REPUBLIC OF INDONESIA

MINISTRY OF MINES

GEOLOGICAL SURVEY OF INDONESIA

REPORT ON GEOLOGICAL SURVEY OF CENTRAL KALIMANTAN

PHASE Ⅳ (No. 1)

PHOTO-GEOLOGICAL SURVEY

JAN. 1978

METAL MINING AGENCY OF JAPAN

JAPAN INTERNATIONAL COOPERATION AGENCY

GOVERNMENT OF JAPAN

REPUBLIC OF INDONESIA

MINISTRY OF MINES

GEOLOGICAL SURVEY OF INDONESIA

REPORT ON GEOLOGICAL SURVEY OF CENTRAL KALIMANTAN

PHASE Ⅳ (No. 1)

PHOTO-GEOLOGICAL SURVEY

JAN. 1978

METAL MINING AGENCY OF JAPAN

JAPAN INTERNATIONAL COOPERATION AGENCY

GOVERNMENT OF JAPAN

P R E F A C E

The Government of Japan, in response to the request extended by the Government of the Republic of Indonesia, decided to conduct an integrated geological survey for mineral exploration in central Kalimantan of Indonesia, and commissioned its implementation to the Japan International Cooperation Agency.

The Agency, taking into consideration of the importance of, technical nature of the survey work, in turn sought the Metal Mining Agency of Japan for its cooperation to accomplish the task within a period of four years.

The Government of the Republic of Indonesia appointed the Geological Survey of Indonesia to excute the survey as the counterpart to the Japanese team. The survey has been carried out jointly by both governments' experts.

The first phase of the survey consists of Landsat data analysis; the second and third phase, aerial photography and airborne magnetic survey; the fourth phase, photo-geological survey.

This report submitted hereby summarizes the results of photo-geological survey, and it will also form a portion of the final report that will be prepared with regard to the results obtained in the fourth phase.

We wish to take this opportunity to express our gratitudes to all sides concerned with the excution of the survey.

January, 1978

Prof. Dr. J. A. Katili

Director General
Ministry of Mines
Republic of Indonesia

Shinsaku Hogen

President
Japan International
Cooperation Agency

Yasuaki Hiratsuka

President
Metal Mining Agency
of Japan

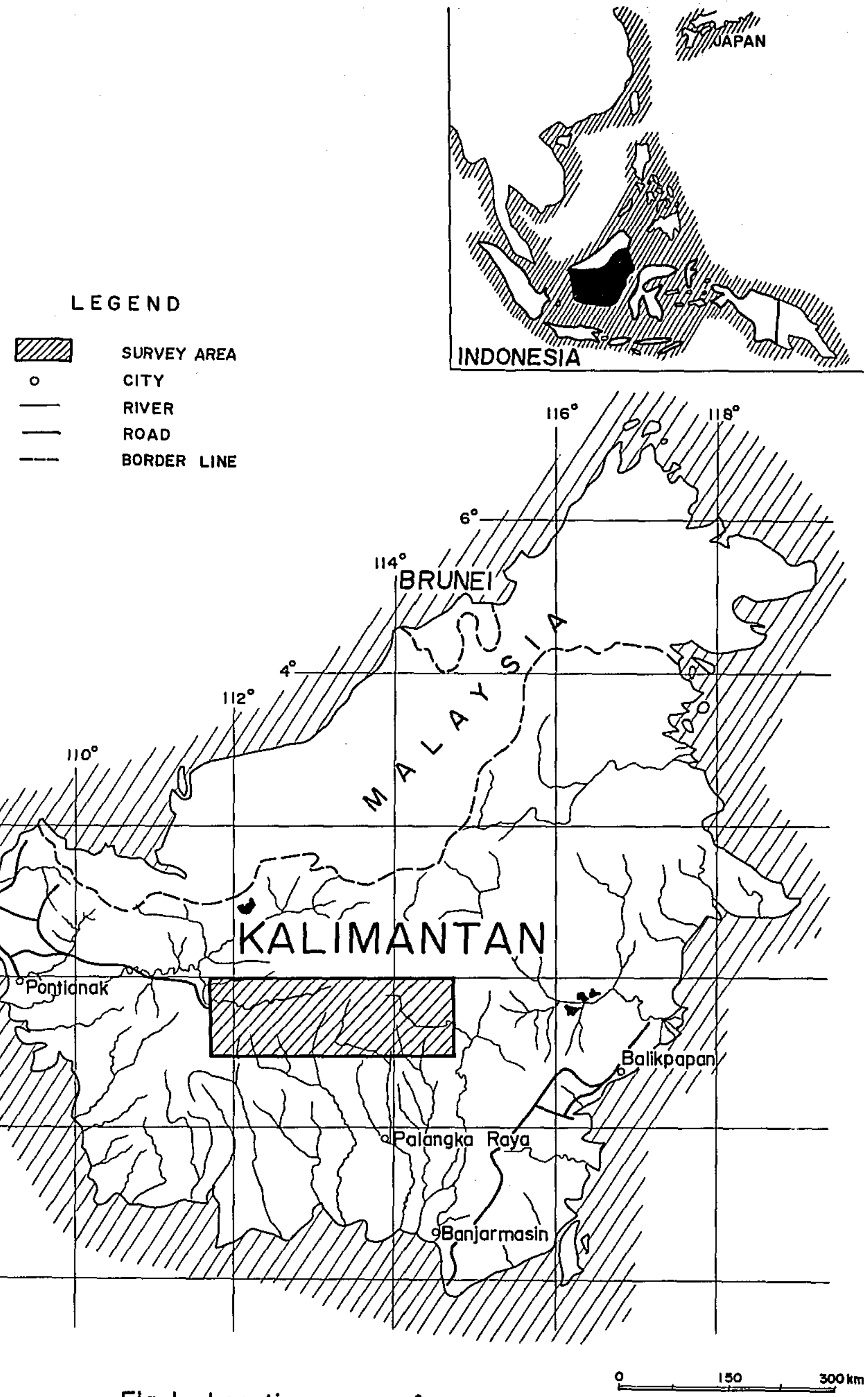


Fig. 1 Location map of survey area

TABLE OF CONTENTS

Illustrations

Tables

Attached sheets

Abstract

The work described in this report is undertaken as a part of the Integrated Geological Survey Project in the Kalimantan district, Indonesia. It was intended to steer planning the future geological survey on the basis of the available geological data and the analyses of aerial photographs taken in 1976 and 1977.

According to the present survey, the geology in this area is divided into 22 units. However, the area is generally divided into four parts in a geological sense:

The southwestern area located at the northeastern margins of the Sunda Shield where the basement composed of the Tertiary rocks is exposed.

The northwestern area corresponding to an eastern half of the Melawi basin of Paleogene in age.

The eastern area located at the western margins of the Kutai basin of Tertiary in age.

The northern area where the terrigenous Plateau Sandstone of Tertiary in age occurs.

The basement rocks consist of Paleozoic metamorphic rocks which are mainly schists, and sediments, volcanics and granitic rocks of Paleozoic to Mesozoic in age. The sedimentary rocks constituting the Melawi basin are grouped and called the Melawi formation. The formation can be divided further into two parts, the upper and the lower. The lower formation of the Melawi Proper consists mainly of sandstone, shale and interbedded layers of coal, and the upper formation the Lebang Claystone. These appear to be deposited under the littoral and lagoonal

environments at Eocene to Oligocene in age.

The sedimentary rocks in the Kutai basin have a reducing tendency in grain sizes, from conglomerate to fine sand, toward east from the central part, that is, toward the upper part of the beds. The beds are divided into two parts. The lower beds have conglomerate at the basement and consist mainly of sandstone, shale and partial intercalations of limestone. Also acidic to intermediate tuffaceous rocks are locally intercalating. The upper beds consist mainly of shale, sandstone, and intercalations of limestone. Judging from fossils in limestone and the lithology mentioned above, the lower beds correspond to the Tanjun formation of Eocene in age, the lowermost of the upper beds correspond to that of the uppermost Eocene in age and the uppermost correspond to that of the lowermost Miocene in age. Most of the upper beds are Oligocene in age and apparently correlate with the Berai formation.

The boundary area between the basins, the Kurai and the Melawi, forms an uplifted zone where the basal conglomerate and the Plateau Sandstone overlie the pre-Tertiary rocks. The Plateau Sandstone covers unconformably the pre-Tertiary rocks at the central part of the zone. However, it becomes the sediments of the Melawi or the Kutai basins in either sides. Thus, the Plateau Sandstone is situated at the upper part of the formations of the basins and is indirectly covering the pre-Tertiary rocks.

The igneous activities of Tertiary in age are characterized by eruption and intrusion of andestic to basaltic rocks and granitic intrusion. The former appears to have taken place repeatedly over a period of Oligocene to Miocene in age, and the latter at the middle Miocene or Pliocene in age.

The principal fold structures in the area are the syncline with the general axial direction of EW in the Melawi basin and the half basin structure, opened toward east, in the Kutai basin. The dips of beds in both basins are mostly gentle and less than 15 degrees. At the southwestern area in which the basement rocks of pre-Tertiary in age are distributed, the fold structures are not clarified by this survey.

There are two major faults with the strike of NE on the eastern side and several discontinuous faults with the strike of WNW on the western side of the survey area. Also linearment-structures are identified from the aerial photographs with some different features in each area. Generally, two system of NE and NW directions are remarkable. Although the NW systems are observed only in the Melawi basin, both systems are characteristic in the other area.

There are four types of ore deposits as folllows:

1) Mineralization of either copper, lead, or zinc.

2) Gold deposits.

3) Diamond deposits.

4) Coal seams.

Gold deposits are mainly composed on.alluvial concentration and partially of gold-bearing quartz veins. Eight gold deposits exist in the area. Diamond deposits seem to be of alluvial origin and are mined by panning surface soils. Both gold and diamond are handpicked in a small scale. Coal seams consist of thin layers of coal with a maximum thickness of 4 to 5 meters. The lateral extent of the layers could not be confirmed.

Mineralizations of copper, lead and zinc have the modes of occurrence of vein and dissemination types. The deposits discovered until now are generally poor. It is, however, considered that there remains some possibility to discover the large scale deposit by the future surveys. It is because the mineralizations are closely associated with the Tertiary granite. Such a case is well known in the Mamut porphyry copper deposit at Sabah. It is also for the reason that the area is geotectonically located at the southwestern extension of the Mamut deposit.

The geological features in the Tertiary granite intrusion accompanying such mineralizations are characterized as follows:

1) The area is located near the boundary of the Tertiary basin at the northeastern end of the Sunda Shield.

2) It is at the intersection between two structures with the EW system which is the general direction of extension of the Melawi basin, and with the NS system which is the direction of the western margin of the Sunda Shield.

3) The continuous faults and magnetic structural lines with the WNW system are changing in their direction to the NE system at the area where numerous fractures occur.

Thus, the area of the concentrated mineralized zones mentioned above are found at the place where such characteristic geological features are dominant. No other prospective place with similar geological conditions was discovered within the survey area.

The outline of geology of the survey area is revealed by the present work and the surveys carried out since 1975. It is therefore recommended that the survey of the next fiscal year should be confined at the promising area which is the central southern area, where the mineralized zones of copper, lead and zinc are concentrated. It is important to accumulate the fundamental data in order to judge whether the mineralized zones are economical or not. Thus, the proposed surveys are the geological surveying together with the geochemical prospecting. If a promising mineralization is found, the intensive geological survey should be carried out.

Nevertheless, it is also suggested that the geophysical prospecting such as IP and prospecting drillings are too early to be carried out so far. Since there are wide distributions of granitic rocks and conglomerate, it is also desirable that a simple radiometric prospecting should be carried out in order to see, if any, depositions of radioactive minerals throughout the area.

Chapter 1 Introduction

1 - 1 Purpose of survey

The work described in this report is undertaken as a part of the 4th-year survey (Phase IV) of the Integrated Geological Survey Project in the Kalimantan district, Indonesia. The purpose of this report is to offer some fundamental geological information for planning the geological field works on some target areas, to be carried out next year, for the prospective ore deposits.

The present work revealed the outline of stratigraphy, geological structure and distribution of igneous rocks in the survey area. Thus, the photo-geological map was prepared. The present major works are based on analyses and interpretations of the aerial photographs taken in 1976 and 1977,and also based on the synthesis of results of the Landsat data analyses in 1975, and of airborne magnetic surveys in 1976 and 1977, with the supplementary geological data by the Geological Survey of Indonesia (hereafter referred to as GSI) who has worked independently in this project. The previous surveys performed since 1975 are shown together with the present works in Table 1.

Table 1 Operation program performed

Items / Year of performance	1975 (Phase I)	1976 (Phase II)	1977 (Phase III) No. 1	1977 (Phase III) No. 2	1977 (Phase IV)
1. Landsat data analysis	100%				
2. Aerial photography		71%	22% (Total 93%)		
3. Airborne magnetic survey		25%	29%	41% (Total 95%)	
4. Photo-geological survey					93%

1 - 2 Survey area

The survey area is located at the central part of the Kalimantan district, Indonesia and is bounded by the latitudes 0° to 1°S and by the longitudes 111°45' to 114°45'E. The area covers approximately 36,300 square kilometers. However, the aerial photographs covering the areas of the southeastern and the northern edges, could not be taken because of the unfavorable weather conditions. Nevertheless, the photo-geological map covering the areas were prepared, to the possible extent on the basis of the available data, without the photo-interpretation. These parts occupy the 7% of the whole area.

1 - 3 Survey method

1 - 3 - 1 Aerial photographs

The numbers of aerial photographs used in the present works are 2,848 which cover the 93 % of the whole region. They consist of 1,987 photographs taken in 1976 and 861 photographs taken in 1977. The orientation diagrams and the aerial photograph numbers are given in Reports of Phase II and Phase III (No. 1) of this project. The scale of the photographs is approximately 1:40,000 with a slight variations on the areas of mountains and plains.

1 - 3 - 2 Procedure

The following geological and geomorphological features are identified from the aerial photographs by using stereoscopes; the drainage pattern, the density, the texture, the resistance (relief energy and errosion), the valley section, the ridge pattern, the lineament, the tone, the geological boundary, and the strikes and dips of bedding and schistosity.

These are drawn directly on the overlay of each aerial photograph so that an interpretation chart is prepared. Thus, a classification of lithostratigraphic units and analyses of geological structures can be carried out.

Because of enormous numbers of photographs, the overlays of four to five courses are compiled together. The compilation diagram is, then, reduced to the scale of the available topographic map (1:250,000) so that the major rivers coincide with those on the topographic map. Thus, a preliminary photo-geological map is prepared on the water system map of the entire area on the basis of the compilation diagrams.

The semi-controlled mosaics are also drawn by using the aerial-photographs reduced to the scale of about 1:250,000 in order to understand the macrostructures of the area and to clarify the positional and structural relationships among the photographs. The complete photo-geological map is prepared with the supplementary geological data reported by the GSI, in respect to the obscure boundaries and geological structures in each unit on the preliminary photo-geological map.

1 - 4 Survey period

Survey period is from June 23, 1977 to January 31, 1978 (duration of photo-interpretation in GSI, June 23, 1977 to August 26, 1977)

1 - 5 Members of teams

The members engaged in the project works are listed herein.

List of members

Indonesian team		Japanese team	
		Supervisor	
		Toshio Kawaguchi	(MMAJ)
Coordinator (Team leader)		Coordinator (Team leader)	
Adjat Sudradjat	(GSI)	Haruhiko Hirayama	(NED)
Members		Members	
H. M. Djuri Rosidi	(GSI)	Tohkichiro Tani	(NED)
Turus Soejitno	(GSI)	Susumu Takeda	(NED)
Oong Kaswanda	(GSI)		
Tjandra Santosa	(GSI)		
Ungkap L. Batu	(GSI)		
Bargur S. Hasan	(GSI)		
M. Firdaus	(GSI)		
Deddy Mulyadi	(GSI)		
E. Kertapati	(GSI)		

Cooperator (Japanese experts attached to GSI)

Sakae Ichihara (JICA)

Mitsuharu Yakoh (JICA)

Note : GSI Geological Survey of Indonesia

JICA Japan International Cooperation Agency

MMAJ Metal Mining Agency of Japan

NED Nikko Exploration and Development Co., Ltd.

1 - 6 Geography of survey area

More than half of the survey area are lowlands and plains about 100 to 500 m above sea level. Mountains occupy the portion from the southwestern to north-central parts. The highest peak (Mt. Raja) is 2,278 m above sea level. The greater part of the area is covered by jungle, with minor forest clearings.

There are no large village, but small ones are distributed sporadically along the rivers.

Some roads run along the rivers in the eastern and western parts. The greater part is generally undeveloped, and rivers are the most important transportation mean.

The climate is characterized by high temperatures and high humidity because it is almost right on the equator and of the extensive lowlands. At Balikpapan and Pontianak cities, which are along the sea coast and nearly in the same latitude as the survey area, the annual average temperature is 26° to 28°C and the annual average humidity is 75 to 80%.

The dry season is from June to September and the rainy season is from October to May. Precipitation varies from place to place, but the average monthly precipitation is 200 to 300 mm in the dry season and 300 to 400 mm in the rainy season. Annual precipitation attains 3,000 to 4,000 mm.

The water system map produced by the analysis of aerial photographs, with available data, is given in PL-I. Tracing the details of drainage in the plains was very difficult even with the photo analysis due to thick plant cover.

Most of the rivers in the survey area start from the Schwaner mountain range and Muller mountainland. The Schwaner mountain range and Muller mountainland are mountain areas traversing the area from the southwest to the north central part. It is about 1,000 to 2,000 m above sea level. Accordingly, those mountains constitute the watersheds.

Kayan River in the northern part, and Melawi River in the central part, are the main rivers in Melawi lowland area. Both rivers move sluggishly in a meandering pattern towards the west. They meet at Sungaipinang, about 3 km west of the survey area, then join the Kapuas River at Sintang, 30 km northwest from Sungaipinang. At the southern part of Melawi River the tributaries come from the Schwaner mountain range, forming fine dendritic valleys in the mountain area. In contrast, most drainage lines in the lowlands run nearly north-south. In Nangambalau and eastward, especially, in the upstream of Ambalan River, characteristic parallel drainage pattern is developed reflecting the local geology.

At the southern foot of the Schwaner mountain range the rivers descend with north-south orientation. Here, the main rivers, from the west to the east are as follows: Serujan River, Mendawai River, Senamang River, Bimban River, Heran River, Baraoi River, Hahoi River, Kahayan River, Hamputung River, Mirih River and others. These rivers change in direction to east-west or northwest-southeast at the southern end of the survey area and outside; farther they meet one another and increase in width. Tributaries flowing into these rivers are highly concentrated in the mountain area and generally dendritic in form.

The largest river in the eastern part is Barito River. It starts from north of the survey area, from the Muller mountainland, and increases in width as it reaches Muara Juloi where it joins with Juloi and Murung

Rivers. The river meanders towards the southeast, and meets the Laung River at Muaralaung in the eastern edge of the survey area, then it changes direction towards north-south ourside of the survey area.

The other main river in the area is the Kapuas River. This river flows towards the south direction with small repeated meanders between the Barito River and Kahayan River in the southern part of the survey area.

Chapter 2 Geology and mineral deposits

2 - 1 General remarks

Reconnaissance works in the survey area have been carried out mainly by Dutch geologists since the later half of the 1800. Several reports have been given by Zeijlmans van Emmichoven, C.P.A. (1939) and others. These reconnaissance works are limited only to a part of the survey area. There are many blank spaces in the survey area even in the 1:500,000 geological map published by GSI. However, the geological work has been carried out by GSI as a link in the chain of this project. Stratigraphic succession and structure are accordingly clarified on the basis of the route maps along the main rivers, Barito River, Kahayan River and others that are located at southern and eastern parts of the Schwaner mountain range. As shown in Fig. 2, the southwestern and south central parts are in the northeastern margin of the Sunda Shield uplift zone, the northwestern part is in the eastern portion of the Melawi basin and the eastern part is in the western margin of the Kutai basin. The rocks in these areas are given in the following section.

Basement rocks : Compose the Sunda Shield part of the survey area. They are Paleozoic metamorphic rocks consisting mainly of schists; Paleozoic to Mesozoic sedimentary, volcanic and acid intrusive rocks.

