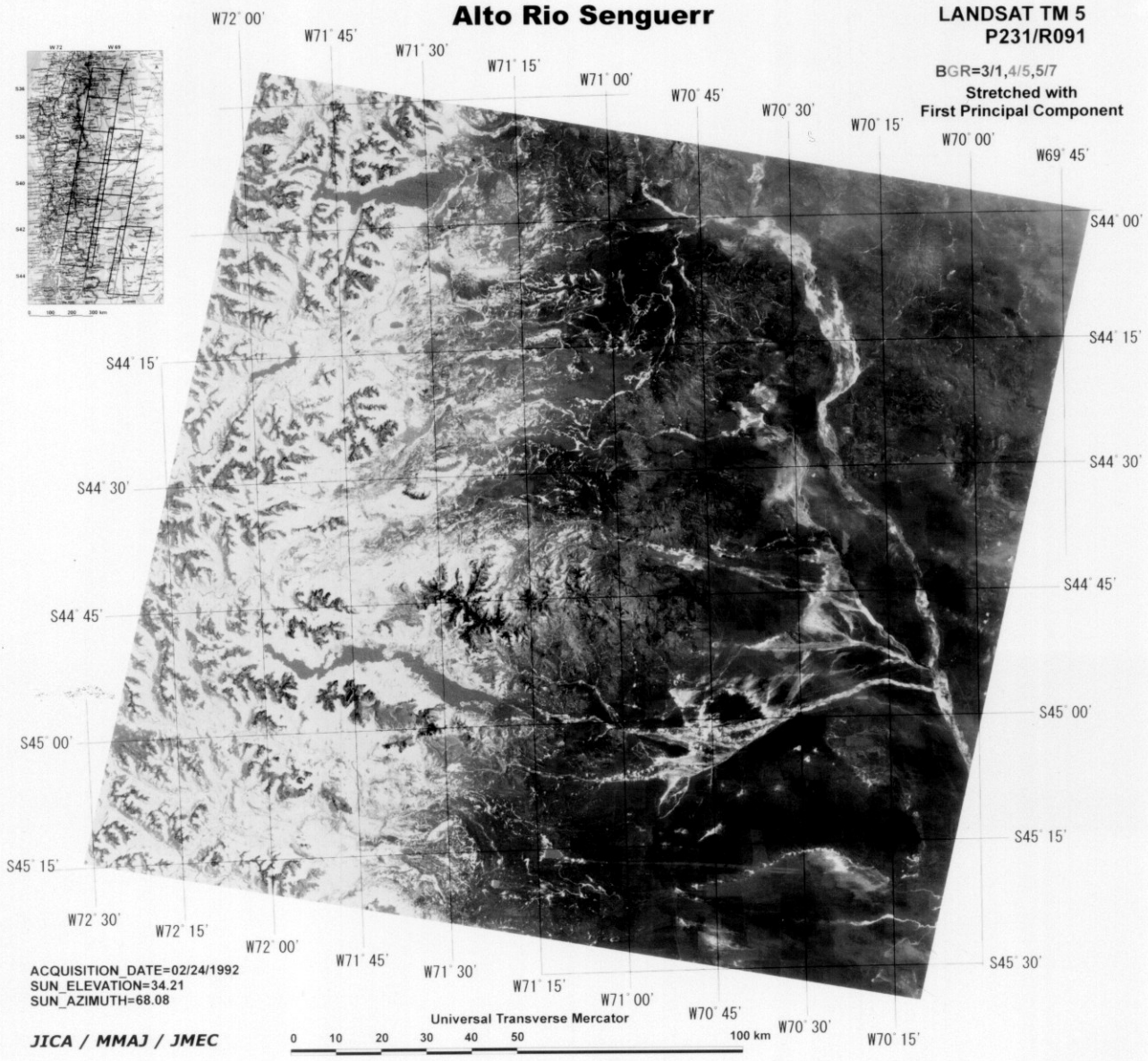


Fig. Ⅱ -2-35 The Senguerr area: Landsat TM ratio image

direction with extension of more than 20 km and two lineaments in the WNW-ESE direction with extension of more than 15 km. In the Cretaceous granite and the Jurassic to Cretaceous volcanic rocks in the north, five parallel NW-SE lineaments with spacing of about 5 km develop. Several lineaments in WNW-ESE direction are also seen. Concentration of lineaments is higher than in other granite distribution areas.