Melawi formation : The rocks composing the Melawi basin are included in the Melawi formation. They are Paleogene Tertiary sedimentary rocks. The Melawi formation is divided into a lower and upper groups. The former is called the Melawi Proper and the latter is called the Lebang Claystone. These sedimentary rocks could have been formed under littoral and lagoonal

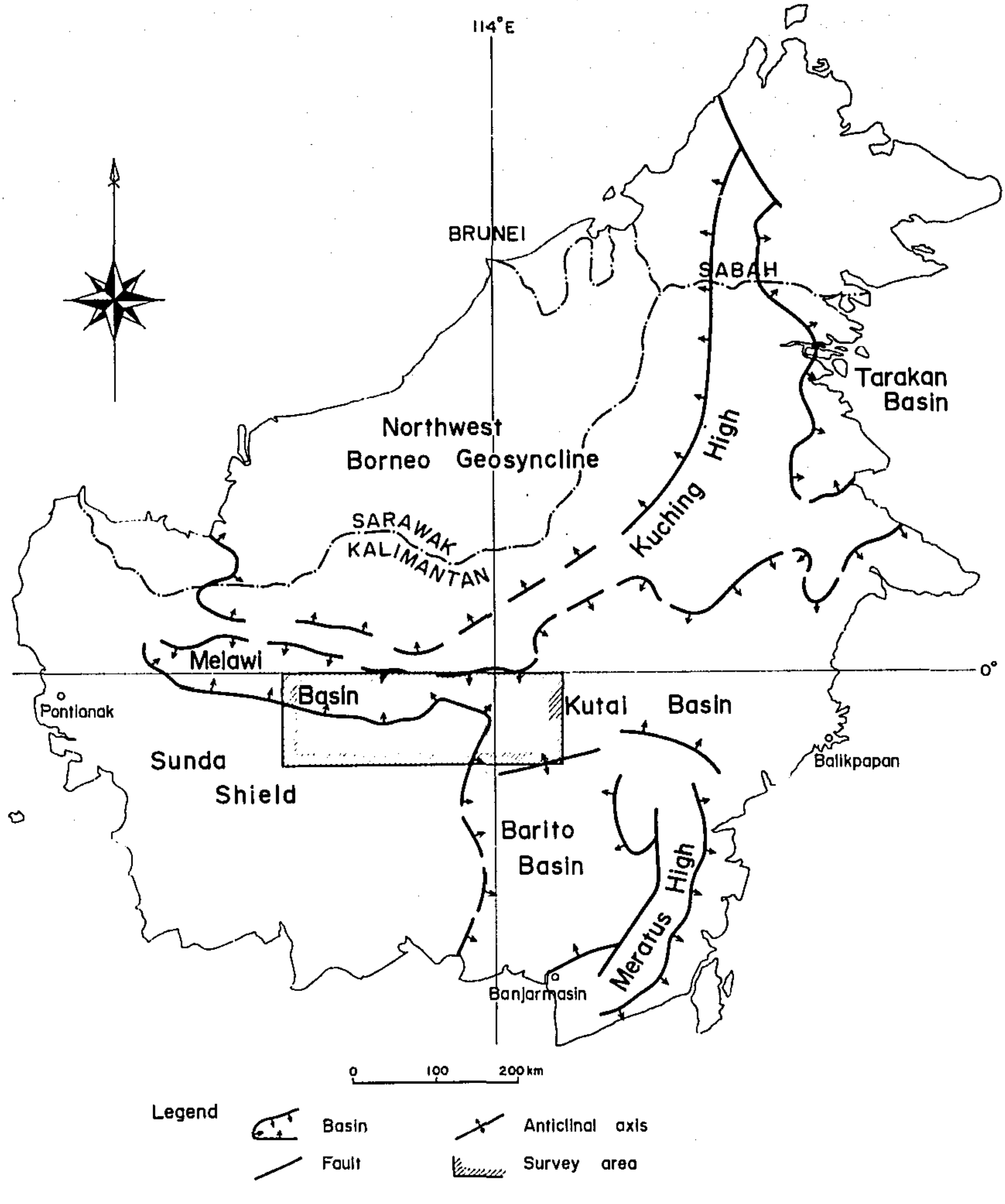


Fig. 2 Structural map of Kalimantan

environments.

The western margin of the Kutai basin in the eastern part of the area consists of the Paleogene Tertiary sedimentary rocks which are mainly formed by deltaic sediments under neritic to shallow water environment. Futhermore, the so-called Plateau Sandstone is distributed mainly in the northern part. This consists of inland quartz sandstone. Quartz diorites and andesites intruded into these Tertiary formation as the small stocks or dykes.

As shown in Table 2, the geology of the survey area is divided into the following rock units : Unit M; mainly Paleozoic to Mesozoic metamorphic rocks, Unit T; Mesozoic volcanic rocks, Unit S-1 to Unit S-12; mainly Mesozoic to Tertiary sedimentary rocks, Unit Q; Quaternary sediments, Unit V-1 to Unit V-3; Tertiary intrusions and lavas, and Unit I-1 to Unit I-4; Paleozoic to Mesozoic intrusions.

The geological structures given here coincide nearly with the former structural divisions. The sedimentary rocks in both Kutai and Melawi basins have generally the low dips (less than 15°) and folding structures have commonly E-W axes. The faults are of the WNW-ESE system in the southwestern part (northeastern part of the Sunda Shield), and of the NE-SW system in the eastern part (western margin of the Kutai basin).

Concerning mineral deposits, small scale gold and diamond placer mines are in operation in the survey area. There are known several mineral showings of copper, lead and zinc and thin coal seams.

Table . 2 PHOTO - GEOLOGICAL INTERPRETATION CHART

UNIT	PHOTO TEXTURE	TOPOGRAPHIC CHARACTERISTICS: DRAINAGE PATTERN		DRAINAGE DENSITY	RESISTIVITY: ROCK	RESISTIVITY: CROSS-SECTION	LINEAMENT (FAULT · JOINT): DIRECTION	LINEAMENT (FAULT · JOINT): INTENSITY	LINEAMENT (FAULT · JOINT): KINDS	LINEAMENT: BEDDING	VEGE-TATION	COMMENT	LITHOLOGY
Q	smooth	meander		rare	very weak						large	usually open timbered	sand, gravel
S - 12	flat	dendritic		medium	weak		mainly I	medium	fault	none	large	thinly overlie on the "unit S-3"	silt
S - 11												by the G.S.I. data	sandstone
S - 10												ditto	andesite agglomerate
S - 9	finely rugged	dendritic		very dense	weak		mainly I	medium	fault	vague	medium ~small	partly open timbered (distributed in the western part)	shale, sandstone, marl
S - 8	finely rugged	dendritic		very dense	weak		rare	weak	fault	vague	medium	partly open timbered (distributed in the Eastern part)	shale, sandstone, limestone
S - 7	coarse	sub-parallel ~dendritic		medium	strong					clear	medium ~small	interculated in the "unit S-5" and the "unit S-6"	sandstone
S - 6	finely rugged	dendritic		dense	weak ~medium		many	medium	fault joint	vague	medium	(distributed in the Western part)	shale, sandstone, marl, lignite
S - 5	finely rugged	dendritic		dense	weak ~medium		many	medium	fault joint	partly clear	medium ~large	(distributed in the Eastern part)	shale, sandstone, limestone
S - 4												by the G.S.I. data	pyroclastic rock
S - 3	flat	sub-parallel		sparse	very strong		mainly I	strong	fault	clear	small	characterized by sharp ridge and small sized vegitation	sandstone
S - 2	flat (partly rugged)	sub-parallel dendritic		medium	strong		many	medium	fault joint	partly clear	large (partly small)	partly similar to the "unit S-3"	sandstone, conglomerate
S - 1	rough	sub-parallel		medium	strong		rare	weak	fault	vague	medium ~large	characterized by rough texture	shale, sandstone, limestone
T												by the G.S.I. data	andesite
M	rugged	dendritic		medium ~dense	medium ~strong		many	medium	fault joint	vague	medium	characterized by special tortuous ridge and valley	schist, slate, quartzite
V - 3	fine	radial ~ sub-parallel		sparse	strong		rare	weak	joint		small	lava dome shape, partly volcanic cone can be observed	andesite ~ basalt
V - 2	fine	radial		medium	strong		rare	weak	joint		small	characterized by typical projecting topograph	dyke rocks of various component (mainly andesite)
V - 1												by the G.S.I. data	granitic rock
I - 4	coarse rugged	dendritic		medium ~dense	strong		many	strong	fault joint		very large	characterized by strong resistivity and sharp ridge	granitic rock
I - 3	coarse	dendritic		medium	strong		many	strong	fault joint		large	characterized by deep valley and moderate ridge	granitic rock
I - 2	rugged	sub-parallel ~dendritic		medium ~dense	very ~strong		many	strong	fault joint		medium ~small	characterized by very high resistance	granitic rock
I - 1	finely rugged	dendritic ~annual		dense	strong		many	strong	fault joint		large	characterized by relatively low resistance	gneiss

2 - 2 Geology

2 - 2 - 1 Description of geological units

As shown before, the geology of the survey area is divided into the following; Unit M (mainly metamorphic rocks), Unit T (volcanic rocks), Unit S-1 to S-12 (mainly sedimentary rocks), Unit Q (Quaternary sediments). Unit V-1 to V-3 (Tertiary intrusions and lavas), and Unit I-1 to I-4 (pre-Tertiary intrusive rocks).

(1) Metamorphic rocks - Unit M :

The metamorphic rocks are treated as one group, Unit M, because it is impossible to subdivid them with the analysis at this time. This unit is developed widely from the upper reaches of Kelewai River to Kahayan River, with granitic rocks in the southwestern part of the survey area. It is also distributed sporadically along Murung River in the northeastern part. These rocks have medium to relatively high resistance to erosion. Accordingly, it is characterized by fine, dense and undulate drainage pattern.

According to the available data, this unit consists of metamorphic rocks such as schists, quartzite, slate and others, and sedimentary rocks such as sandstone, shale, limestone, etc. It is assumed that the metamorphic rocks are Carboniferous to Permian and the sedimentary rocks are Triassic to Jurassic.

(2) Mesozoic volcanic rocks - Unit T :

This unit is distributed locally along Baraoi River, in the southern edge of the central portion of the survey area, and its branches. It is impossible to distinguish it under the aerial photograph because of its small areal distribution. Accordingly, its distribution is estimated from the other available data.

According to the results of the survey by GSI, this unit consists of andesite, and it is considered that it corresponds with the upper Triassic Serion Volcanic formation by Khee Meng Leon (1972).

(3) Sedimentary rocks composed mainly of Mesozoic and Tertiary system - Units S-1 to S-12 :

Unit S-1 : This unit is distributed in an area from the Tabulus River (an affluent of Juloi River) to Naan River in the northeastern part of the survey area. It is characterized by relatively high resistance and outthrust peaks,changing gradually to flat peaks in the northern part. It is assumed that a part of this unit is composed of conglomerate to sandstone by the photogeological characteristics. According to the survey by GSI, the formation which is distributed in this area is composed mainly of shale and sandstone intercalated with limestone.

The Tertiary system in the survey area shows low dips, generally less than 15°. On the other hand, this formation shows nearly vertical dips in some other places. Accordingly, it is difficult to consider that this formation belongs to the Tertiary system. It would be reasonable to correlate it to the Jurassic Serang formation or the Cretaceous Pedawan formation by Khee Meng Leon (1972).

Unit S-2 : This unit is distributed widely, centering around the central part of the survey area, such as between Barito River and the headwaters of Laung River, the headwaters of Kapuas River and the headwaters of Mirih River. The thickness of the formation decreases gradually to the west; it is thin out near the Rijahdjanda mountain.

It is characterized topographically by relatively high resistance to erosion and the drainage is subparallel and of rather low density. According to the survey results by GSI, this unit consists of sandstone and conglomerate and covers unconformably the granitic and metamorphic rocks at the headwaters of Mirih River.

Unit S-3 : This unit is distributed widely, centering at the headwaters of Barito River in the northeastern part of the survey area and spreading towards the northern part of the survey area. This unit decreases in thickness towards the west, as the similar to Unit S-2, and thins out near the Kepenjahu mountain in the central part of the survey area. This unit is also distributed at the central part of the syncline near the Alat mountain and the Beturan mountain in the northwestern part of the survey area. It is topographically characterized by strong resistance to erosion, flat hills, subparallel sparse and long drainage, and sharp cliffs at the boundary with other units. Generally, it is covered by short tree vegetation. Accordingly, it is distinguished clearly from the other units. It consists of quartz sandstone.

This unit corresponds to the Plateau Sandstone reported by the previous workers. The unit is developed in all the lower to upper Tertiary horizons distributed in the survey area. It interfingers with the other units. According to the survey of GSI, this unit covers directly and unconformably metamorphic and granitic rocks at Murung River in the northeastern part of the survey area. This unit lies on Unit S-2 at Barito River and Unit S-9 near Beturan mountain and Alat mountain in the northwestern part. It is interbedded between Unit S-6 near Lobabharimau in the central part of the survey area.

Unit S-4 : This unit is distributed along tributaries of Kapuas River in the southeastern part of the survey area. It is impossible to distinguish between this unit and Unit S-5 by aerial photographs, because they are of similar topographic features. In consequence, this unit and unit S-5 are divided according to the survey results of the GSI. This unit consists chiefly of acidic to intermediate tuffaceous rocks accompanied with acidic to intermediate lava flows. This unit and Unit S-2 are conformable or interfingering.

Unit S-5 : This unit is widely distributed around Barito River in the eastern part of the survey area. It is characterized by low resistance and dense drainage. Generally, bedding planes are unclear, but they are distinctly developed south of Murauntu village, in the southeastern part of the area where folded structures have E-W axes. It is analyzed with photogeological method that this unit consists mainly of shale. However, the result of GSI shows that this unit consists mainly of sandstone and shale, with accompanying thin beds of limestone. Much sandstone is developed in the western part where the lower part of this unit is distributed. There are lithologic differences between the lower and upper parts. This unit covers conformably Unit S-2. It is assumed that the relationships between this unit and Unit S-4 are partly conformable and partly interfingering.

Unit S-6 : This unit is widely distributed around Melawi River in the central to western part of the survey area. Topographic characteristics of this unit are similar to Unit S-5, but the former has slightly high resistance. It is also considered that this unit consists mainly of shale. This unit corresponds probably to the Melawi Proper of the lower part of Melawi formation by Zeijlmans van Emmichoven, C.P.A. (1939). The rocks of Melawi Proper consists of shale, sandstone, marl and arenaceous limestone, with associated lignite bed. It covers unconformably the pre-Tertiary system.

Unit S-7 : This unit is distributed within Units S-4, S-5 and S-6 in the central and eastern part of the survey area in mostly lenticular form. It is characterized by high resistance, relatively coarse and subparallel drainage and medium to fine vegetation. Geological structure of this unit is controlled by the other units which intercalate it. bedding planes are frequently observed. According to the analysis of this unit by photogeological method it consists of conglomerate or sandstone, which results also agree with those of GSI.

Unit S-8 : This unit is distributed around Barito River and Maruwai River in the eastern edge, and southeastern edge of the survey area. It is characterized by low resistance and dense, fine and meandering drainage. This unit is analyzed with photogeological method to consist mainly of shale. While the survey results of GSI showed this unit consists of shale, limestone and sandstone; fossils found from limestone in this unit are mostly Oligocene, but some suggest that it ranges from the uppermost Eocene to the lowermost Miocene in age.

Unit S-9 : This unit is distributed in the lowlands around the Melawi River and Kayan River in the northwestern part of the survey area. It shows virtually similar features with Unit S-8 and the photo analysis shows that shale. This unit corresponds to Lebang Claystone in the upper part of the Melawi formation by Zeijlmans van Emmichoven, C.P.A. (1939). It is reported to consist mainly of shale associated with alternation of arkose sandstone and arenaceous marl, gradually changing to the Plateau

Sandstone horizontally and vertically.

Unit S-10 : This unit is of small distribution near Mirih village in the southern part of the survey area. This is impossible to analyze by topographic features under the aerial photographs. It is delineated on the basis of the survey by GSI. This unit consists of andesitic agglomerate and covers unconformably granitic and metamorphic rocks.

Unit S-11 : This unit is of small distribution at the branches of Hahoi River and a portion of the upper reaches of Baraoi River in the south central part of the survey area. It is characterized by low resistance and flat lowlands. According to the survey results of GSI, this unit consists of sandstone. It covers unconformably metamorphic and granitic rocks.

Unit S-12 : This unit is mainly distributed as thin beds in an area where Unit S-3 is developed in the central-north and northeastern part of the survey area. Topographically, it is subdued by the lower strata (Unit S-3). It forms flat hills. It is characterized by the dendritic drainage and vegetation of tall trees. There is no description about this unit in the previous data. It is assumed that this unit consists of unsolidified silt of relatively young age.

(4) Quaternary sediments

Unit Q : This is distributed principally along Barito River and Malawi River, the principal rivers in the survey area. It is a river deposit consisting of sand and gravel.

(5) Pre-Tertiary granitic rocks

Unit I-1 : This unit is distributed at the southern part of the survey area, principally around Mirih River and Kahayan River, and the southwestern part of the survey area. It is characterized by moderate resistance and sometimes dense annular drainage texture. Trees are high and the vegitation is dense. According to the survey of GSI, it is composed of gneiss.

Unit I-2 to I-4 : These units, as a whole, are distinguished from other units by mere topographical characteristics. But their boundaries between them are not clear and it is difficult to differentiate each from the other. All of them have high resistance and, in part, moderately to highly dense dendritic drainage texture. Their distinguishing characters are: Unit I-2 has high resistance, sharp ridges and generally sparse vegetation; Unit I-3 has round ridges and deep valleys; Unit I-4 is almost similar to Unit I-3, but it has sharp ridges. These units, as a whole, consist of granites and diorites. It is not clear whether the differences of the photocharacteristics of these rocks are due to variation of lithofacies in the same intrusive body or due to plutonic rocks that were intruded at different stages.

(6) Tertiary igneous rocks

Unit V-1 : Since the distribution range of this unit is small, it is impossible to distinguish it on the aerial photographs. This unit has been clarified as granite by the survey of GSI. It is distributed minutely in catchment area of Mirih River, Kahayan River and Kapuas River in the southern part of the survey area. This unit intrudes Units M, I-1, S-1, and S-4.

Therefore, the stage of intrusion is Tertiary or later.

This young acidic intrusive rock is developed in Sarawak and Sabah too; and it is known, by absolute age, that the similar rock in Sarawak is Middle Miocene (Knee, Meng Leon, 1972).

Unit V-2 : This unit is distributed in small patches of intrusives throughout whole survey area. It is particularly concentrated at the area between Barito River and Laung River in the central eastern part of the survey area, and at the headwaters of Kahayan River and Mirih River in the central and northwestern parts of the survey area. It is characterized by high resistance, protruding peaks and radial drainage texture. The vegetation is, in general, sparse. This unit intrudes all units within the survey area, except the Quaternary river deposits. The unit is composed of andesite and basalt, Tertiary in age or younger, according to the survey of GSI.

Unit V-3 : The distribution of Unit V-3 is almost similar to that of Unit V-1. The distribution range of Unit V-3 is however wider compared to that of Unit V-2 which is mainly elliptical. It is characterized by high resistance and radial or subparallel drainage. The vegetation is, in general, sparse like Unit V-2.

According to the survey of GSI, this unit consists of andesitic to basaltic lavas and contains partly pyroclastic rocks of the same nature.

2 - 2 - 2 Summary of geology

Summarizing the geology of this area,an idealized cross section is shown in Fig. 3.

The pre-Tertiary system that forms the basement of this area consists of Units M, T and S-1. Judging from lithology, and in accordance with

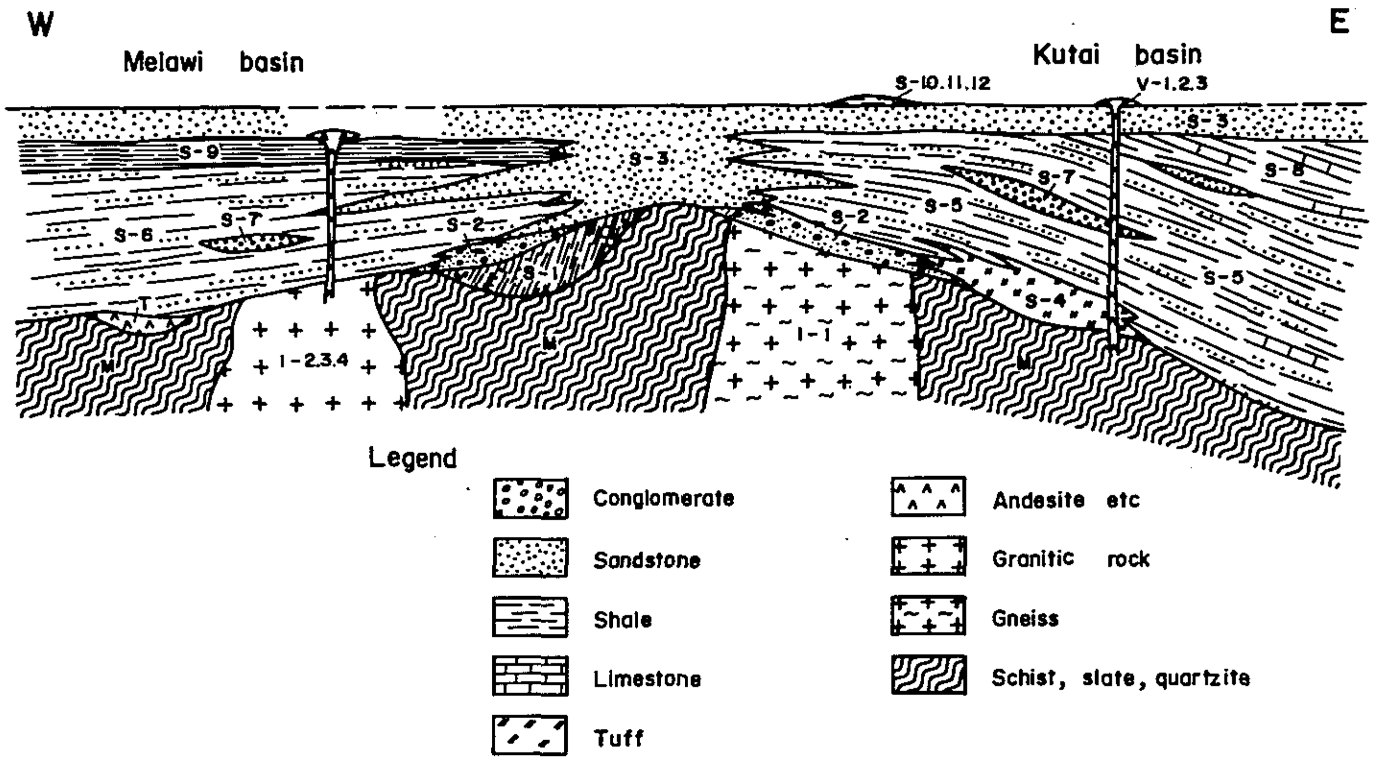


Fig. 3 Idealized cross section

Knee Meng Leon's stratigraphy (1972), they are correlated as follows. Most of Unit M is probably correlated with Terbat formation of Carboniferous to Permian age, and partly with Sadong formation of Triassic age and Serabang formation of Jurassic age. A part of the schist of Unit M is correlatable with Kerait Schist of pre-upper Carboniferous age. Andesite of Unit T is correlated with Serian Volcanic formation of Triassic age. Shale containing limestone-sandstone could be correlated with Serabang formation of Jurassic period or Pedawan formation of Cretaceous period. Granitic rocks and gneisses are not definitely clear, except that these rocks certainly intdude a part of Unit M, and they are covered unconformably by Tertiary rocks. The igneous activities related with these intrusive rocks mainly consist of three cycles in Sarawak, namely: Paleozoic to Triassic period; Jurassic to Cretaceous period and upper Cretaceous period. But it is not clear in which cycle the granitic rocks were intruded.

The Tertiary system consists of deposits of two sedimentary basins, divided almost at the centre of the area. The sedimentary basin of the western part of this area almost occupies a half eastern area of Melawi basin, and these deposits are classified in accordance with the stratigraphy of Zeijlmans van Emmichoven, C.P.A. (1939). The horizon that contained mainly Unit S-6 and subordinately Unit S-2 and Unit S-7 is correlated with Melawi Proper of the lower part of Melawi formation. The horizon of Unit S-9 is possibly correlated with Lebang Claystone. It is inferred that thickness of the formation totals 2,000 - 3,000 m.

The sedimentary basin at the eastern part of this area forms the western margin of Kutai basin, and the deposits of this area are correlated with the stratigraphy of Kutai and Barito basin by Samuel, L. and Muchsin, S. (1975). According to the fossils found by the survey of GSI, the lowest part of Unit S-8 belongs to the uppermost Eocene and the uppermost part of it belongs to the lowermost Miocene. The major part of it belongs to Oligocene. Unit-8 is probably correlated with Berai formation. Judging from the fact, it is assumed that Units S-2, S-4, S-7 and S-5, which correspond to the lower bed of Unit S-8, are correlated with the Tanjung formation of the Eocene age. The relationships between the strata composing mainly Unit S-5 and Unit S-8 are gradual conformity.

Unit S-3, distributed at the northern part of this area, is terrestrial sediments called Plateau Sandstone. Unit S-3 covers unconformably the pre-Tertiary system at the central part of this area and interfinger with the sediments of Melawi basin and Kutai basin. Towards the west, in Melawi basin, Unit S-3 comes to occupy the upper part of Unit S-9. According to Zeijlmans van Emmichoven, C.P.A. (1939), it seems that Melawi formation grades to Plateau Sandstone. Toward the east, from the west end of Kutai basin,Unit S-3 comes to cover Units S-2, S-5, and S-8 in slightly angular unconformity.

In effect, Plateau Sandstone covers directly the pre-Tertiary system at the area dividing Melawi basin from Kutai basin. The upper horizon appear transgressively on the basin sides. This fact suggests the expansion of the terrestrial area. Since Plateau Sandstone does not contain fossils clearly indicative of the age, its accurate age is not determined. Judging from the available data and the result of this survey, it is nearly certain that its age is Eocene to Oligocene. But it is possible that the lower part of Plateau Sandstone is late Cretaceous, as exemplified in West Sarawak by Khee, Meng Leon (1972). In this case, Plateau Sandstone may interfinger with Unit S-1 partially. Its upper limit may reach up to Miocene.

The other sedimentary rocks are Units S-10, S-11, and S-12. Since these rocks are folded slightly like Unit S-12, they are not Quaternary sediments. They are probably Miocene or later. Judging from the distribution and lithofacies, Units S-11 and S-12 could be formed under lacustrine environment.

Units V-1, V-2, and V-3 have been formed by Tertiary igneous activities. Judging from their occurrences the age of the granitic rocks (V-1) is Oligocene or later. According to Khee Meng Leon (1972), the stage of intrusion of Tertiary granitic rocks is middle Miocene in West Sarawak, and the Kinabalu granite in Sabah is Pliocene. The granites of the area (V-1) are assumed Miocene or Pliocene also, and this interpretation is not inconsistent with their occurrences. Units V-2 and V-3, could have piled up repeatedly at the stage of deposition from Unit S-2 to Unit S-9, i.e., the stage from Eocene to Oligocene, and partially reached up to Miocene.

2 - 3 Geological structure

The geological structure of the survey area is divided into three tectonic provinces roughly as follows :

1) The southwestern and central northern upheaval zones, where basement rocks are distributed.

2) The basin from the central northern part to the northwestern part of the survey area (eastern part of Melawi basin).

3) The basin at the eastern part of the survey area (the western

margin of Kutai basin).

The boundary between Melawi basin and Kutai basin is an upheaval zone, but no clear boundary line is drawn. Near the boundary, Tertiary basal conglomerate and sandstone are present.

In the eastern side of Melawi basin, although small-scale and loose fold structures exist in the whole, the structure is generally NW or N dipping loose monocline. At the western side, a synclinal structure with E-W fold axis develops.

In Kutai basin, towards the east, the upper strata are distributed gradually. In the eastern edge, a synclinal structure is formed at the position corresponding to the western elongation of the center of the deposition in Kutai basin by Samuel, Luki and Muchsin, S.(1975).

The dips of sedimentary rocks in both basins are low, in general, and are less than 15°. In particular, the dip tends to become low from the Plateau Sandstone (Unit S-3) and upwards.

The fold structure in distribution area of the basement is not clear by photogeological analysis.

The photolineament from aerial photographs have differences in density and direction from place to place. At the southwestern part in which the basement rocks are exposed, as shown in Fig. 4, generally the lineaments are predominant from N-S system to NE system, following NW system parpendicular to the former. The greater part of lineament is about 2 to 5 km long, and those of WNW system tend to have continuation.

At the upheaval zone in the central northern part, in which Unit S-1 is distributed, as shown in Fig. 5, there are two structural systems, namely one is NE to ENE system and NWN to NW system normal to the former.

At the area corresponding to Melawi basin in the northwestern part, as shown in Fig. 6, remarkable direction is recognized, and NNW system is predominant. These photolineaments tend to concentrate in Units S-5 and S-7 in Melawi Proper. But photolineament is developed locally in the Plateau Sandstone (Unit S-3), and is recognized perceptibly in Unit S-9 (Lebang Claystone).

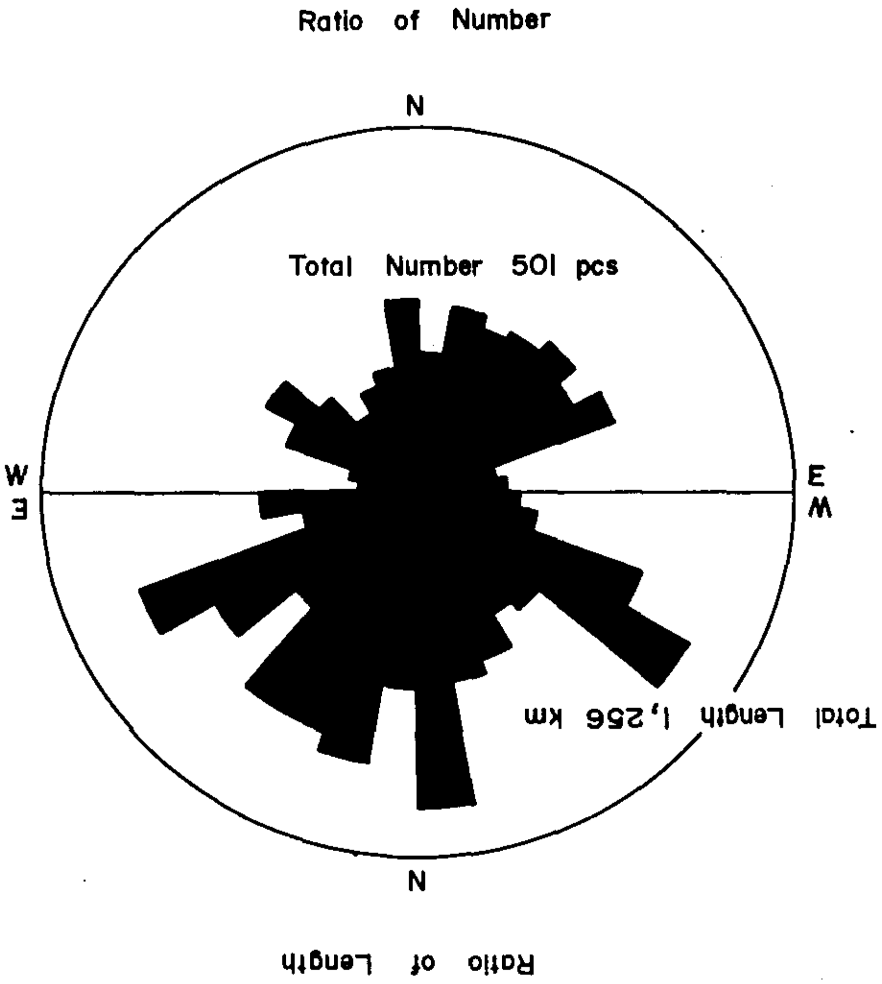
At the area corresponding to Kutai basin in the eastern part, as shown in Fig. 7, there develop ENE system and WNW-NW system. Generally, developments of photolineament are a little, especially no clear lineament is recognized in the area covered by Plateau Sandstone.

As is described above-mentioned, lineaments in this area are of predominant two systems such as NE system or NW system, and in the area except Melawi basin, these two systems are recognized.

These photolineaments are unrelated to bedding, schistosity and boundary of stratum. Therefore it seems that most of the photolineaments reflect fault structures.

In this area, two principal faults of NE-SW system are recognized at the eastern part. One of them is faced between Tewah village and Mirih village along the Kahayan River, and northward. The fault becomes subdued within sandstone and conglomerate beds (Unit S-2). The basement rocks are bordered by Tertiary sandstone and conglomerate (Unit S-2) at this fault in the western tributary of Kapuas River. Other faults trend in the NE direction through Rudijak Village along Kapuas River and Muara Lahung village along Barito River.

This fault is inferred from the fault structure shown by airborne magnetic survey that had been carried out before this survey. It seems that Tertiary igneous rocks intrude along fault lines, but the detail is



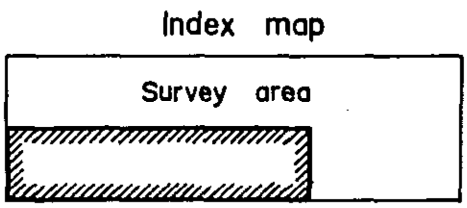


Fig. 4 Rosegraph of lineament
(S-W part of survey area)

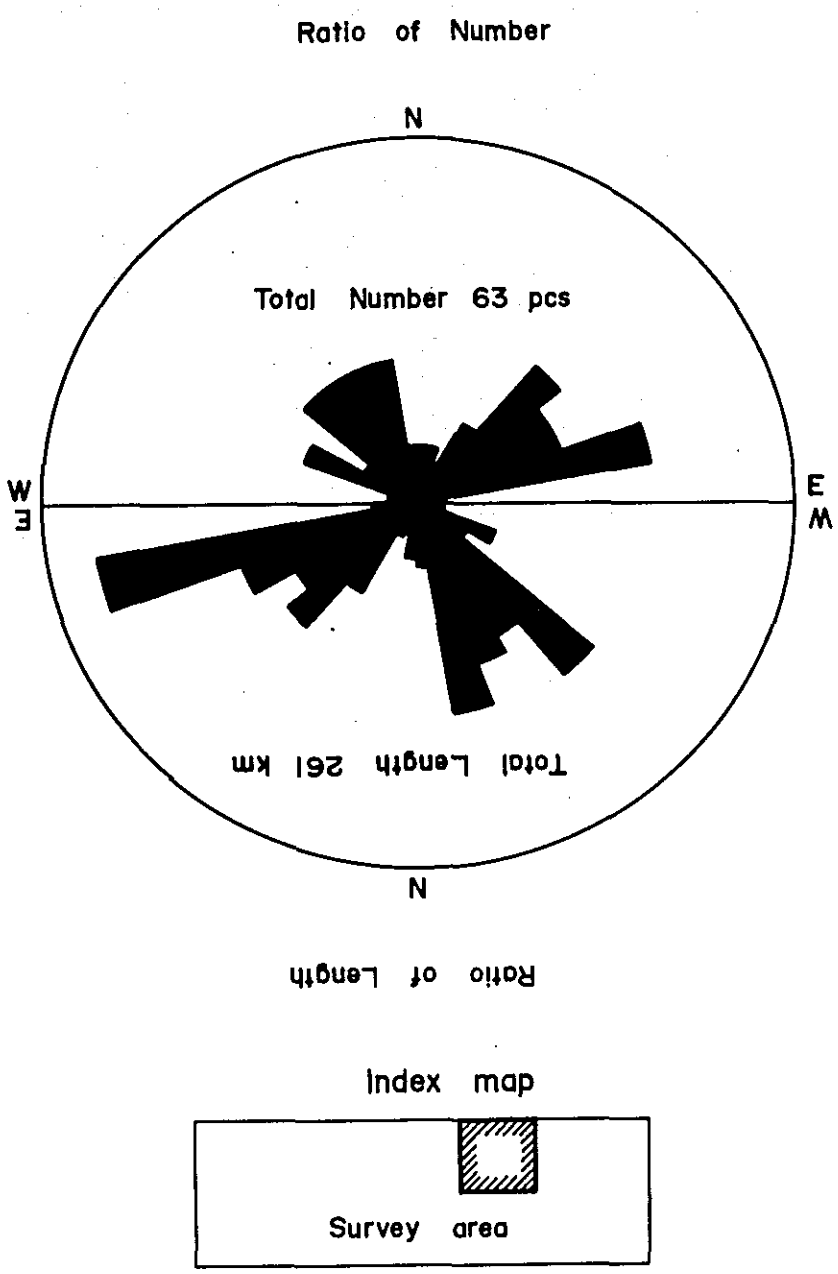
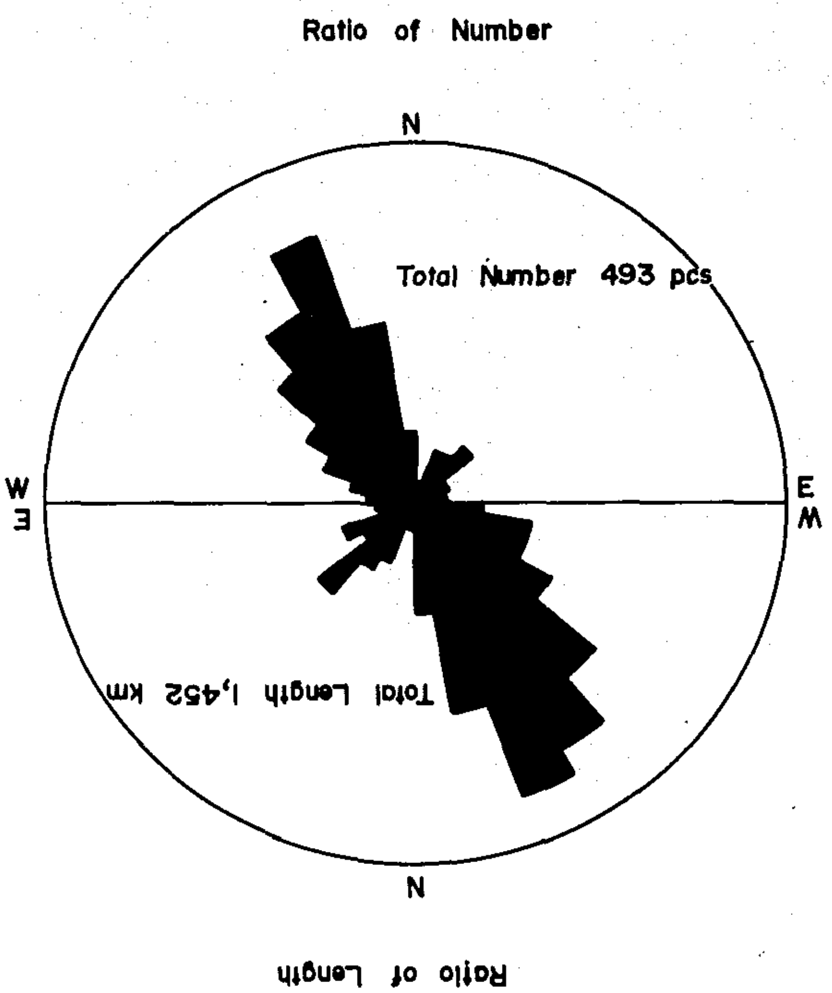


Fig. 5 Rosegraph of lineament
(N-E part of survey area)



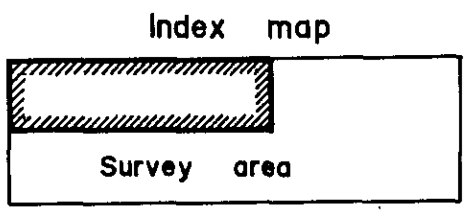
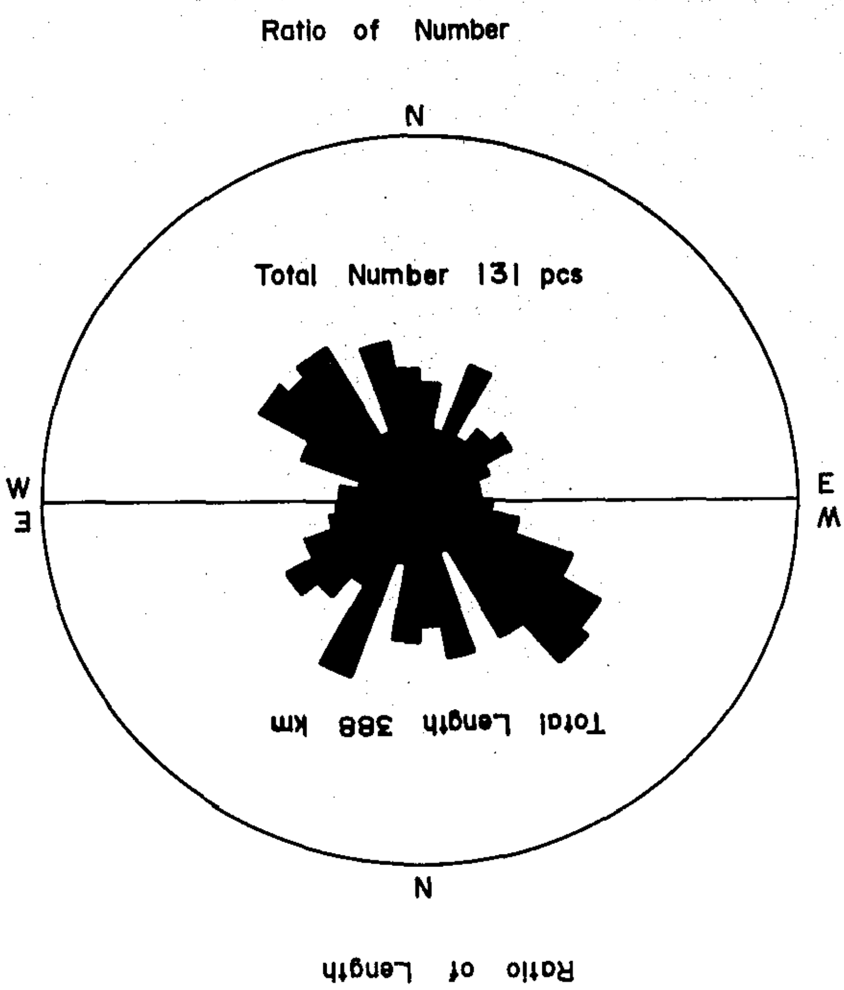


Fig. 6 Rosegraph of lineament
(N-W part of survey area)



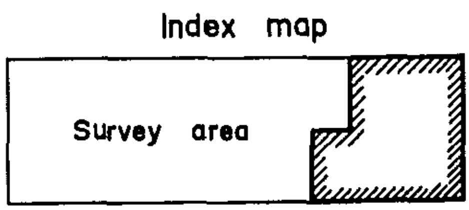


Fig. 7 Rosegraph of lineament
(E part of survey area)

not clear owing to insufficiency of geological data.

2 - 4 Mineral deposits

2 - 4 - 1 Description of mineral deposits

Ore deposits in this region are divided into four types;

1) Mineralization of either copper, lead, or zinc.

2) Gold deposits.

3) Diamond deposits.

4) Coal seams.

The gold and diamond deposits have been mined so far in a small scale by panning. All descriptions in this chapter are based on the data of the geological reconnaissance undertaken independently by the GSI. No detailed investigation on ore deposits has been carried out beyond their survey.

(1) Mineralization of base metals

This type of mineralization is concentrated at the central southern area of the region. There exist 14 deposits especially within the confined areas around the rivers of the Kahayan, Mirih and Kanpuas. Most deposits have the mode of occurrences of a vein or net-work type. Ore minerals consist usually of pyrite, sphalerite, galena and rarely chalcopyrite.

B - 1 : This mineralized zone is located along a branch of the Mirih River, to the northeast of the Lapan village. It consists of net-work veins with a maximum width of a few centimeters and with discontinuous extent of a few hundred meters along the branch. Ore minerals are chalcopyrite, galena, sphalerite and pyrite. The host rock is sericite schist. Chemical analyses of two selected samples are as follows;

Cu	> 2.00%	0.05%
Pb	0.07%	0.05%
Zn	0.30%	0.07%

B - 2 : This zone extends along the NNE direction, at the east of the Rangan Hiram village. There are two areas, with the interval of 2 kilometers, which consist of clusters of parallel veins with a maximum width of 20 to 30 centimeters. The veins are composed mainly of quartz. Ore minerals are pyrite and small amounts of chalcopyrite, bornite and sphalerite at the margins of the veins. The host rock is probably sandstone although the original rock has been altered by strong silicification and pyritization.