[Folding and circular structures]

(1) Folding structure

Main rocks of this area are volcanic and granite rocks. Sedimentary rocks are only distributed in part of the northeast and southwest areas. The Jurassic sedimentary rocks (geological unit: Jis) distributed in the northeast, a N-S trending anticlinal structure is recognized (Fig. II-2-33). Its east wing is unconformably covered by the Cretaceous sedimentary rocks, and the west wing is covered by the Quaternary volcanic rocks. No other folding structures are found in this area.

(2) Circular structure

Five circular structures were extracted in this area (Fig. II-2-33). The distribution and size of these circular structures are as follows:

(a) One circular structure recognized in the Jurassic volcanic rocks (geological unit: Jmv) distributed in the northeast: This circular structure is about 5 km in diameter and is of a subsidence type. No alteration zones are found around it.

(b) Three circular structures recognized in the Cretaceous volcanic rocks (geological unit: Kiv) distributed to the north of the Lago Fontana in the central: Size of these circular structures is about between 6 km and 2 km in diameter. All are of a subsidence type. Among them, alteration zones were extracted inside or on the periphery of two circular structures located on the western side. No alteration zones are found around the circular structures on the eastern side. All of these circular structures are semi-circular.

(c) Two circular structures recognized in the Cretaceous volcanic rocks (geological unit: Kiv) distributed in the south of the Lago Fontana in the south: Both of these circular structures are about 3 km in diameter, and are of a subsidence type. An alteration zone was extracted in the circular structure on the eastern side.

12) The Colelache area

[Geological unit]

Rocks and sediments distributed in this area were classified into 19 geological units (Fig. II-2-36 and Table II-2-13). One of them was comparable mainly to schist of the Paleozic, four units to the sedimentary rocks from the Jurassic to Tertiary, six to the volcanic rocks from the

Jurassic to Quaternary. Another three units correspond to the unconsolidated or semi-consolidated sediments of the Quaternary. Four geological units can be mainly compared to the intrusive rocks generated in the Paleozoic, Jurassic, Cretaceous and Tertiary. One unit was judged to be an alteration zone.

[Alteration zone]

In this area five alteration zones were extracted in the Tertiary volcanic rocks (geological unit: Tiv) distributed in the central area (Fig. II-2-36 and Table II-2-26). Two alteration zones are located in the northwest of this area; one in the central and three in the southwestern area. Morphology is generally ellipsoid or irregularly amoebic. The largest one is an alteration zone distributed in the northwest of this area, which is about 4 km toward direction of the longer axis. Its location is where the N-S and NW-SE lineaments cross each other.

[Lineament]

Number of lineaments interpreted and extracted in this area is 129 in total (Fig. II-2-36). For the distribution and direction, these lineaments can be divided into the eastern portion of this area and the remaining area. The following characteristics of these two groups are recognized:

(1) Lineaments distributed in the east are further divided into those in the northern area and those in the southern area. In the northern range, there is development of lineaments bending from NNE-SSW to NW-SE along the left bank of the Chubut river. These lineaments have the same sense that the east side rises extending over 40 km. These lineaments form a boundary between the Jurassic sedimentary and volcanic rocks (on the eastern side of the lineaments) and the Cretaceous sedimentary rocks (on the western side of the lineaments). Lineaments crossing these lineaments almost at right angles were collectively extracted in the Paleozoic granite and Jurassic sedimentary and volcanic rocks.

In the southern range, several lineaments extending to the N-S direction develop and were extracted in the Paleozoic granite and Jurassic volcanic rocks. Two of them have a sense that the western side rises, and the southern end of both lineaments change direction to NW-SE. The longest extension of the lineaments is 25 km.

(2) In areas other than (1), lineaments in different directions were extracted in the Jurassic to Cretaceous sedimentary and volcanic rocks. These lineaments tend to be in the NNE-SSW to NW-SE directions. The number of lineaments trending toward the E-W is extremely small.