B - 3 : This zone is located at the upperstream of the Mirih River. Numerous irregular thin veins of powdery pyrite occur in andesite. No ore mineral other than pyrite is observed. The width of veins is about 25 centimeters at its maximum. A similar veins with about one meter in width is confirmed at a place of the one kilometer downstream.

B - 4 : This zone is at the upperstream of the Mirih River. Veins of mainly pyrite and sphalerite occur with a width of about one meter. The host rock is unknown because of severe silicification.

B - 5 : This zone is also located at the upperstream of the Mirih River. Several irregular veins with a maximum width of one meter occur in shale. Pyrite is the only one ore mineral in the veins.

The intrusions of small granite dykes of Tertiary in age are observed along the routes between the two zones, B - 3 and B - 4. The granite dikes and the host rock are often altered by mainly silicification with pyrite dissemination.

B - 6 : This zone is at the north of the Hamputung village. There are irregular veins in andesite with a width of 10 centimeters and with a discontinuous extent of about 100 meters along the marsh. With the naked eye, only pyrite is recognized in the veins. Chemical analyses of the selected samples show no copper, no lead, neither zinc. The host rock is andesite.

B - 7 : Several veins of 50 centimeters in a maximum width occur in schist and gneiss along the marsh at the west of the Tekoroi village. The length of the area along the marsh is about 2 kilometers. Ore minerals consist mainly of pyrite, a small amount of galena, and sometimes minor contents of chalcopyrite and sphalerite. According to the chemical analyses, one of the best ores contains a trace of gold, 300g/T of silver, 2.00% of lead, 0.20% of copper and 0.07% of zinc. The host rock consists of schist and gneiss.

B - 8 : Quartz veins of 3 centimeters in width occur in gneiss at the north of the Tekoroi village. Ore minerals such as pyrite and only a minor amount of chalcopyrite are found in the veins.

B - 9 : This zone is located at the upperstream of the Meraya River, about 2 kilometers outside of the survey area. This zone consists of pyrite veins with a width of a few centimeters and occur in gneiss.

B - 10 : This zone occurs in conglometrate at the upperstream of the Mahoroi River. The major veins accompanying several thin veinlets are 0.3 to 1.5 meters in width with the confirmed length of 15 meters. Ore minerals consist mainly of pyrite and a minor amount of chalcopyrite. The ore contains the 0.03% of copper.

B - 11: Pyrite veins with a width of about 10 centimeters occur in andesite at the upperstream along the Kahayan River, from the Mahoroi village.

B - 12 : Pyrite veins of 20 to 30 centimeters in width occur in sandstone at the upperstream along the Kahayan River, from the Mahoroi village.

B - 13 : Several veins with a maximum width of 50 centimeters are sporadically distributed in slate over the area of about 2 kilometers along the upperstream of the Kapuas River. Only pyrite is observed with the naked eye.

B - 14 : The disseminated zone of pyrite, with severe silicification, occurs in tuffaceous sandstone over the area of 10 kilometers at the downstream of the Mendang River.

(2) Gold deposits

There are eight gold deposits which are classified into two modes of occurrences; gold bearing quartz veins and alluvial deposits at the area of the Barito River and of the Kapuas River.

G - 1 : This is an alluvial deposit located at the upperstream of the Usu River. At present gold is panned during the rainy season.

G - 2 : The clusters of gold bearing quartz veins over a width of 2 to 3 centimeters occur in andesite at the north of the Dirung Linking village. The ore near the surface is presently mined by hand by several workers.

G - 3 : This is an alluvial deposit located at the area of the Beriwit River. About twenty people are usually panning for gold.

G - 4, 5 and 6 : All these deposits are of alluvial at the area of the Barito River. The gold is panned only during the rainy season.

G - 7 : The deposit occurs in coarse quartz sandstone near the Pinang village. Numerous gold-bearing quartz veins with a maximum width of about 50 centimeters are sporadically distributed over the area of one kilometer along the marsh. The ores near the surface are mined by hand by several workers and panned on the spot.

G - 8 : The gold bearing quartz veins with a maximum width of one meter occur at the area of the Senamang River, toward southwest of the survey area. The ore is mined at present by seventy miners through the pit sank with one meter in diameter and 4 meters in depth. They are also crushing screes of the gold-bearing quartz veins.

(3) Diamond deposits

There exist two diamond mines at the southeast of the survey area. Diamond is picked from the surface soil overlying the Tertiary sandstone and conglomerate. The deposits appear to be of Alluvial, but the origin is rather speculative. The mining procedure is a panning of soils obtained through the pit sank with the size of 1.5 meters in diameter and 6 meters deep. It is said that the D - 1 deposit has produced a diamond of maximum size of 25 carat. The tone ranges from transparent to yellowish tint. At present, two hundred or three hundred miners are working in these mines.

(4) Coal seams

It is said that coal is presently mined in a small scale in the neighborhood of the survey area. However, a few poor outcrops of coal layers are only observed within the area.

C - 1 : There are three coal layers in alternations of sandstone and shale. The layers are 4 to 5 meters in thickness. Only one outcrop in the survey area was found but no confirmation of the lateral extent was made.

C - 2 : Two coal layers occur with an interbedded shale of about 50 centimeters thick.

C - 3 : The coal layer is 1.5 meters thick and laterally about 15 meters long.

2 - 4 - 2 Summary of mineral deposits

The mineral deposits are classified into four types as described above. Gold and diamond are at present mined but the future outlooks for development are poor because of small scale of deposits. It is also poor in respect to coal except its mining in a small scale judging from the thickness of seams at the outcrops.

Mineralizations of base metals, copper, lead and zinc are concentrated at the central south of the survey area. They are definitely in some relation with the distribution of the Tertiary granite intrusions which are characteristic geological episode in the central south. The field survey also suggests that there is a relationship between the mineralization and the intrusion of the granite, since the rock alteration accompanying pyrite dissemination tends to become stronger toward the margin of the granite.

The distribution of the Tertiary granite in the survey area coincides geotectonically with the extension of the Kinabalu granite of Tertiary in age, which brings about large scale porphyry copper deposits.

Thus, although the mineralization reported here are so far generally poor, it suggests strongly the necessity for exploration of porphyry copper deposits.

Chapter 3 Discussion

In this chapter, the geological structure and mineralization will be mainly discussed, on the basis of the results of the already mentioned, with the consideration of the airborne magnetic survey results.

The airborne magnetic survey results are in good agreement with the geological structure obtained by the present survey. Considering that the results also give us some significant information concerning the subsurface structure which would be never known by means of either photogeological or field survey, geological comments are given to them.

At the end of this chapter the necessary future surveys are suggested on the basis of the results discussed (ref. Fig. 8).

1) Geological structure of the Pre-Tertiary system

The analyses of the airborne magnetic survey data indicate a magnetic half basin structure opened against the north of the central northern part. The location of the opening area is different from that of the center of the Melawi basin, and the eastern area is corresponding to the area of distribution of the pre-Tertiary rocks. According to Knee, Meng Leon (1972), a marine transgression at the Jurassic age covered the northern wing of the Sunda Shield. This magnetic basin is not related to that at the Tertiary age. This is reflected by a shape of the sedimentary basin at the late Mesozoic age. It is therefore considered that the area of the magnetic basin is close to a center of the late Mesozoic sedimentary basin.

In the eastern area, a magnetic syncline with a direction of ENE is observed. At the eastern margin, the syncline extends toward

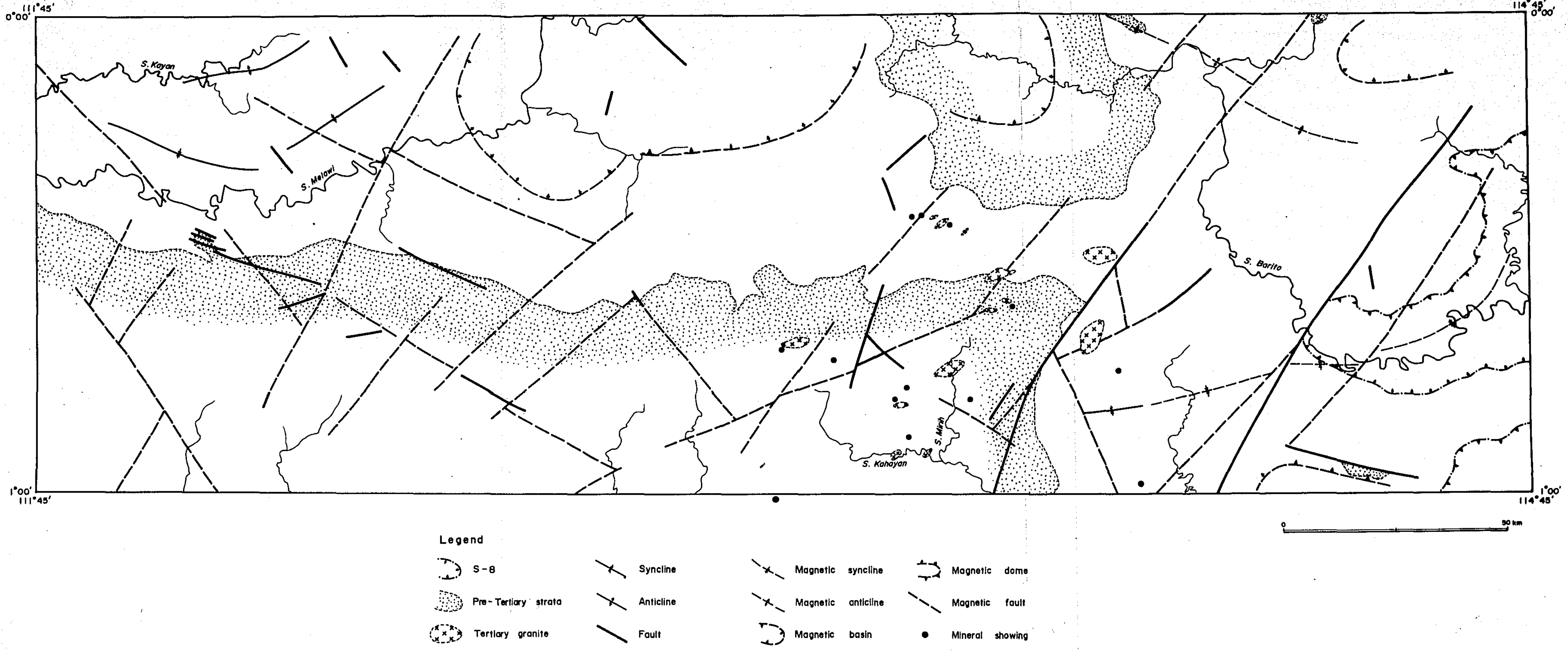


Fig. 8 Compiled structural map

the central part of an area of the unit S-8 distribution which is the uppermost formation of the area. However, it is not consistent with the present geological structure. This suggests that the magnetic syncline reflects the boat-shaped basin of the basement.

A magnetic anticline with a direction of WNW and magnetic domes are dominant at the north eastern area which corresponds to the wing of the syncline, and at the southeastern area, respectively. Also the syncline is located at the center of the Kutai basin from Eocene to Oligocene in age (Samuel, L. and Muchsin, S., 1975). Accordingly, it appears that the area is equivalent to the western margins of the Kutai basin which forms a boat-shaped basin during sedimentation.

2) Fractures

Faults and magnetic structural lines (hereafter simply called fractures) in this region are divided into two systems, the NW to WNW and NE systems. Both systems are intersecting each other or sometimes perpendicularly. The fractures with the WNW system and NE system are continuous in the western area and eastern area respectively. Both fractures tend to be dominant in the area of the basement rock distribution and in the Kutai basin, but less dominant in the Melawi basin.

3) Mineralization

Gold, diamond and coal deposits of four types of mineralization are rather in small scale for the future development. The most promising mineralizations of copper, lead and zinc will be therefore discussed in this section.

Such promising mineralizations are of a vein or dissemination types. Both types seem to be intimately related with the Tertiary granite. The future prospecting of ore deposits should be undertaken for porphyry copper or large scale vein-type deposits.

The Mamut mine, at the Sabah State, along the northeastern extension of the survey area, is a porphyry copper deposit with a close relation to the Kanabalu granite, Tertiary in age. The mine and the area under the present survey are located in the area of the similar geological structure. The distributions of the mineralized zones of copper, lead and zinc, and the Tertiary granite are concentrated at the centeral southern part of the survey area. The geological features of this area are characterized as follows:

(a) The area is close at the boundary of the Tertiary basin at the northeastern end of the Sunda Shield.

(b) It is equivalent to the intersection of two structures with the EW system concordant with a general extension of the Melawi basin, and with a NS system which is a direction of the western margin of the Sunda Shield as shown in Fig. 2.

(c) Among fractures identified in this survey, the continuous fracture with the WNW system is changing in its direction to the NE system in this area where numerous fractures occur.

It is considered that the ore mineralizations and the intrusion of the Tertiary granite are probably controlled by the above geological features which indicate the area to be characteristic, comparing with other area.

4) Recommendations on future survey

The outline of the geology in the survey area has been revealed by the present work and surveys carried out since 1975, although there remain some parts which are not investigated or obscure. Because of the extremely vast area, it is impossible to survey in more detail than the reported here over the whole region within one year which is the final year of the project. Therefore, it is reasonable to recommend that the future survey should be concentrated at the restricted area with the promising features mentioned in this report.

The most promising deposits are mineralized zones enriched in copper, lead and zinc, of which origins are probably related to the Tertiary granite. The survey of the next year should be confined at the central southern area with such deposits. It is unlikely that there are promising areas for prospecting other than the reported area.

The investigation of the mineralized zone was done by using the results of the geological reconnaissance of the GSI since it can not be obtained from the photo-geological survey. Thus, only the outline of the mineralized zones is given here.

It is recommended that the more detailed survey is carried out next year in the restricted area and the features of each mineralized zone are clarified in connection with the geological structure. Thus, the possibility for the future development can be examined. The proposed investigations are the geological field survey including the investigation of ore deposits at the promising area. It may be more effective, if geochemical prospectings are carried out at the same time.

However, it is rather premature to perform such geophysical prospecting as IP and prospecting drillings, until the gathering of the fundamental geological data of each mineralized zone is made and the data are analyzed.

Furthermore, prospectings of radioactive minerals have been carried out by the CEA-BATAN at the western side of the area. There is no information available in respect to the occurrence of radioactive mienerals in the area under consideration. Nevertheless, because of a wide distribution of granitic rocks and conglomerate, a simple radioactive prospecting should be also undertaken in order to know, if any, the extent of depositions of the radioactive minerals over the area.

Chapter 4 Conclusion

The geology and the ore deposits in the survey area are clarified by the present works with the geological reconnaissance data obtained from the GSI.

On the basis of these results, the proposed survey of the next year is summarized as follows:

The purpose:	The survey is undertaken at the promising area, with a strong stress on porphyry copper deposits or large scale vein-type deposits, which are related to the Tertiary granite. It is performed to gather the fundamental geological data of the deposits. These will be evaluated for the possible future development.
The area of survey :	The central southern area of the present survey area.
The procedure :	The geological field survey together with the geochemical prospecting is carried out, and the detailed investigation is followed on the promising ore deposits.

In addition to the above proposed surveys, it is recommended that a simple redioactive prospecting should be performed to know a distribution of radioactive minerals, if any, in this area.

References

1. Bemmelen,R.W. Van (1939); De geologiie van het westelijle deel van de Westerafdeeling van Borneo, Jaarboek van het Mijnwezen in Nederlandsch-Indie.

2. Bemmelen,R.W. Van (1949); The Geology of Indonesia.

3. Billman, Harold G. and Kartaadipura, Witoelar (1974); Late tertiary biostratigraphic zonation, Kutei basin, Offshore East Kalimantan, Indonesia. Proceeding Indonesian Petroleum Association, Third Annual Convention, June, pp. 301-310.

4. CEA and BATAN (1973); Batang Kawah, Rapport de synthese.

5. Direktorat Geologi Indonesia (1969); Peta Geologi, Kalimantan Tenggara, Sekala 1:500,000

6. Direktorat Geologi (1970); Peta Geologi, Kalimantan Barat dan Barat - Daja, Sekala 1: 500,000.

7. Direktorat Geologi (1973); Projek Survey Pertambangan,Kalimantan Tengah 1972 - 1973, No. Projek 1.2.2.1.1.

8. Gwinn, J.W., Helmig, H.M. and Kartaadipoetra,L. Witoelar (1974); Geology of the Badak field, East Kalimantan, Indonesia. Proceeding Indonesian Petroleum Association, Third Annual Convention, June, p.p. 311 - 331.

9. Jatukum,J.A. (1973); Plate Tectonics and the Search for Mineral Deposits in Western Indonesia. CCOP Newsletter, 1 (1), p.p. 14 - 17.

10. Khee, Meng Leon (1972); Regional geology, Sarawak and Sabah. Malaysia Geological Survey Annual Report, p.p. 67 - 77.

11. Ministry of Mines Indonesia, GSI, JICA and MMAJ (1977); Report on Geological Survey of Central Kalimantan (Phase I and II)

12. Ministry of Mines Indonesia, GSI, JICA and MMAJ (1978); Report on Geological Survey of Central Kalimantan (Phase II - 1,2), (Phase III - 1,2).

13. Nakamura, T., Miyake, T. and Kawano, N. (1970); Exploration and Prospecting in Mamut Mine, Sabah, Malaysia. Economic-Geology Vol. 20, No. 100, p.p. 107 - 113.

14. Samuel, Luki and Muchsin, S. (1975); Stratigraphy and sedimentation in the Kutai basin Kalimantan. Indonesia petroleum association Fourth Annual Convention Jakarta June 2 - 3, p.p. 1 - 17.

15. Zeijlmans van Emmichoven, C.P.A. (1939); De geologie van het céntrale en oostelijke deel van de Westerafdeeling van Borneo. Jaarboek van het Mijnwezen in Nederlandsch-Indie.

PL. I

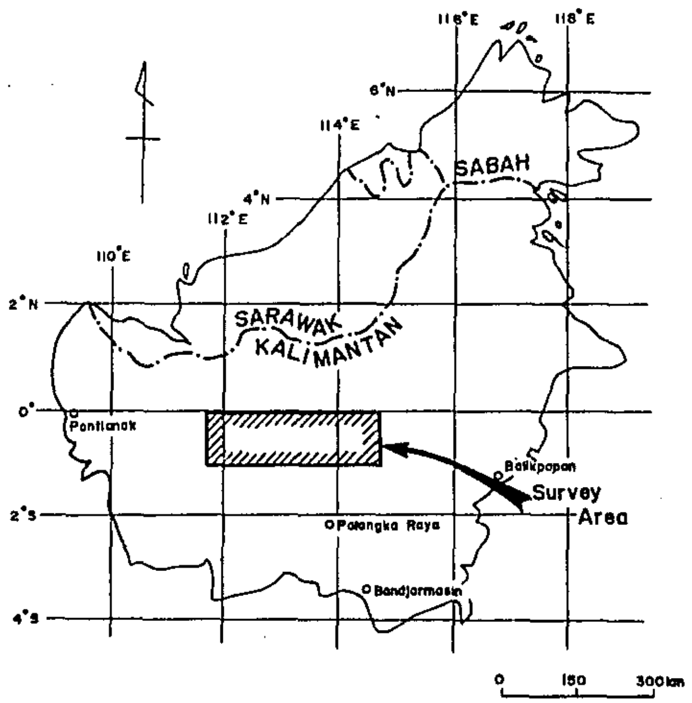
METAL MINING AGENCY OF JAPAN
JAPAN INTERNATIONAL COOPERATION AGENCY
— GEOLOGICAL SURVEY OF INDONESIA

PHOTO - GEOLOGICAL SURVEY OF CENTRAL KALIMANTAN, INDONESIA

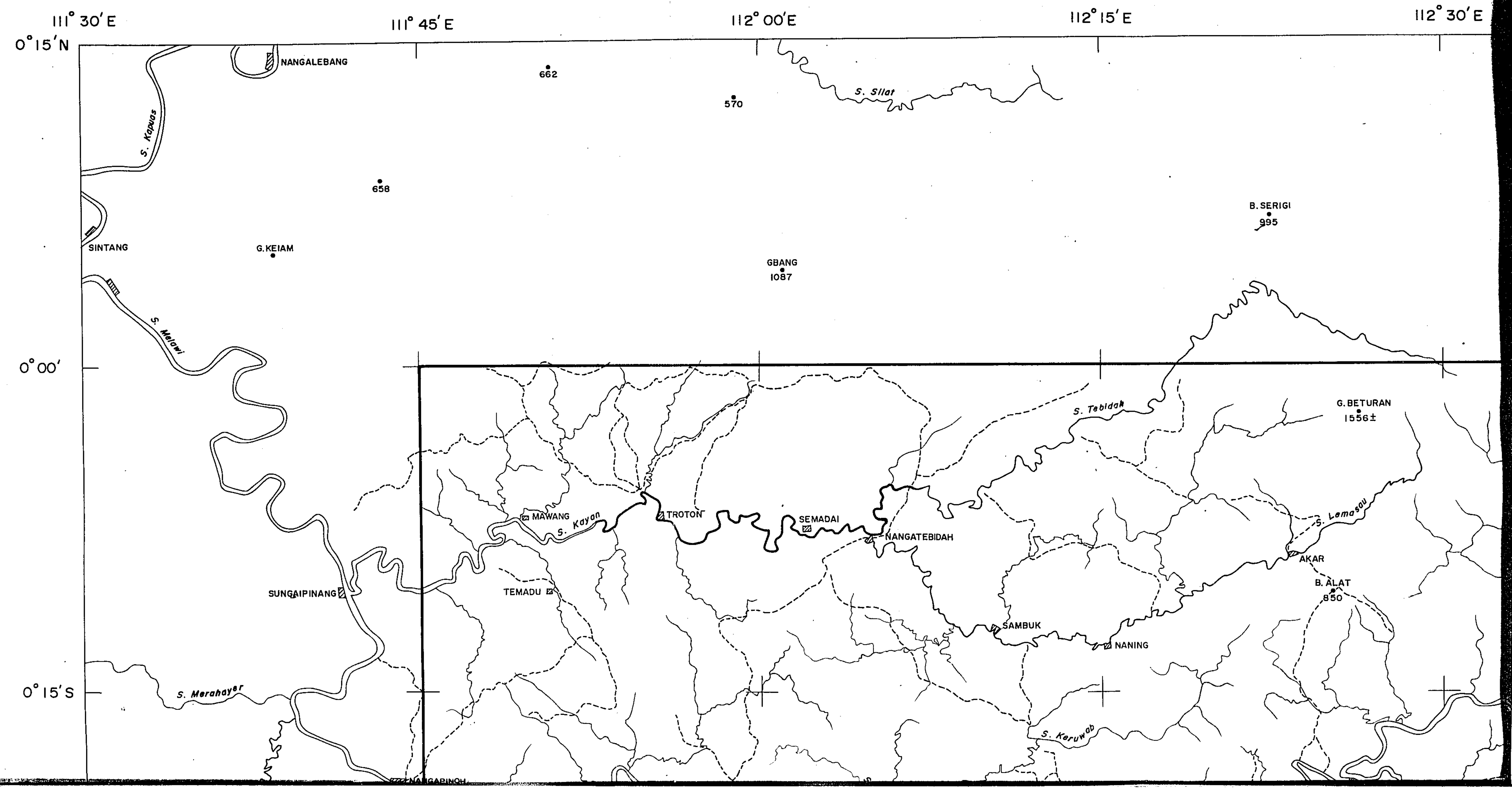
WATER SYSTEM MAP

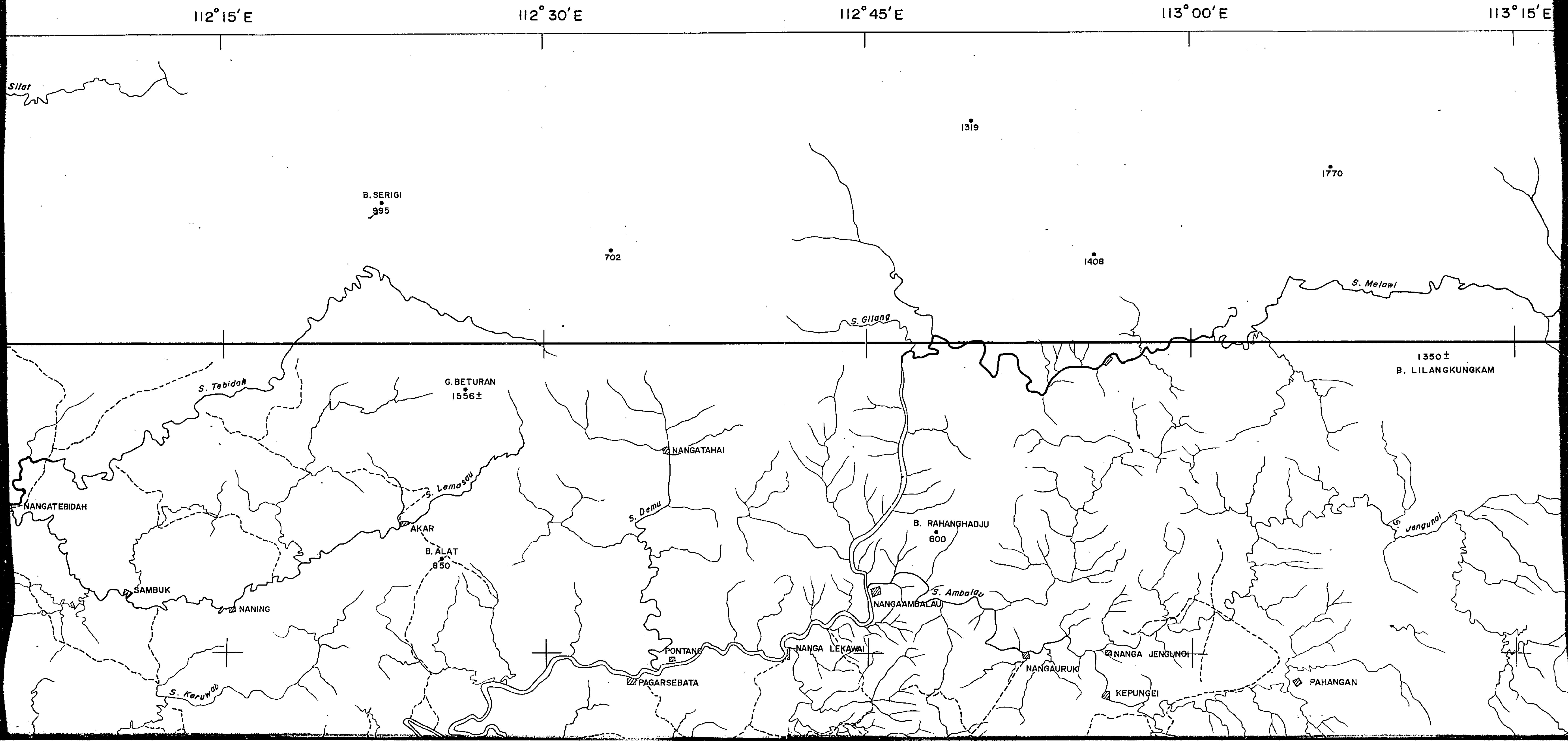
Scale 1: 250,000

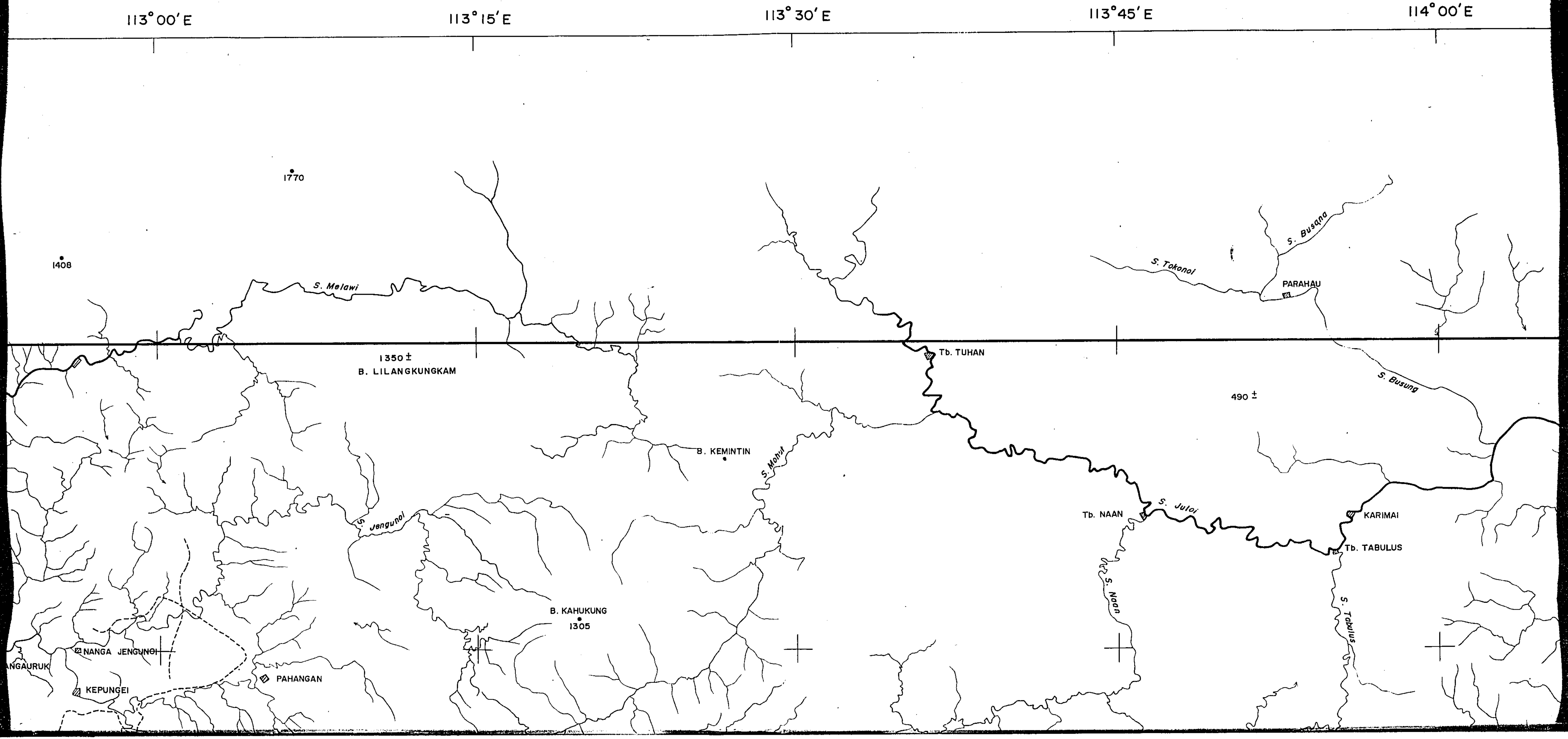
0 5 10 15 20km



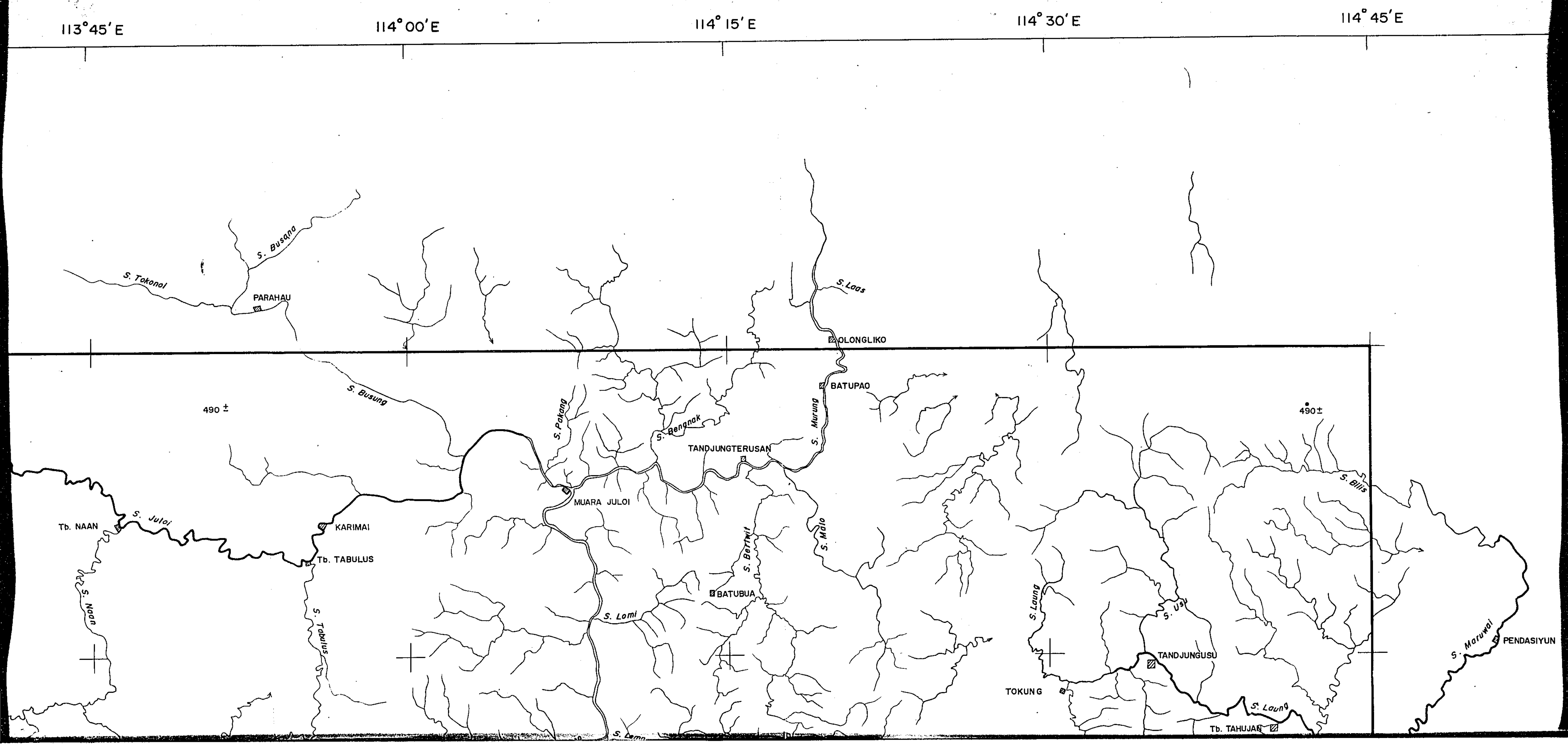
January · 1978


111° 30′ E
111° 45′ E
112° 00′E
112° 15′ E
112° 30′ E
0° 15′ N
0° 00′
0° 15′ S
NANGALEBANG
662
570
S. Silat
S. Kapuas
658
SINTANG
G. KEIAM
B. SERIGI
995
GBANG
1087
S. Melawi
S. Tebidah
G. BETURAN
1556±
MAWANG
S. Kayan
TROTON
SEMADAI
NANGATEBIDAH
S. Lemasau
AKAR
B. ALAT
850
TEMADU
SUNGAIPINANG
SAMBUK
NANING
S. Merahayer
S. Keruwab
NANGAPINOH

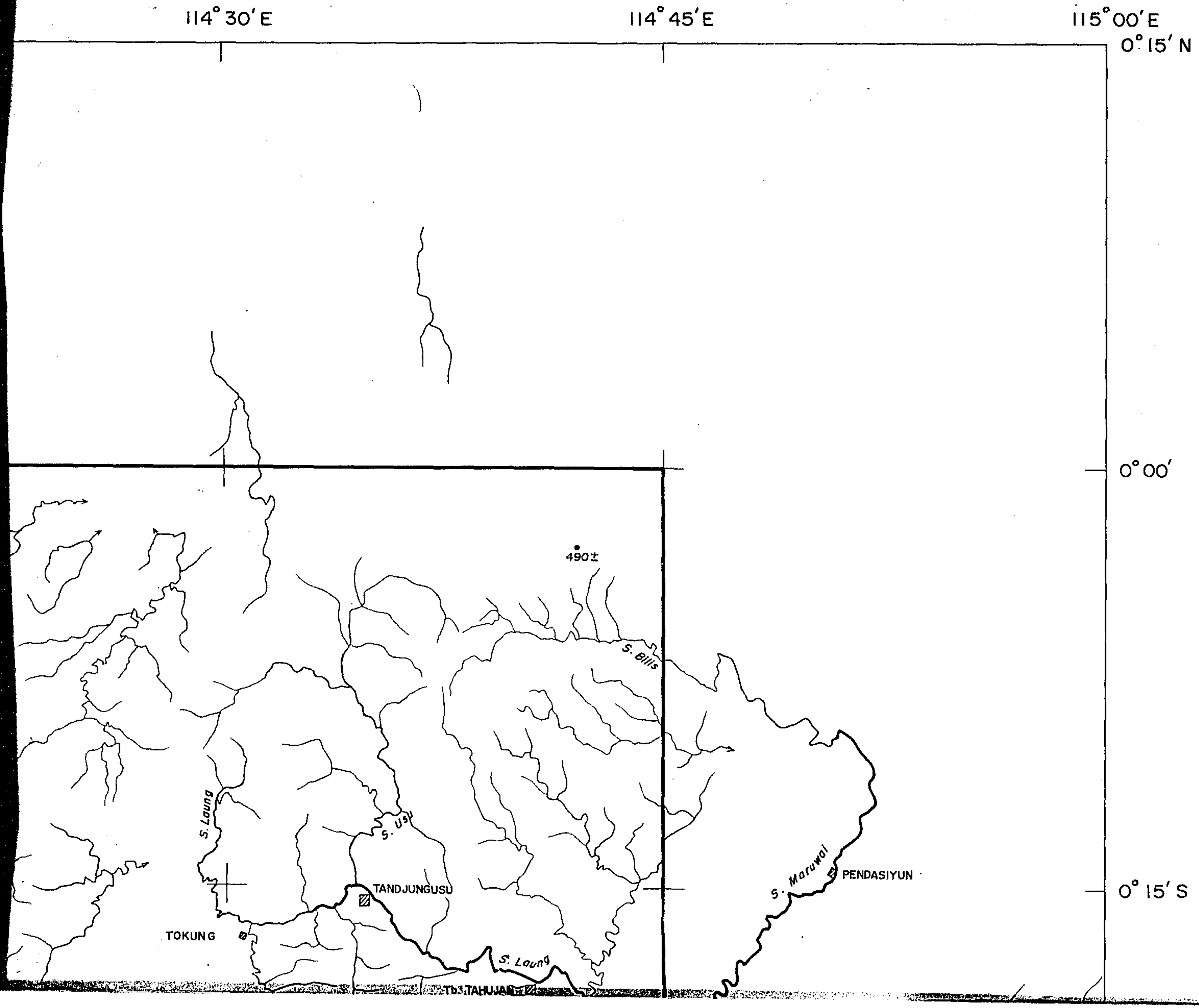

112° 15′ E
112° 30′ E
112° 45′ E
113° 00′ E
113° 15′ E
Silat
1319
1770
B. SERIGI
995
702
1408
S. Melawi
S. Gilang
1350±
B. LILANGKUNGKAM
G. BETURAN
1556±
S. Tebidah
NANGATAHAI
S. Lemasau
NANGATEBIDAH
S. Demu
AKAR
B. ALAT
850
B. RAHANGHADJU
600
S. Jengunoi
SAMBUK
NANING
S. Ambalau
NANGAAMBALAU
PONTANG
NANGA LEKAWAI
NANGAURUK
NANGA JENGUNOI
PAGARSEBATA
S. Keruwab
KEPUNGEI
PAHANGAN



113°00'E
113°15'E
113°30'E
113°45'E
114°00'E
1770
1408
S. Melawi
S. Tokanol
S. Busana
PARAHAU
Tb. TUHAN
1350 ±
B. LILANGKUNGKAM
S. Busung
490 ±
B. KEMINTIN
S. Mohut
S. Jengunoi
S. Juloi
Tb. NAAN
KARIMAI
Tb. TABULUS
S. Naan
S. Tabulus
B. KAHUKUNG
1305
NANGA JENGUNOI
NGAURUK
KEPUNGEI
PAHANGAN



113°45'E
114°00'E
114°15'E
114°30'E
114°45'E
S. Busana
S. Tokonal
PARAHAU
S. Laas
OLONGLIKO
BATUPAO
S. Busung
490 ±
490±
S. Pakang
S. Bengnak
S. Murung
TANDJUNGTERUSAN
MUARA JULOI
S. Juloi
Tb. NAAN
KARIMAI
Tb. TABULUS
S. Naan
S. Tabulus
S. Berrut
S. Malo
BATUBUA
S. Lomi
S. Billis
S. Laung
S. Usu
TANDJUNGUSU
TOKUNG
S. Laung
Tb. TAHUJAN
S. Maruwai
PENDASIYUN



PL. I

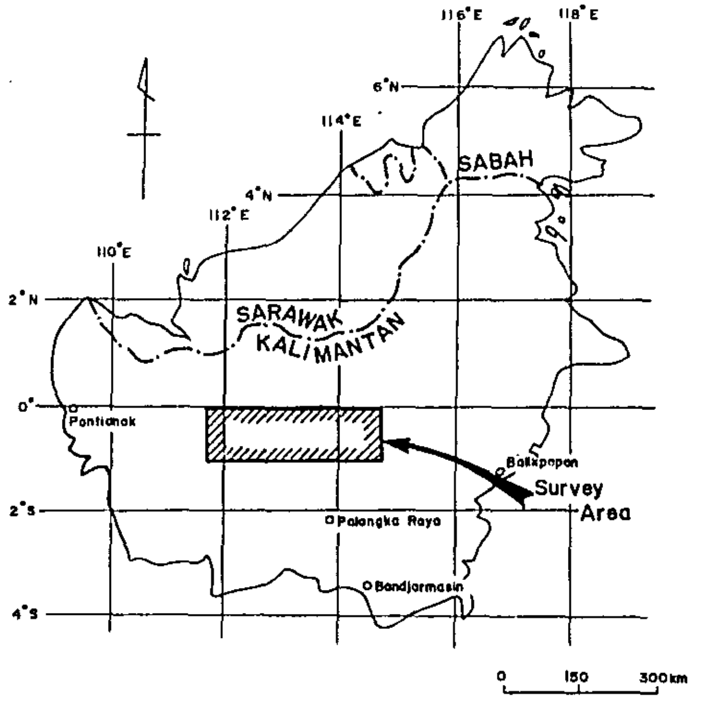
METAL MINING AGENCY OF JAPAN
JAPAN INTERNATIONAL COOPERATION AGENCY
– GEOLOGICAL SURVEY OF INDONESIA