Table Ⅱ-2-13 Characteristics of photogeologic units of the Colelache area

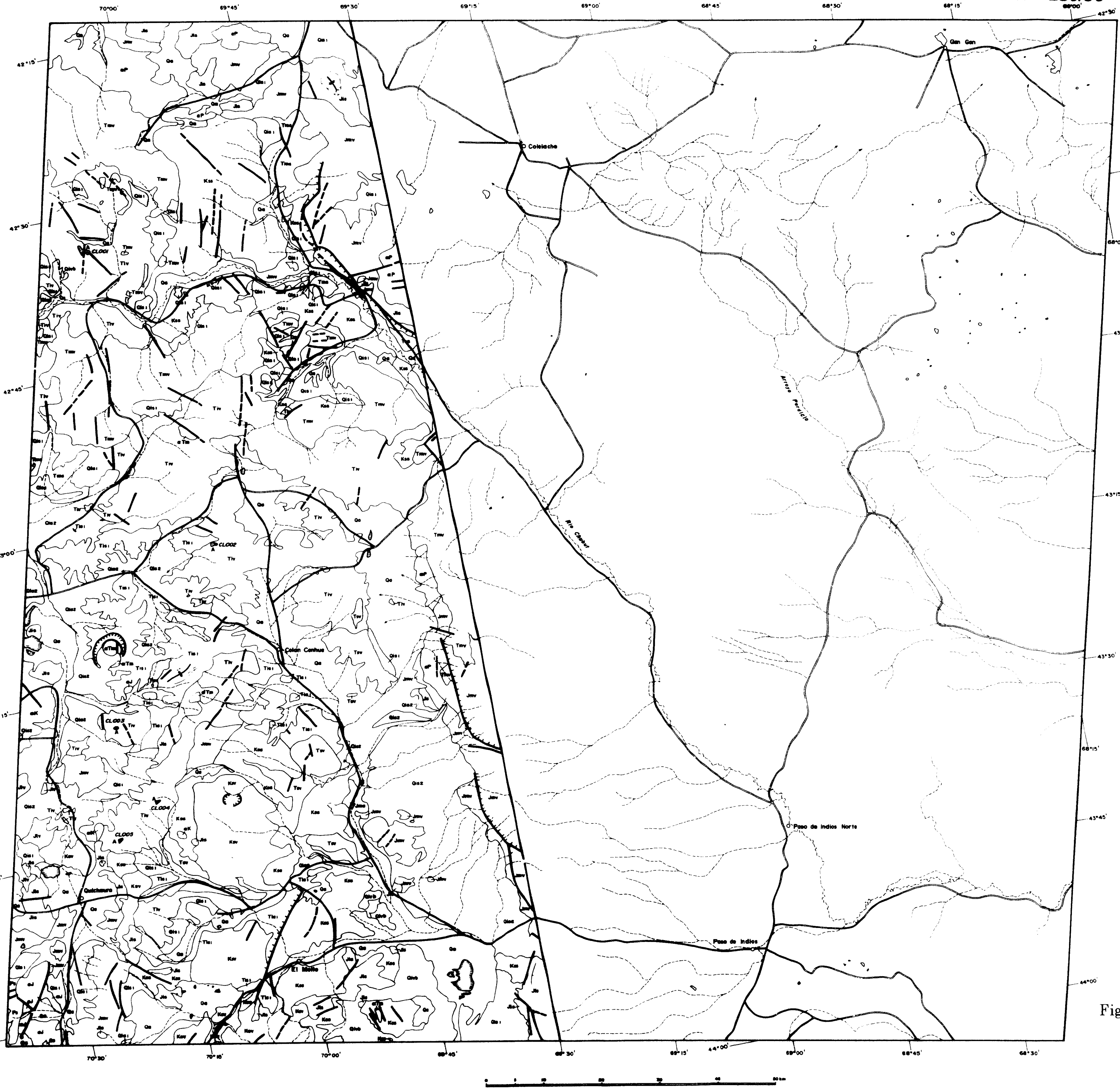
Unit	Photo-Characteristics		Mophologic Expression					Superficial Cover		Probable Lithology
	Tone	Texture	Drainage		Rock	Section	Bedding	Vegetation	Cultivation	(Correlation with available Geologic Map)
			Pattern	Density	Resistance					
Qa	gray, purplish red, green	very fine	meandering	very low	very low		none	partly dense	partly intense	Unconsolidated sediments composed of gravel, sand, silt and clay (Holocene : Recent alluvial deposits)
Qis2	light gray	medium	sub-parallel	low	low		none	none	none	Glacial deposits (Pleistocene : Gracial deposits)
Qis1	purplish	fine	sub-parallel	low	low		very gentle	rare	none	Unconsolidated sediments composed of gravel, sand, silt and clay (Pleistocene : Fluvial, talus deposits)
Qivb	reddish brown	rough	radial	medium	low		none	none	none	Basic volcanic rocks (Pleistocene : Basalt, pyroclastic rocks)
Tsv	brown	rough	sub-parallel	low	medium		none	none	none	Volcanic rocks (Pliocene: Basalt and pyroclastic rocks)
Tms	grayish purple	coarse-fine	sub-dendritic	low	low		rare	none	partly	Sedimentary rocks (Miocene: Continental sedimentary rocks, Collon Cura, Pedregoso Formation etc.)
Tmv	brown	coarse	sub-dendritic	medium	medium-high		massive	partly	rare	Mainly pyroclastic rocks (Miocene: Basaltic rocks, El Mirador Formation)