PHOTO - GEOLOGICAL SURVEY OF CENTRAL KALIMANTAN, INDONESIA

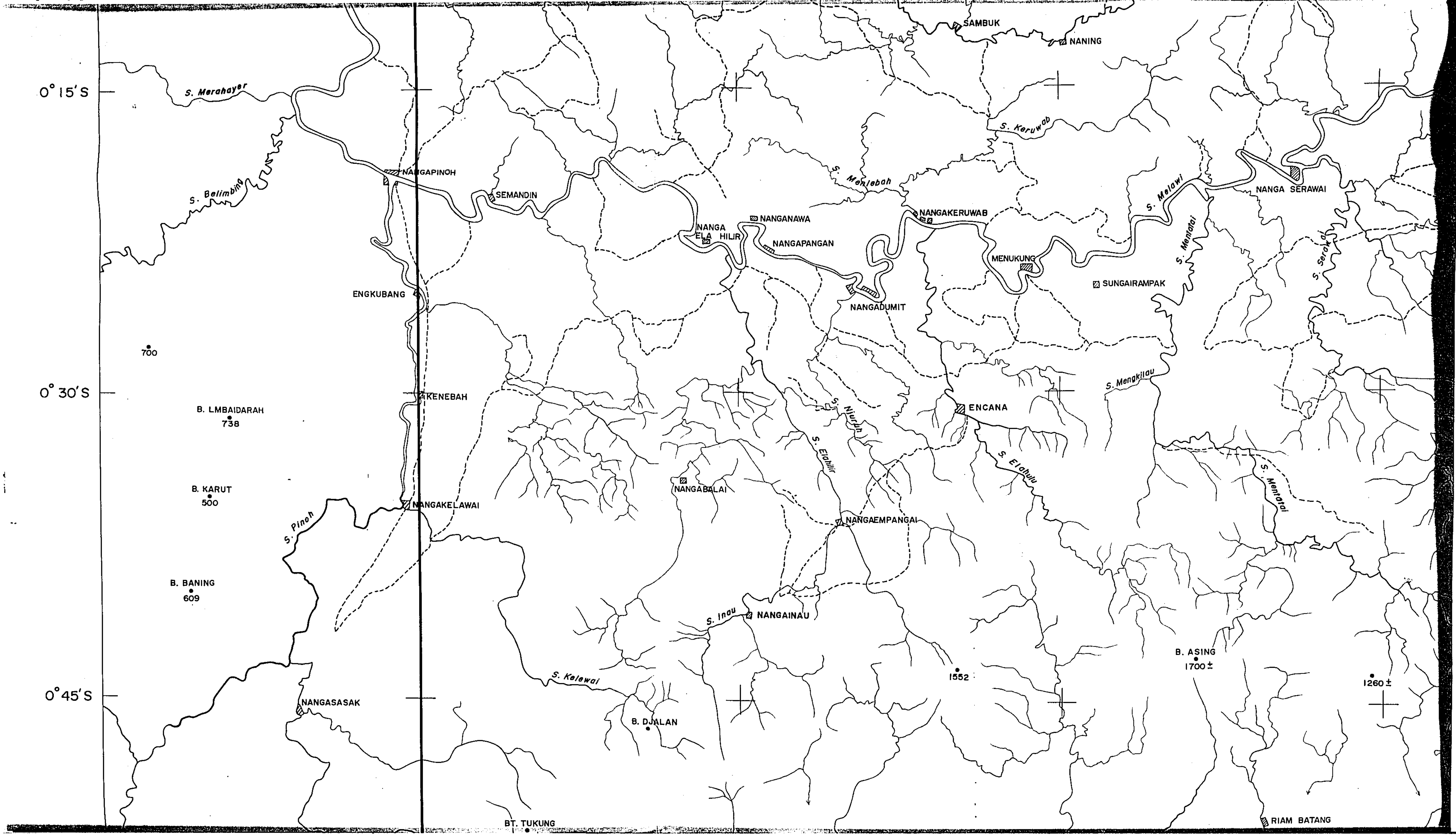
WATER SYSTEM MAP

Scale 1: 250,000

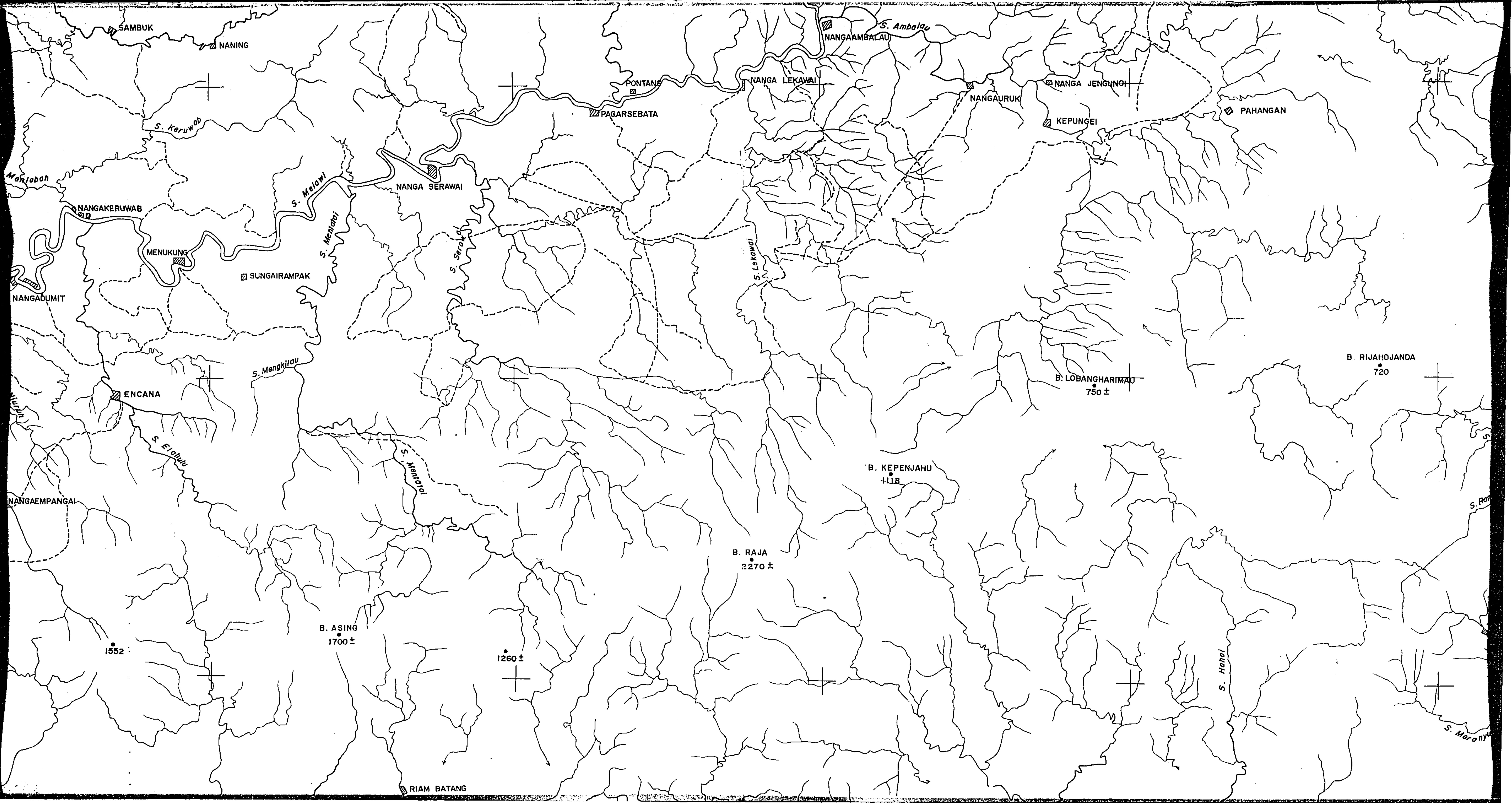
0 5 10 15 20 km

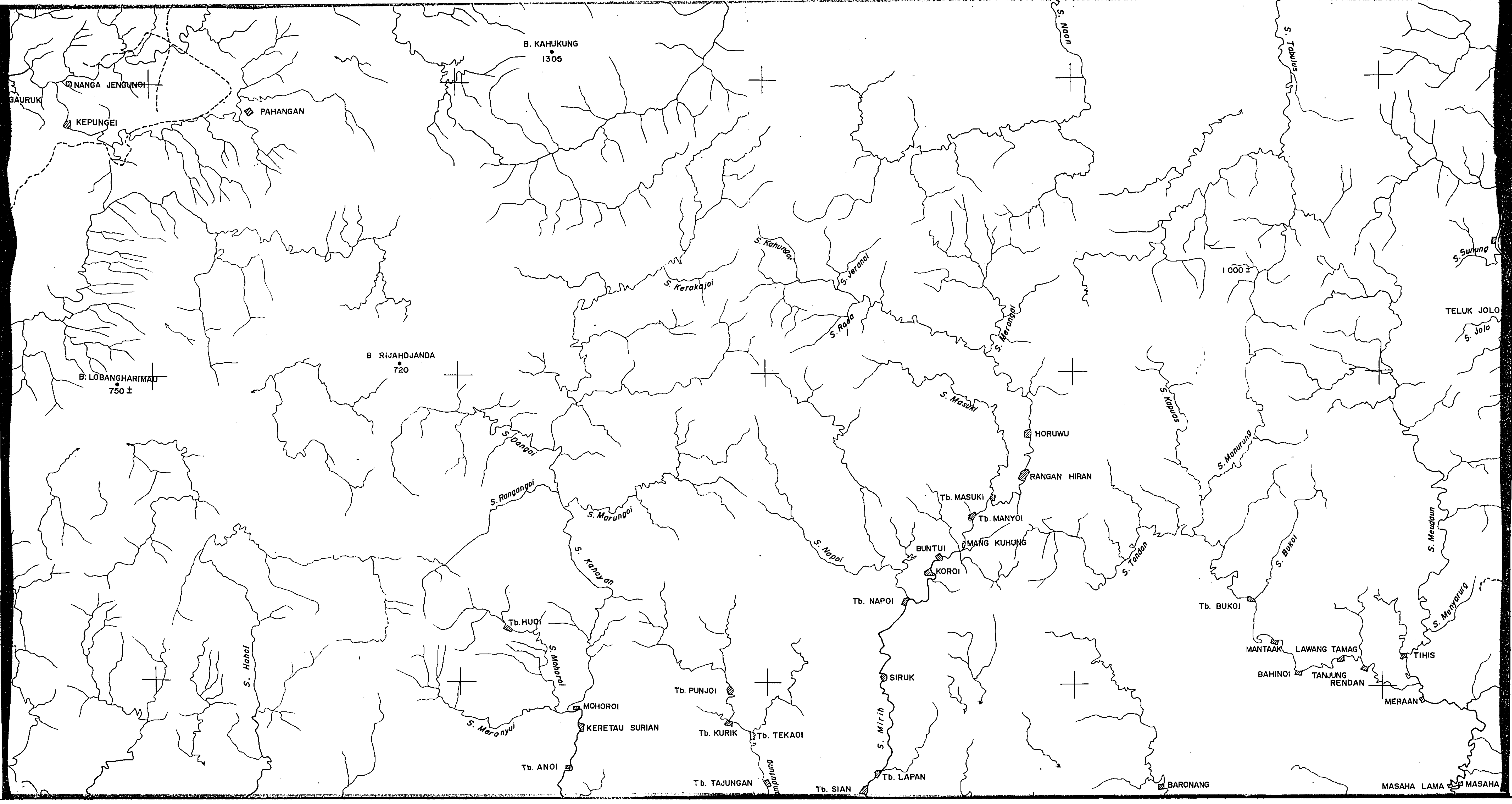


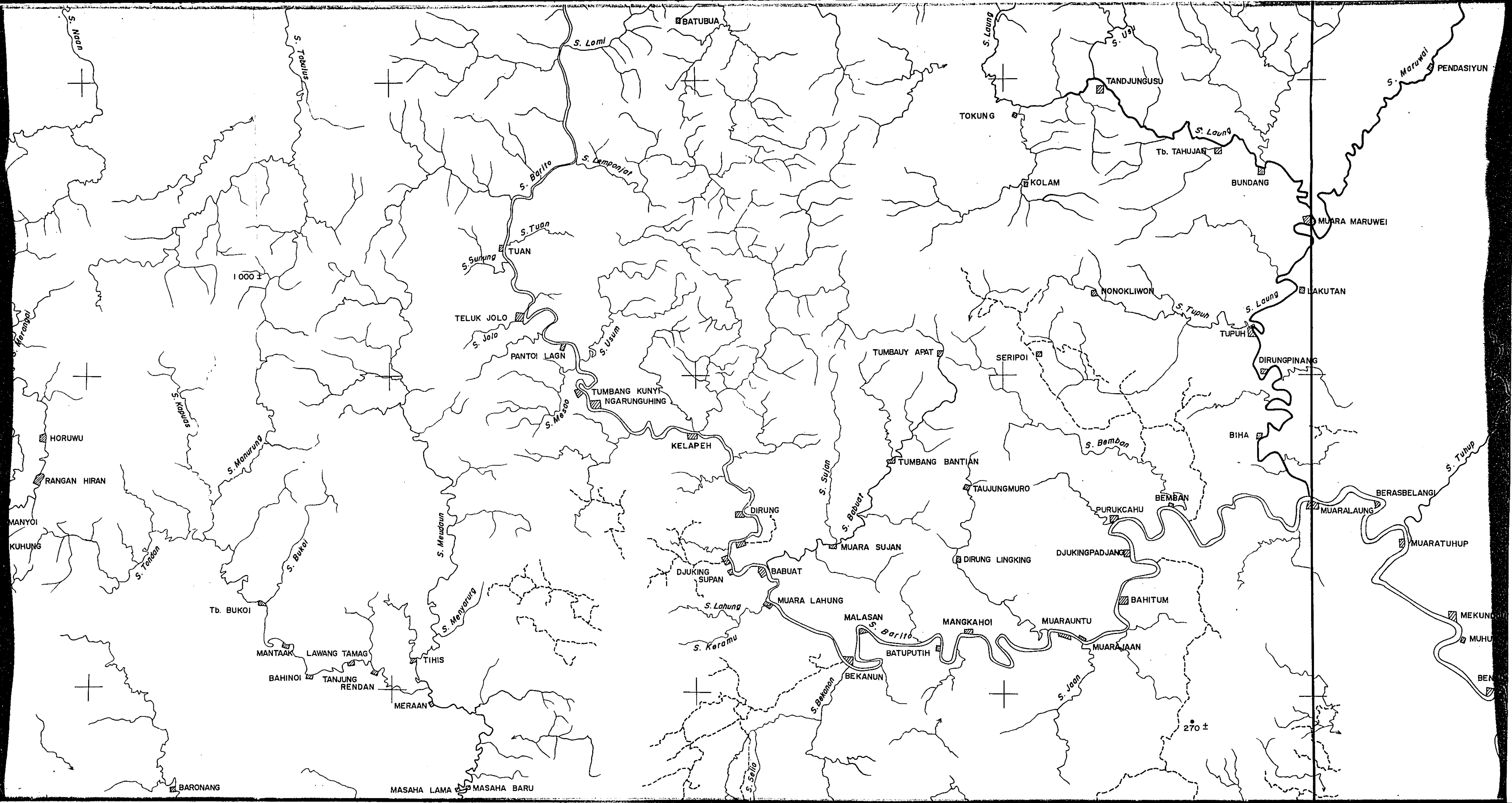
January · 1978

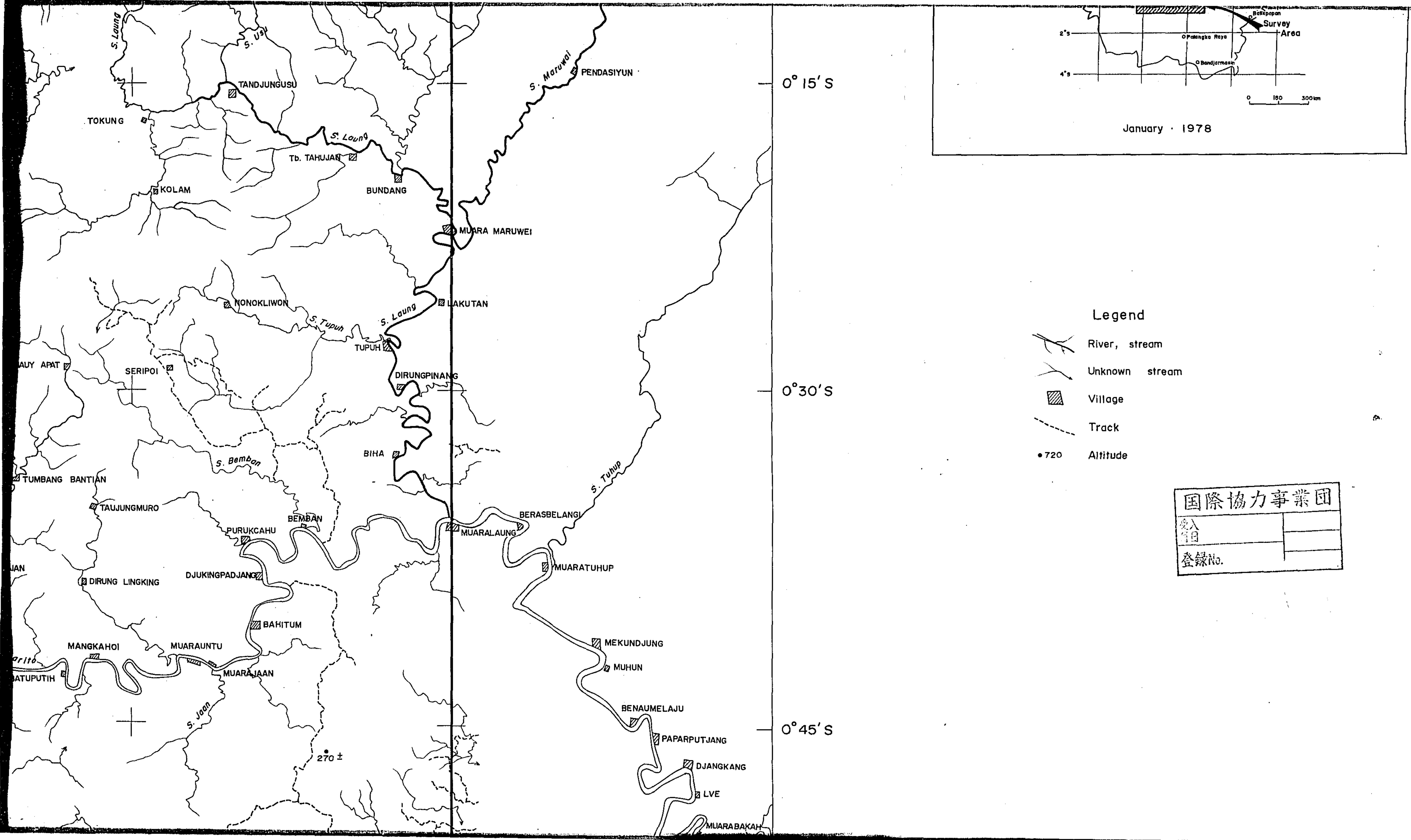


SAMBUK
NANING
0° 15'S
S. Merahayer
S. Keruwab
S. Belimbing
NANGAPINOH
SEMANDIN
S. Menlebah
NANGAKERUWAB
S. Melawi
NANGA SERAWAI
NANGA
ELA HILIR
NANGANAWA
NANGAPANGAN
MENUKUNG
S. Mentatai
S. Serawai
SUNGAIRAMPAK
ENGKUBANG
NANGADUMIT
700
0° 30'S
KENEBAH
S. Mengkilau
ENCANA
B. LMBAIDARAH
738
S. Njuruh
S. Elahilir
S. Elahulu
S. Mentatai
B. KARUT
500
NANGABALAI
NANGAKELAWAI
S. Pinoh
NANGAEMPANGAI
B. BANING
609
S. Inau
NANGAINAU
B. ASING
1700 ±
1552
S. Kelewai
1260 ±
0° 45'S
NANGASASAK
B. DJALAN
BT. TUKUNG
RIAM BATANG