Tiv	dark brown	coarse	sub-dendritic	medium	medium-high		massive	dense	partly	Andesitic volcanic rocks(Eocene-Oligocene : Andesite, basalt and pyroclastic rocks)
Tis1	brown, dark brown	coarse	sub-dendritic	medium	low		partly	none	none	Sedimentary rocks (Eocene-Oligocene: Continental sedimentary rocks, Sarmiento Formation etc.)
Kss	gray	fine-medium	pinnate	medium	low-medium		bedded	none	none	Fine to medium grained sedimentary rocks (Upper Cretaceous : Sandstone, mudstone, conglomerate)
Ksv	brown, dark brown	medium	sub-dendritic	medium-high	medium-high		massive	rare	none	Volcanic rocks (Upper Cretaceous: Basic volcanic rocks, Tres Picos Prieto Formation etc.)
Jmv	brown	medium	sub-parallel	medium-high	medium-high		massive	partly dense	none	Volcanic rocks (Middle-Upper Jurassic: Intermediate volcanic rocks, Lago La Plata, Lonco Trapia Formations etc.)
Jis	brown	medium	sub-parallel	low-medium	medium		partly	partly	none	Sedimentary rocks (LowerJurassic: Marine and continental sedimentary rocks, Piltriquitron Formation etc.)
Ps	dark gray	rough	sub-dendritic	high	high		schistose	none	none	Schistose rocks (Paleozoic : Phyllite, schist, gneiss and migmatite)
αTm	gray	coarse	sub-dendritic	medium	high		massive	none	none	Felsic igneous rocks (Miocene : Granite, granodiorite, tonalite and diorite)
αK	brown	coarse	sub-dendritic	medium	high		massive	partly dense	none	Igneous rocks (Upper Cretaceous : Granitic rocks)

Table Ⅱ-2-13 Characteristics of photogeologic units of the Colelache area

Unit	Photo-Characteristics		Mophologic Expression					Superficial Cover		Probable Lithology
	Tone	Texture	Drainage		Rock	Section	Bedding	Vegetation	Cultivation	(Correlation with available Geologic Map)
			Pattern	Density	Resistance					
αJ	brown	coarse	sub-dendritic rectangular	medium	high		massive	partly	none	Igneous rocks (Jurassic : Plutonic rocks and hypabyssal rocks)
αP	gray	coarse	sub-dendritic rectangular	medium	medium-high		massive	partly	none	Igneous rocks (Paleozoic : Plutonic rocks and hypabyssal rocks)
A	light gray	fine	none	low	low		none	none	none	Alteration Zone (Hydrothermal alteration zone)

Colelache

WR 230/90



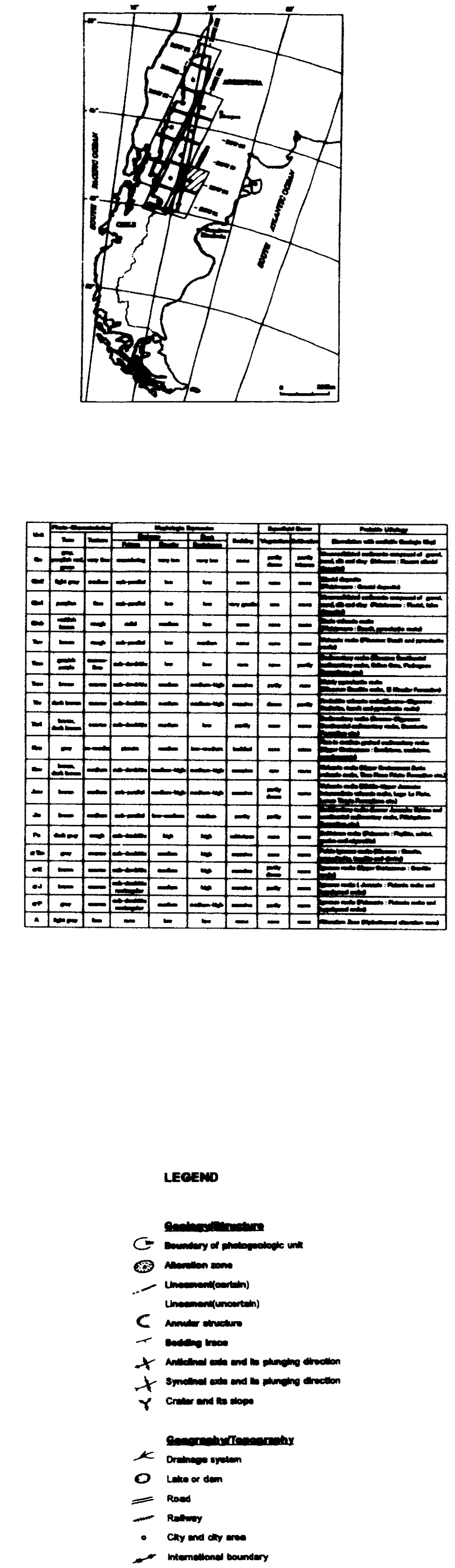


Fig. II-2-36 The Colelache area:
Photogeologic interpretation map

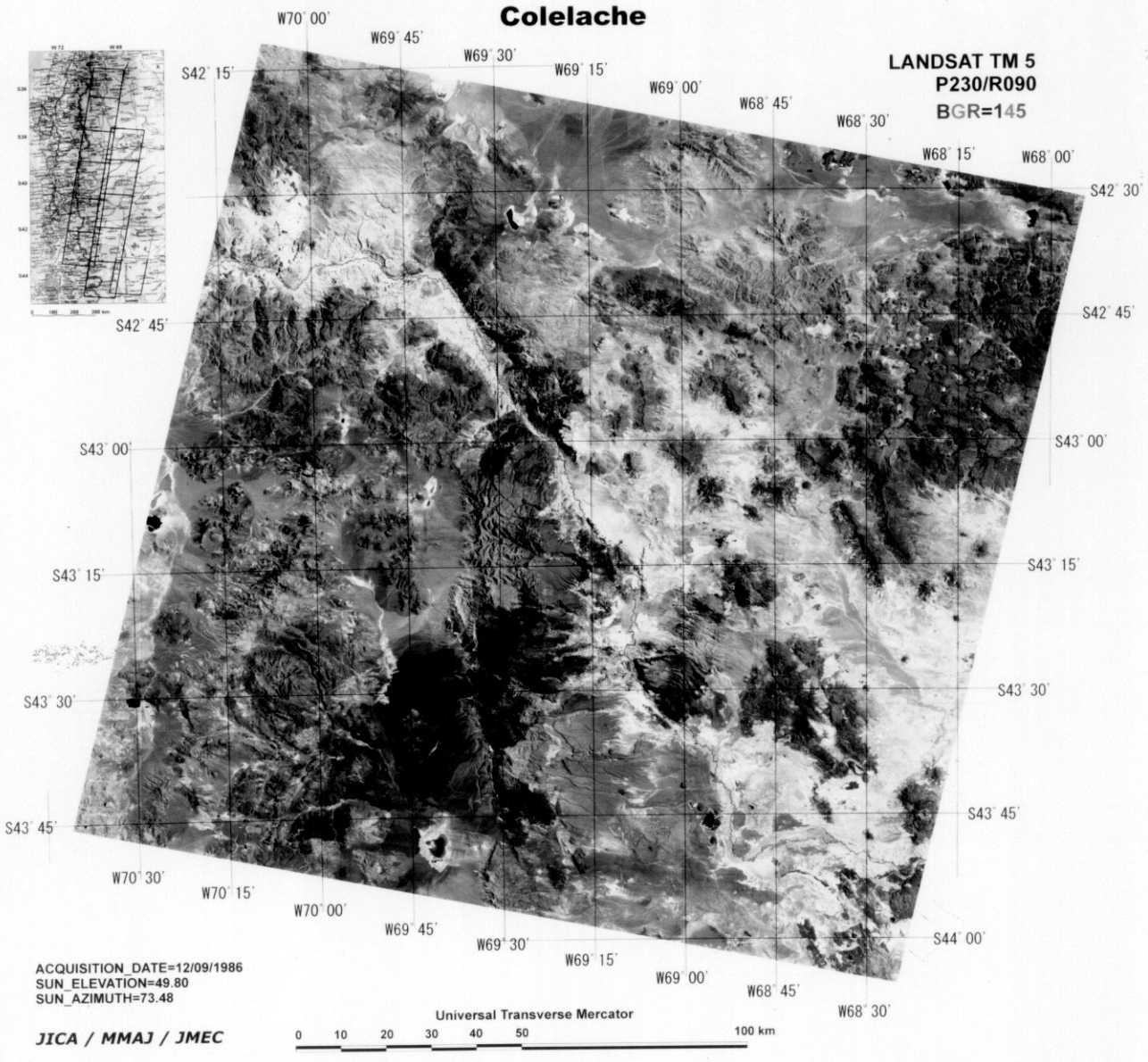


Fig. Ⅱ -2-37 The Colelache area: Landsat TM false color image

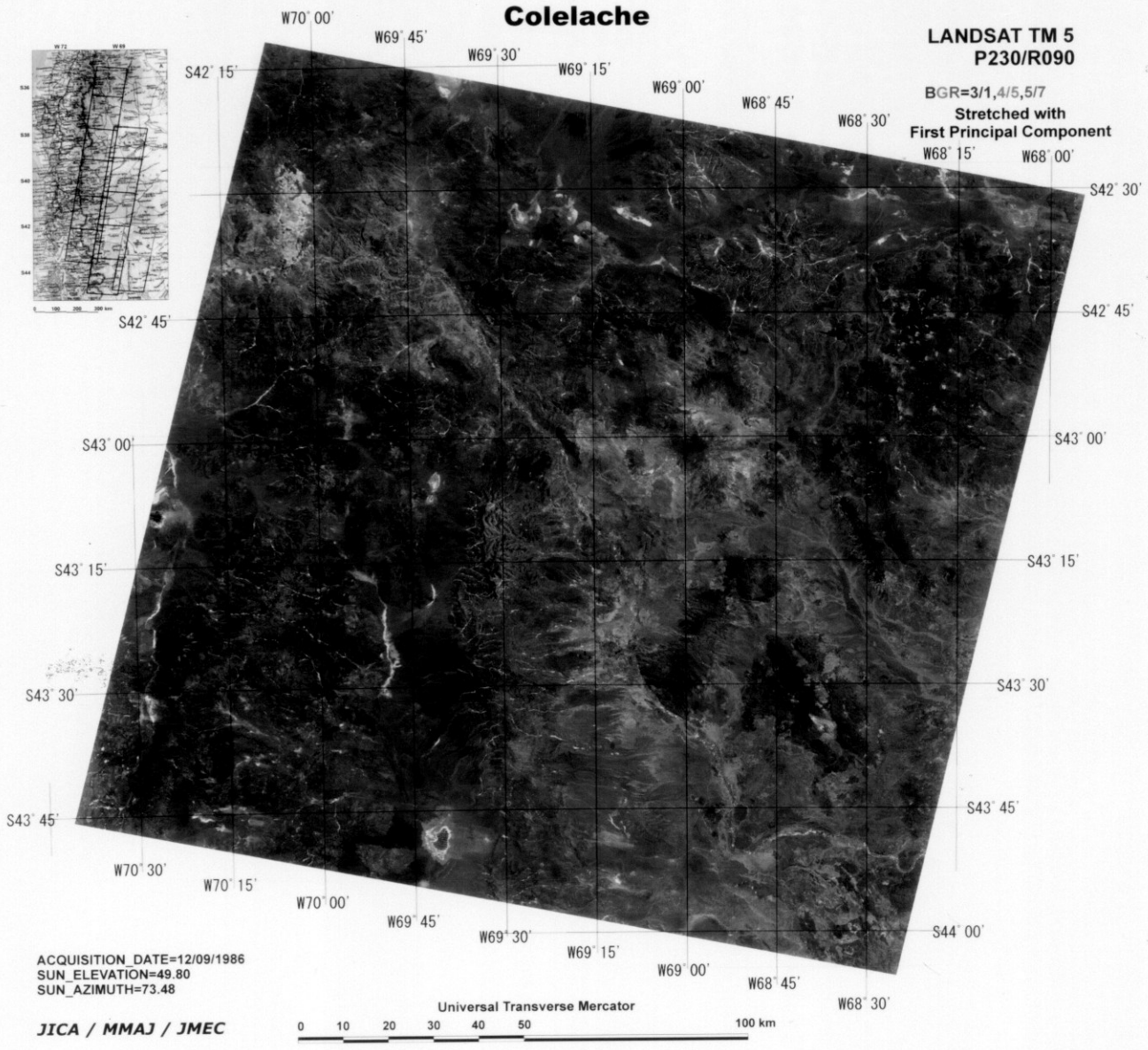


Fig. Ⅱ -2-38 The Colelache area: Landsat TM ratio image

[Folding and ciruclar structures]

(1) Folding structure