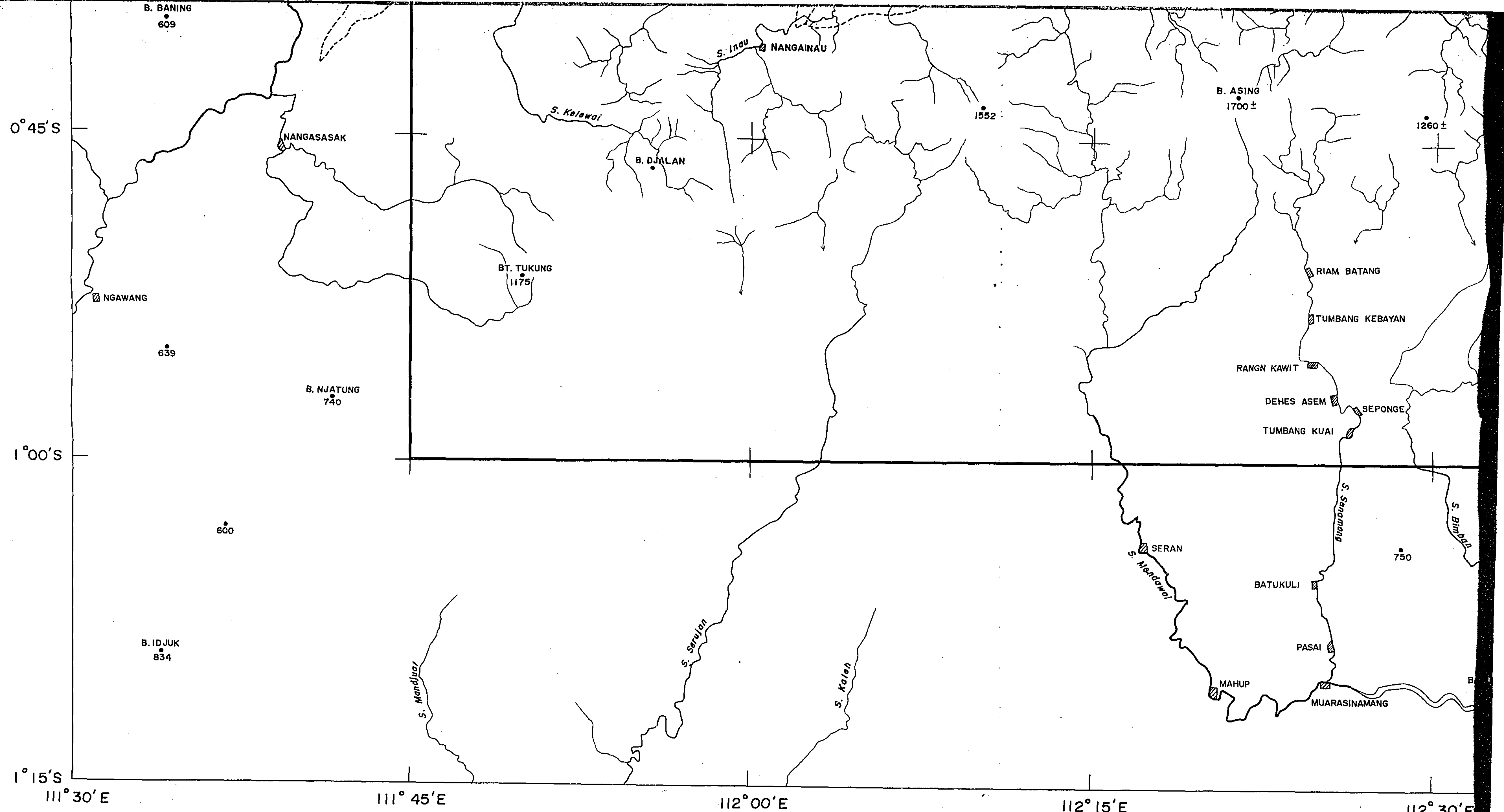

SAMBUK
NANING
S. Ambalau
NANGAAMBALAU
PONTANG
NANGA LEKAWAI
NANGAURUK
NANGA JENGUNOI
PAHANGAN
KEPUNGEI
PAGARSEBATA
S. Keruwab
S. Melawi
NANGA SERAWAI
NANGAKERUWAB
MENUKUNG
SUNGAIRAMPAK
S. Mentatai
S. Lekawai
NANGADUMIT
S. Mengkilau
ENCANA
B. RIJAHDJANDA
720
B. LOBANGHARIMAU
750 ±
B. KEPENJAHU
1118
NANGAEMPANGAI
S. Mentatai
B. RAJA
2270 ±
B. ASING
1700 ±
1552
1260 ±
S. Hahoi
RIAM BATANG

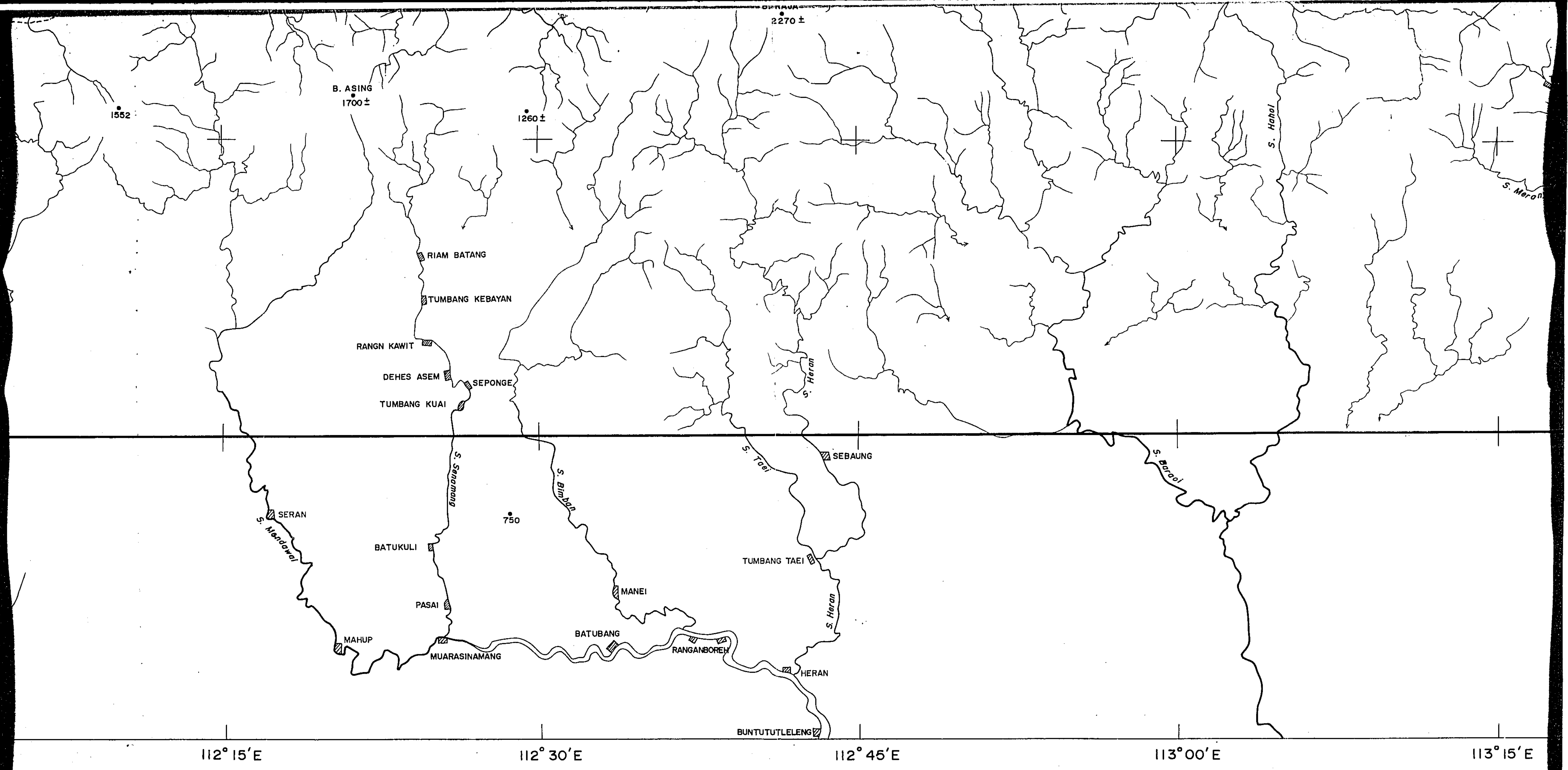

B. KAHUKUNG
1305
NANGA JENGUNOI
GAURUK
KEPUNGEI
PAHANGAN
S. Naan
S. Tabulus
S. Kahungoi
S. Jeranoi
S. Kerakajoi
S. Rada
S. Merangai
S. Sunung
1000 ±
TELUK JOLO
S. Jolo
B. RIJAHDJANDA
720
B. LOBANGHARIMAU
750 ±
S. Masuki
S. Kapuas
S. Manurung
HORUWU
S. Dangoi
RANGAN HIRAN
Tb. MASUKI
S. Rangangoi
S. Marungoi
Tb. MANYOI
MANG KUHUNG
BUNTUI
KOROI
S. Napoi
S. Tondan
S. Bukoi
S. Meudaun
S. Kahayan
Tb. NAPOI
Tb. BUKOI
S. Menyorung
Tb. HUOI
S. Mohoroi
S. Hahoi
MANTAAK
LAWANG TAMAG
TIHIS
BAHINOI
TANJUNG
RENDAN
SIRUK
Tb. PUNJOI
MOHOROI
MERAAN
S. Meranyui
KERETAU SURIAN
Tb. KURIK
Tb. TEKAOI
S. Mirih
Tb. ANOI
Tb. LAPAN
Tb. TAJUNGAN
Tb. SIAN
BARONANG
MASAHA LAMA
MASAHA

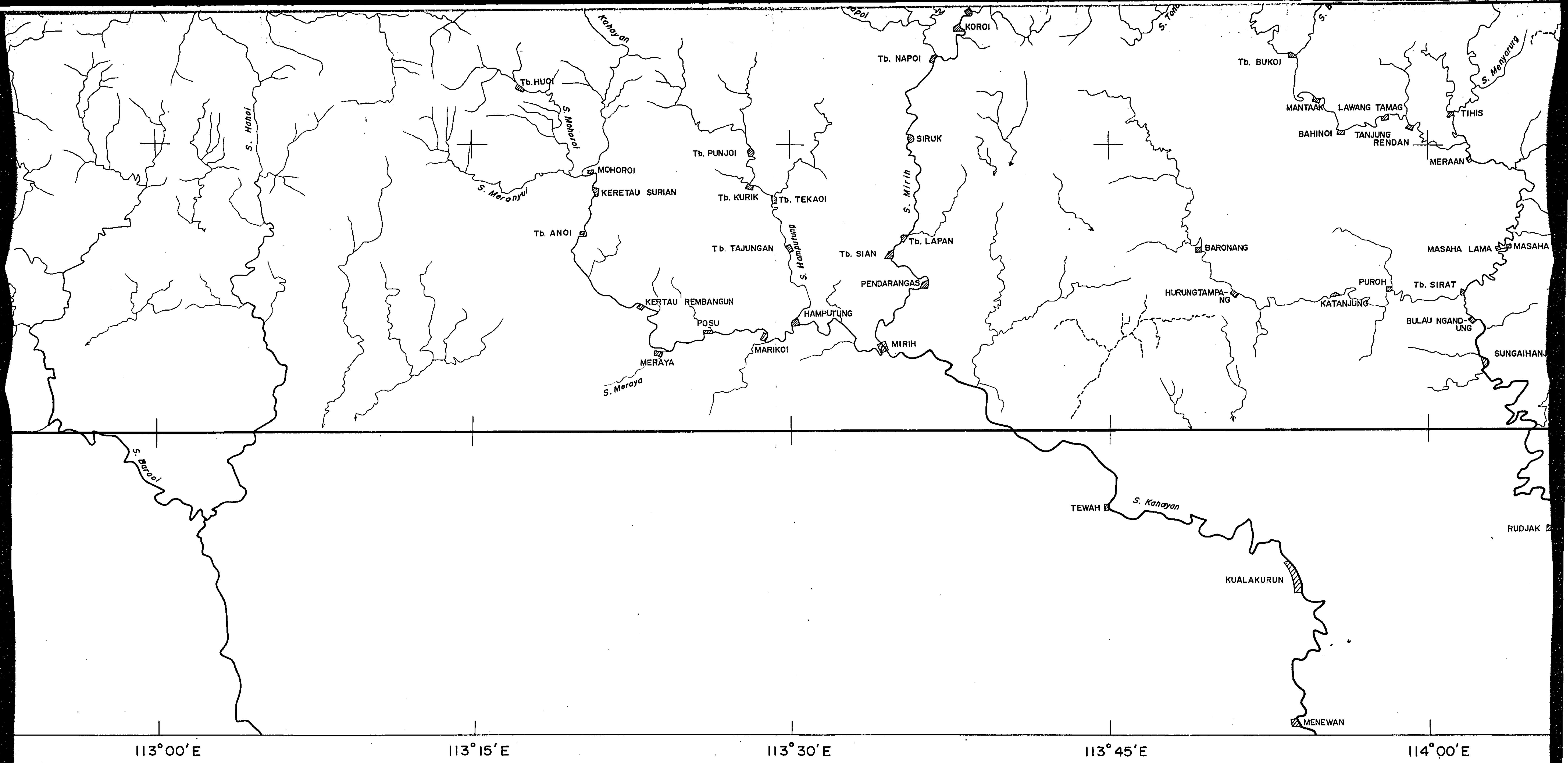

S. Naan
S. Tobulus
S. Lomi
BATUBUA
S. Laung
S. Usu
PENDASIYUN
S. Maruwai
TANDJUNGUSU
TOKUNG
S. Laung
Tb. TAHUJAN
BUNDANG
S. Barito
S. Lemponjat
KOLAM
MUARA MARUWEI
S. Tuan
TUAN
S. Sunung
1000 ±
NONOKLIWON
LAKUTAN
S. Tupuh
S. Laung
TUPUH
TELUK JOLO
S. Jolo
S. Merangai
PANTOI LAGN
S. Usum
TUMBAUY APAT
SERIPOI
DIRUNGPINANG
TUMBANG KUNYI
NGARUNGUHING
S. Kapuas
S. Mesoo
HORUWU
S. Manurung
KELAPEH
BIHA
S. Bemban
TUMBANG BANTIAN
S. Tuhup
RANGAN HIRAN
S. Sujan
TAUJUNGMURO
BEMBAN
BERASBELANGI
MUARALAUNG
MANYOI
DIRUNG
PURUKCAHU
S. Babuat
KUHUNG
S. Tondan
S. Bukoi
S. Meudaun
MUARA SUJAN
MUARATUHUP
DJUKINGPADJANG
DIRUNG LINGKING
DJUKING
SUPAN
BABUAT
Tb. BUKOI
S. Menyarung
S. Lahung
MUARA LAHUNG
BAHITUM
MEKUN
MALASAN
S. Barito
MANGKAHOI
MUARAUNTU
MUHU
MANTAAK
LAWANG TAMAG
TIHIS
S. Keramu
BATUPUTIH
MUARAJAAN
BAHINOI
TANJUNG
RENDAN
BEKANUN
S. Bekanon
S. Jaan
BEN
MERAAN
270 ±
S. Setio
BARONANG
MASAHA LAMA
MASAHA BARU

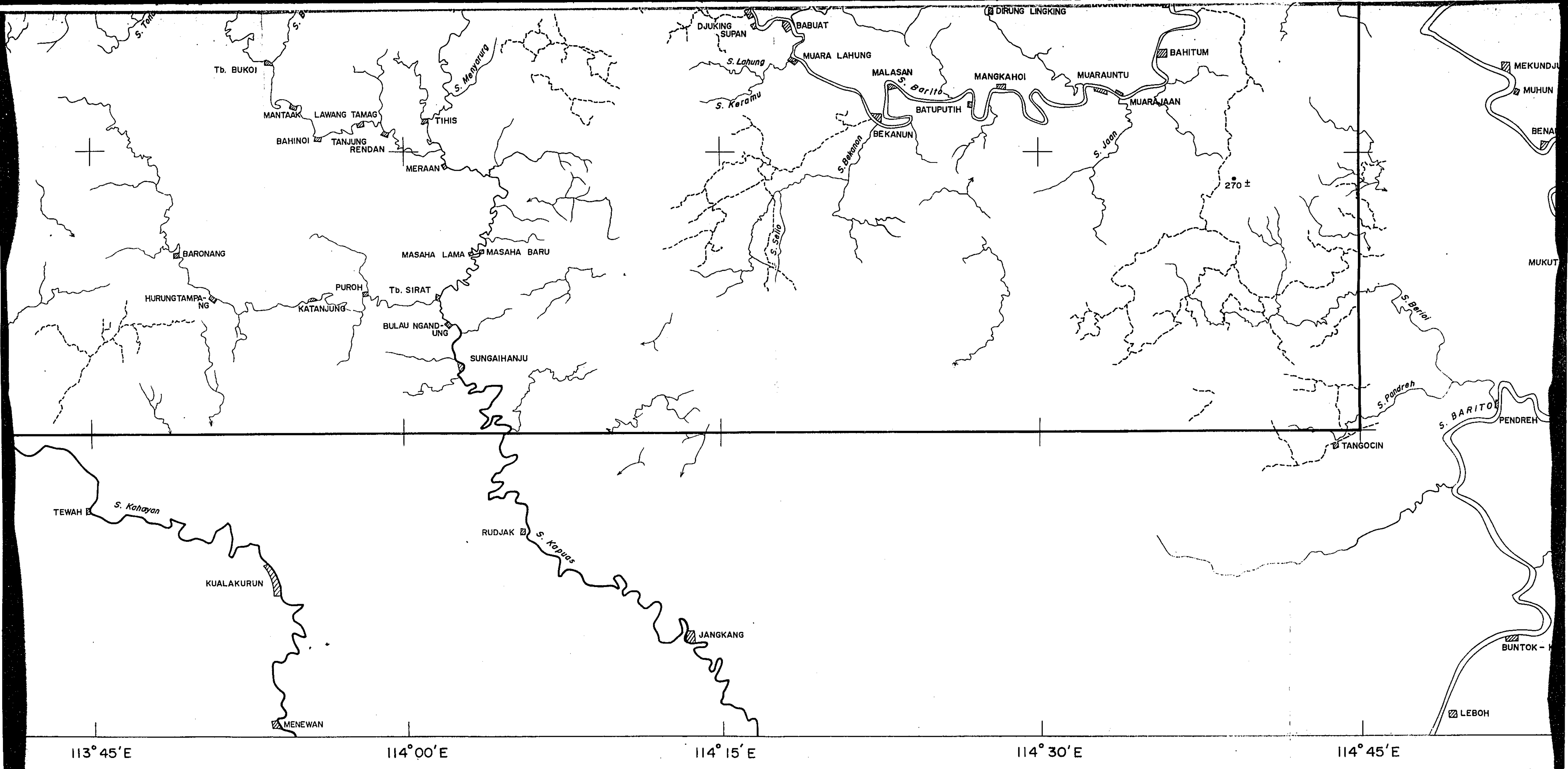


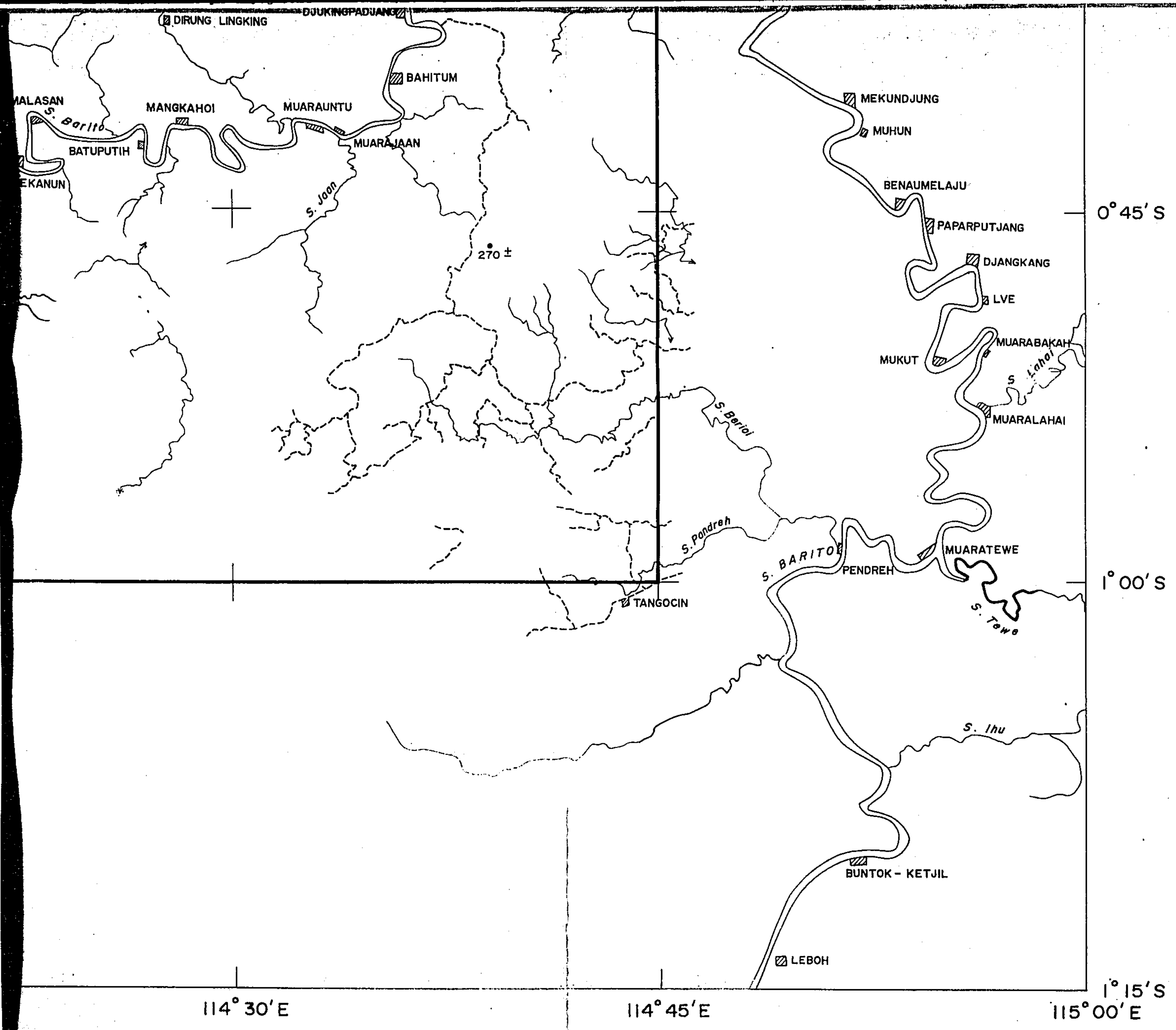
0° 15' S
0° 30' S
0° 45' S
Balikpapan
Survey Area
2°s
4°s
Palangka Raya
Bandjarmasin
0 150 300km
January · 1978
Legend
River, stream
Unknown stream
Village
Track
•720 Altitude
S. Laung
S. Usu
TANDJUNGUSU
TOKUNG
Tb. TAHUJAN
BUNDANG
KOLAM
S. Maruwai
PENDASIYUN
MUARA MARUWEI
NONOKLIWON
S. Tupuh
LAKUTAN
TUPUH
DIRUNGPINANG
SERIPOI
BIHA
S. Bemban
TUMBANG BANTIAN
TAUJUNGMURO
PURUKCAHU
BEMBAN
MUARALAUNG
BERASBELANGI
S. Tuhup
MUARATUHUP
DIRUNG LINGKING
DJUKINGPADJANG
BAHITUM
MANGKAHOI
MUARAUNTU
MUARAJAAN
S. Jaan
270 ±
MEKUNDJUNG
MUHUN
BENAUMELAJU
PAPARPUTJANG
DJANGKANG
LVE
MUARABAKAH