Two folding structures were extracted in this area. One is a synclinal structure in the NNW-SSE direction, which is recognized in the Jurassic sedimentary rocks (geological unit: Jis) distributed in the northeast. The other is an anticlinal structure in the NE-SW direction, which is recognized in the Tertiary sedimentary rocks (geological unit: Tis1) distributed in the central area.

(2) Circular structure

In this area, two circular structures were extracted (Fig. II-2-36). One is located in the Lower Tertiary sedimentary rocks (geological unit: Tis1) distributed 30 km west of Colan Conhue in the central area, is about 6 km in diameter. In the central part of this circular structure, the Middle Tertiary granittic rocks intruding the Lower Tertiary sedimentary rocks are distributed, but alteration zones are not found around them. The other circular structure is located in the Upper Cretaceous volcanic rocks (geological unit: Ksv) distributed about 27 km south-southwest of Colan Conhue, and is 3 km in diameter. No alteration zones are found on its periphery.

13) The Buen Pasto area

{Geological unit}

Rocks and sediments distributed in this area were classified into 20 geological units in total (Fig. II-2-39 and Table II-2-14). One of them was comparable mainly to the schist of the Paleozoic, five units to the sedimentary rocks from the Jurassic to Tertiary, and another seven units to the Jurassic to Quaternary volcanic rocks. Three geological units correspond to the unconsolidated or semi-consolidated sediments of the Quaternary. In addition, three geological units are comparable to the intrusive rocks generated in the Triassic, Jurassic and Cretaceous. One unit was judged to be an alteration zone.

[Alteration zone]

In this area seven alteration zones were extracted (Fig. II-2-39 and Table II-2-27). Two alteration zones were recognized in the Jurassic volcanic rocks (geological unit: Jmv) distributed in the west, four in the Cretaceous volcanic rocks (geological unit: Kiv-Ksv) and one in Cretaceous sedimentary rocks (geological unit: Kis2). Morphology of alteration zones is massive or ellipsoid. The largest one is 2.8 km by 2.0 km. Two alteration zones contact with the lineaments.