B. BANING
609
NANGAINAU
S. Inau
S. Kelewai
B. ASING
1700 ±
1552
1260 ±
0°45'S
NANGASASAK
B. DJALAN
BT. TUKUNG
1175
NGAWANG
RIAM BATANG
TUMBANG KEBAYAN
639
RANGN KAWIT
B. NJATUNG
740
DEHES ASEM
SEPONGE
TUMBANG KUAI
1°00'S
S. Senamang
S. Bimban
600
SERAN
S. Mandawai
750
BATUKULI
S. Serujan
B. IDJUK
834
S. Mandjual
S. Kalah
PASAI
MAHUP
MUARASINAMANG
1°15'S
111°30'E
111°45'E
112°00'E
112°15'E
112°30'E


2270 ±
B. ASING
1700 ±
1552
1260 ±
RIAM BATANG
TUMBANG KEBAYAN
RANGN KAWIT
DEHES ASEM
SEPONGE
TUMBANG KUAI
S. Hahol
S. Heran
S. Senamang
S. Bimban
S. Taei
SEBAUNG
S. Baraoi
SERAN
S. Mendawai
750
BATUKULI
TUMBANG TAEI
MANEI
S. Heran
PASAI
MAHUP
MUARASINAMANG
BATUBANG
RANGANBOREH
HERAN
BUNTUTUTLELENG
112° 15'E
112° 30'E
112° 45'E
113° 00'E
113° 15'E


Kahayan
Tb. HUOI
S. Mohoroi
S. Hahol
MOHOROI
S. Meranyui
KERETAU SURIAN
Tb. ANOI
Tb. PUNJOI
Tb. KURIK
Tb. TEKAOI
Tb. TAJUNGAN
S. Hamputung
KERTAU REMBANGUN
POSU
MERAYA
S. Meraya
MARIKOI
HAMPUTUNG
KOROI
Tb. NAPOI
SIRUK
S. Mirih
Tb. LAPAN
Tb. SIAN
PENDARANGAS
MIRIH
Tb. BUKOI
MANTAAK
LAWANG TAMAG
BAHINOI
TANJUNG RENDAN
TIHIS
S. Menyarung
MERAAN
BARONANG
MASAHA LAMA
MASAHA
HURUNGTAMPA-NG
KATANJUNG
PUROH
Tb. SIRAT
BULAU NGAND-UNG
SUNGAIHANJ
S. Baraoi
TEWAH
S. Kahayan
RUDJAK
KUALAKURUN
MENEWAN
113°00'E
113°15'E
113°30'E
113°45'E
114°00'E


DIRUNG LINGKING
DJUKING
SUPAN
BABUAT
MUARA LAHUNG
S. Lahung
BAHITUM
MEKUNDJ
MUHUN
BENA
Tb. BUKOI
S. Menyarurg
MALASAN
S. Barito
MANGKAHOI
MUARAUNTU
MUARAJAAN
S. Keramu
BATUPUTIH
BEKANUN
MANTAAK
LAWANG TAMAG
TIHIS
BAHINOI
TANJUNG
RENDAN
S. Bekanon
S. Jaan
MERAAN
270 ±
S. Selio
BARONANG
MASAHA LAMA
MASAHA BARU
MUKUT
PUROH
Tb. SIRAT
HURUNGTAMPA-
NG
KATANJUNG
S. Bariai
BULAU NGAND-
UNG
SUNGAIHANJU
S. Pandreh
S. BARITO
PENDREH
TANGOCIN
TEWAH
S. Kahayan
RUDJAK
S. Kapuas
KUALAKURUN
JANGKANG
BUNTOK-
LEBOH
MENEWAN
113° 45' E
114° 00' E
114° 15' E
114° 30' E
114° 45' E



DIRUNG LINGKING
DJUKINGPADJANG
BAHITUM
MALASAN
S. Barito
MANGKAHOI
MUARAUNTU
BATUPUTIH
MUARAJAAN
EKANUN
S. Jaan
270 ±
MEKUNDJUNG
MUHUN
BENAUMELAJU
0° 45' S
PAPARPUTJANG
DJANGKANG
LVE
MUARABAKAH
MUKUT
S. Lahai
MUARALAHAI
S. Bariai
S. Pondreh
S. BARITO
PENDREH
MUARATEWE
1° 00' S
TANGOCIN
S. Tewe
S. Ihu
BUNTOK - KETJIL
LEBOH
1° 15' S
114° 30' E
114° 45' E
115° 00' E

PL. II

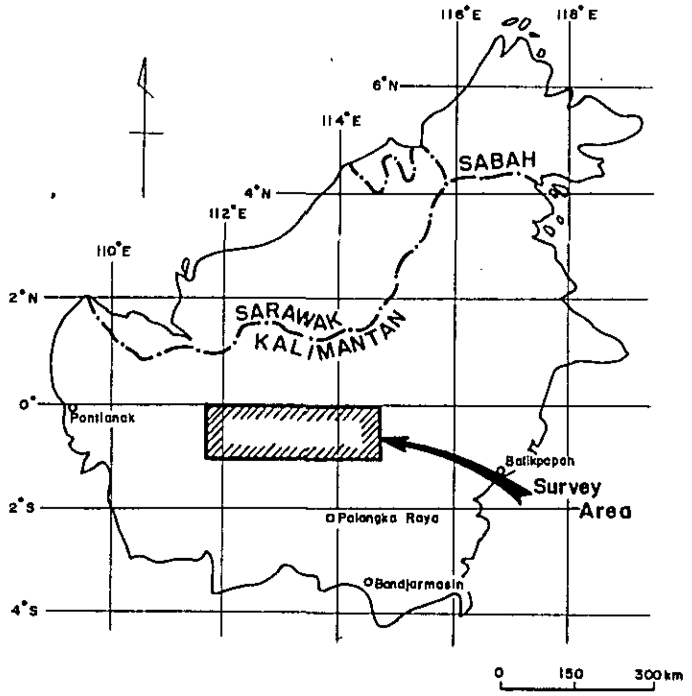
METAL MINING AGENCY OF JAPAN
JAPAN INTERNATIONAL COOPERATION AGENCY
—
GEOLOGICAL SURVEY OF INDONESIA

PHOTO - GEOLOGICAL SURVEY
OF
CENTRAL KALIMANTAN INDONESIA

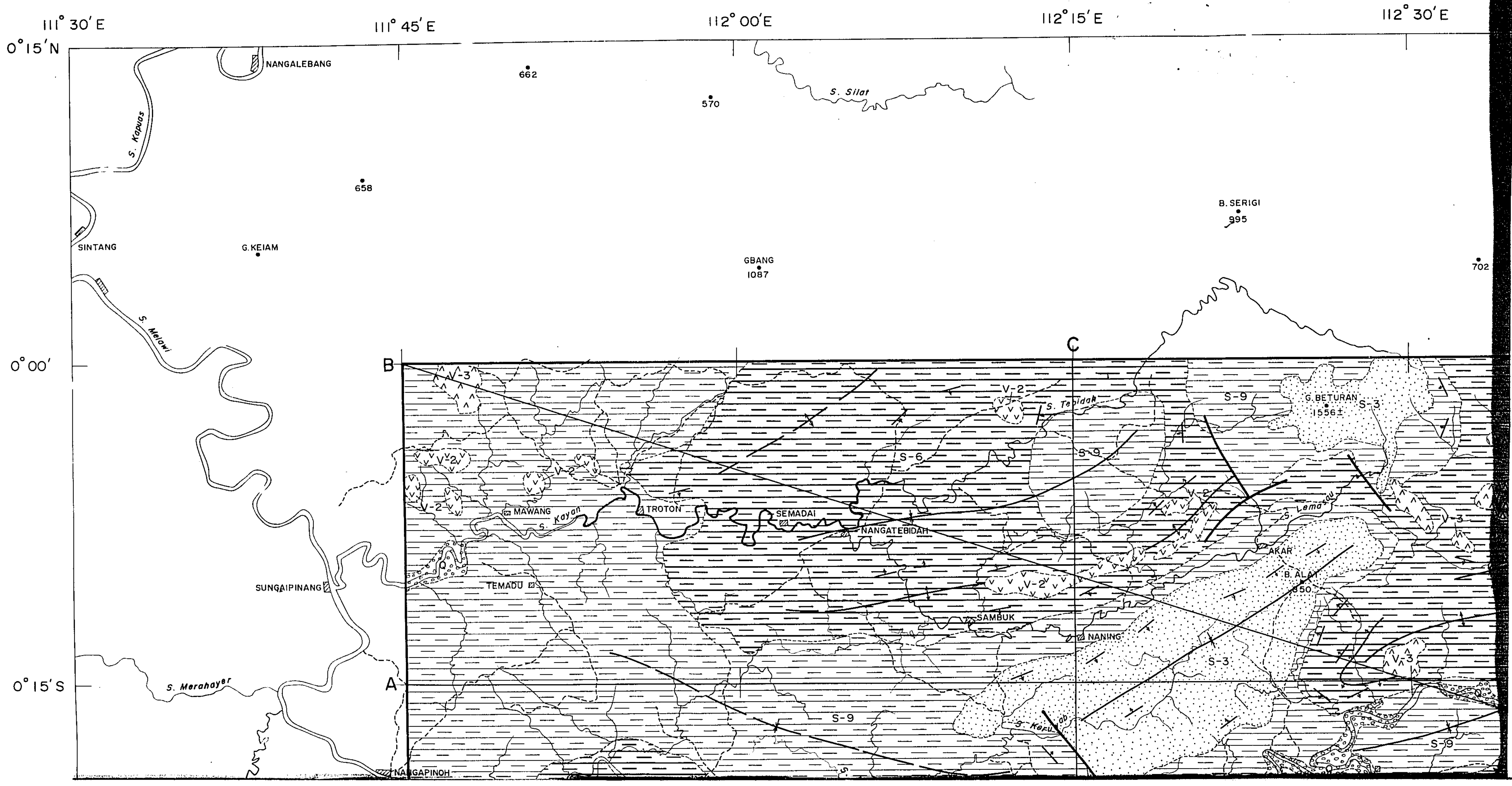
PHOTO - GEOLOGICAL MAP

Scale 1 : 250,000

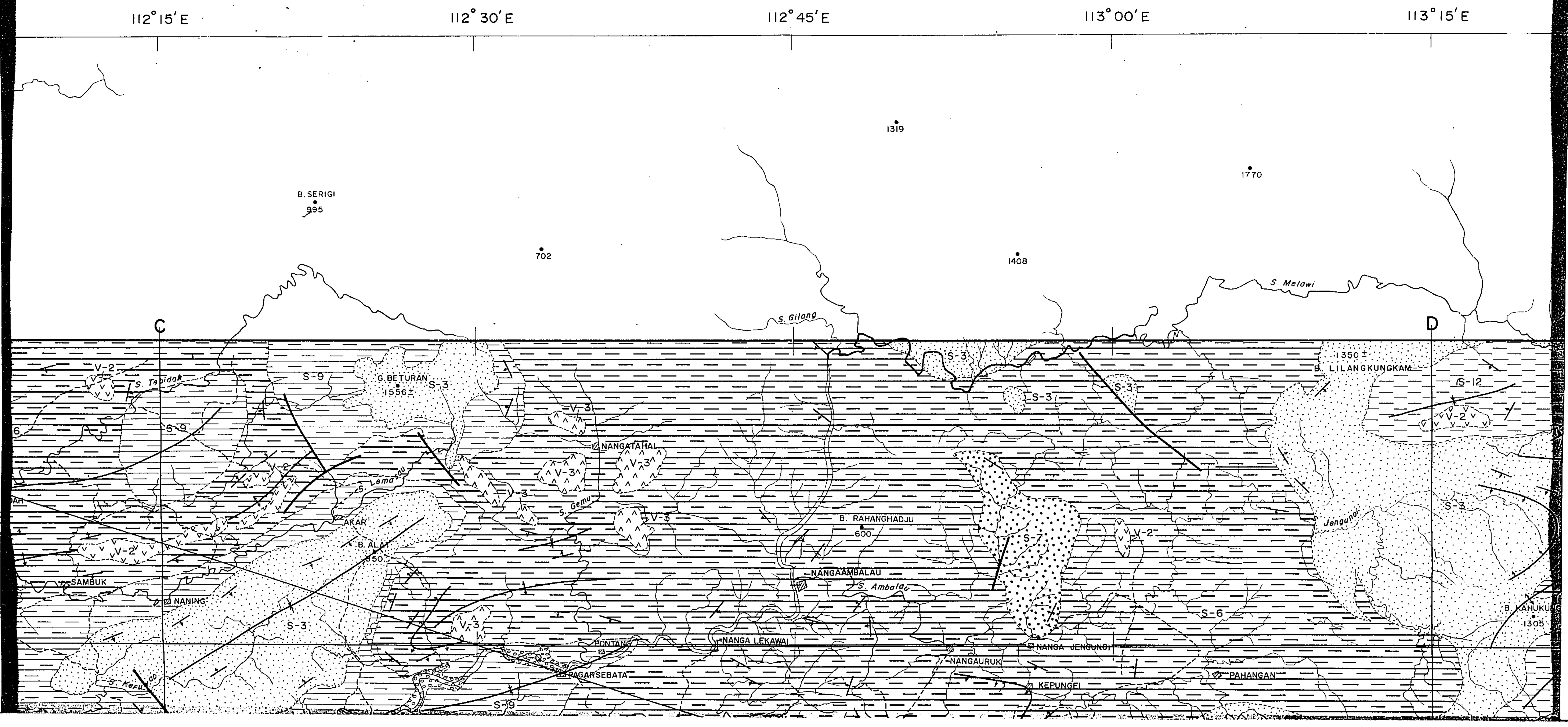
0 5 10 15 20 km

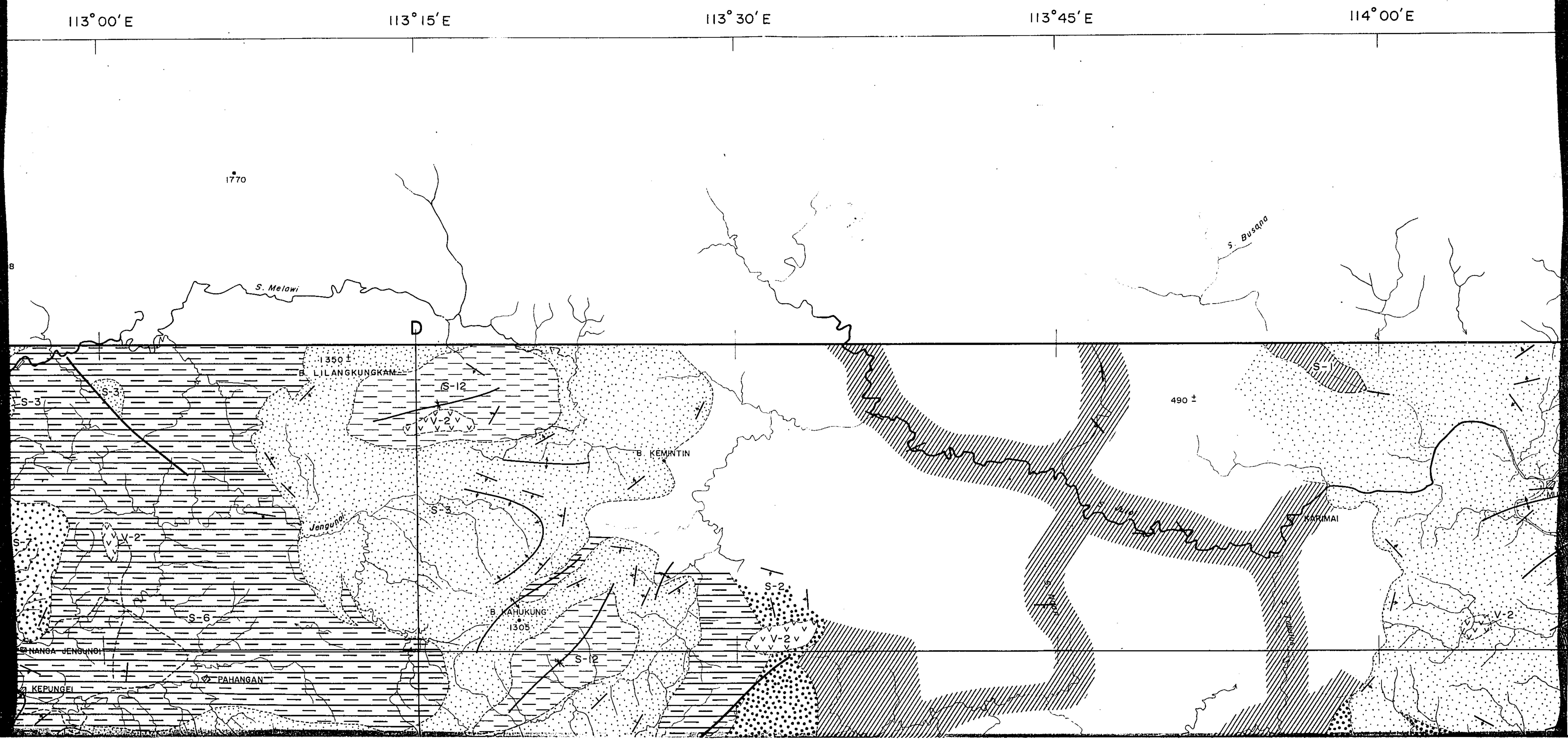


January · 1978

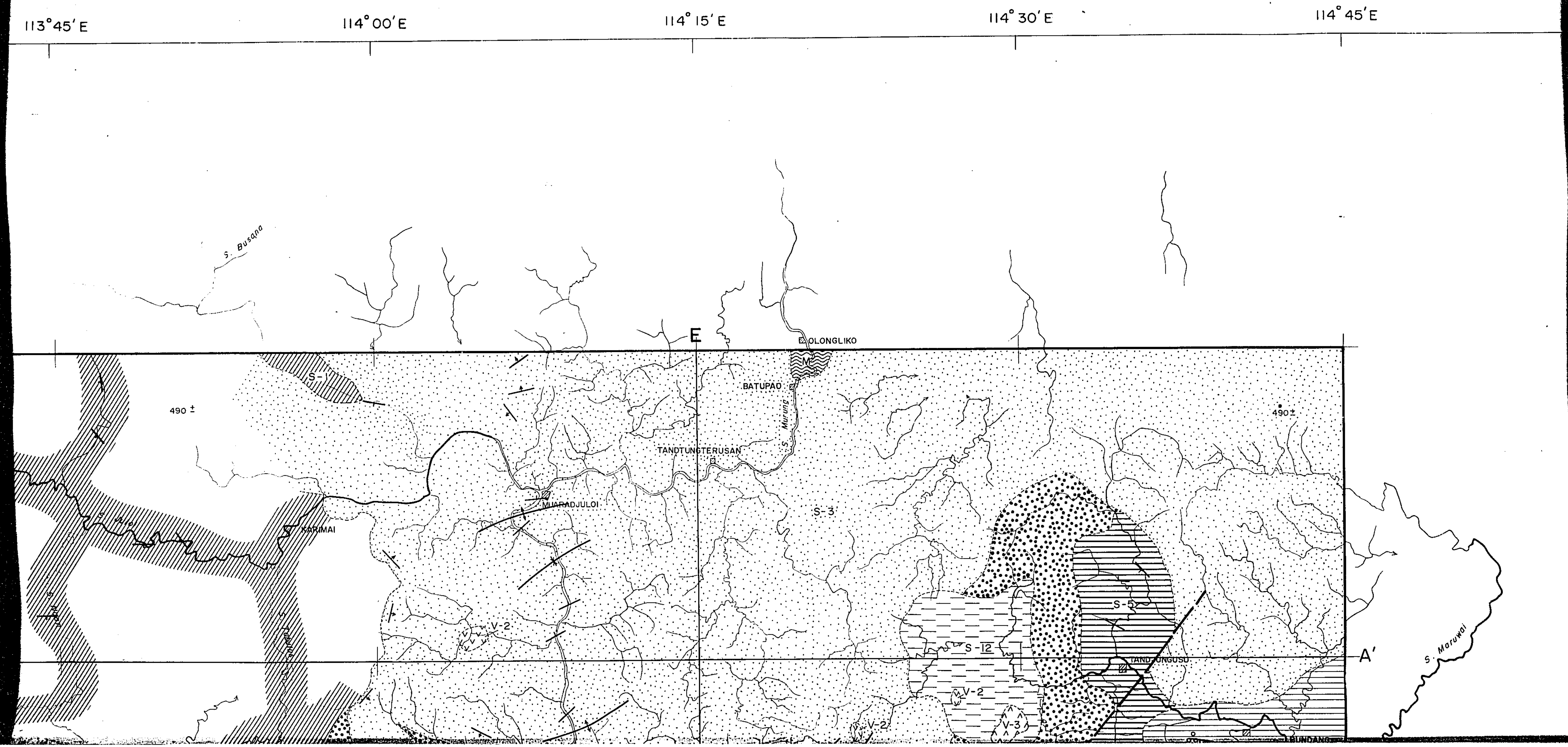


111° 30′ E
111° 45′ E
112° 00′ E
112° 15′ E
112° 30′ E
0° 15′ N
0° 00′
0° 15′ S
NANGALEBANG
662
570
S. Silat
S. Kapuas
658
B. SERIGI
995
SINTANG
G. KEIAM
GBANG
1087
702
S. Melawi
C
B
A
V-3
V-2
S. Tebidah
S-9
G. BETURAN
1556±
S-3
S-6
MAWANG
S. Kayan
TROTON
SEMADAI
NANGATEBIDAH
S. Lemasau
AKAR
B. ALAI
850
SUNGAIPINANG
TEMADU
SAMBUK
NANING
S. Merahayer
S. Keruyab
NANGAPINOH

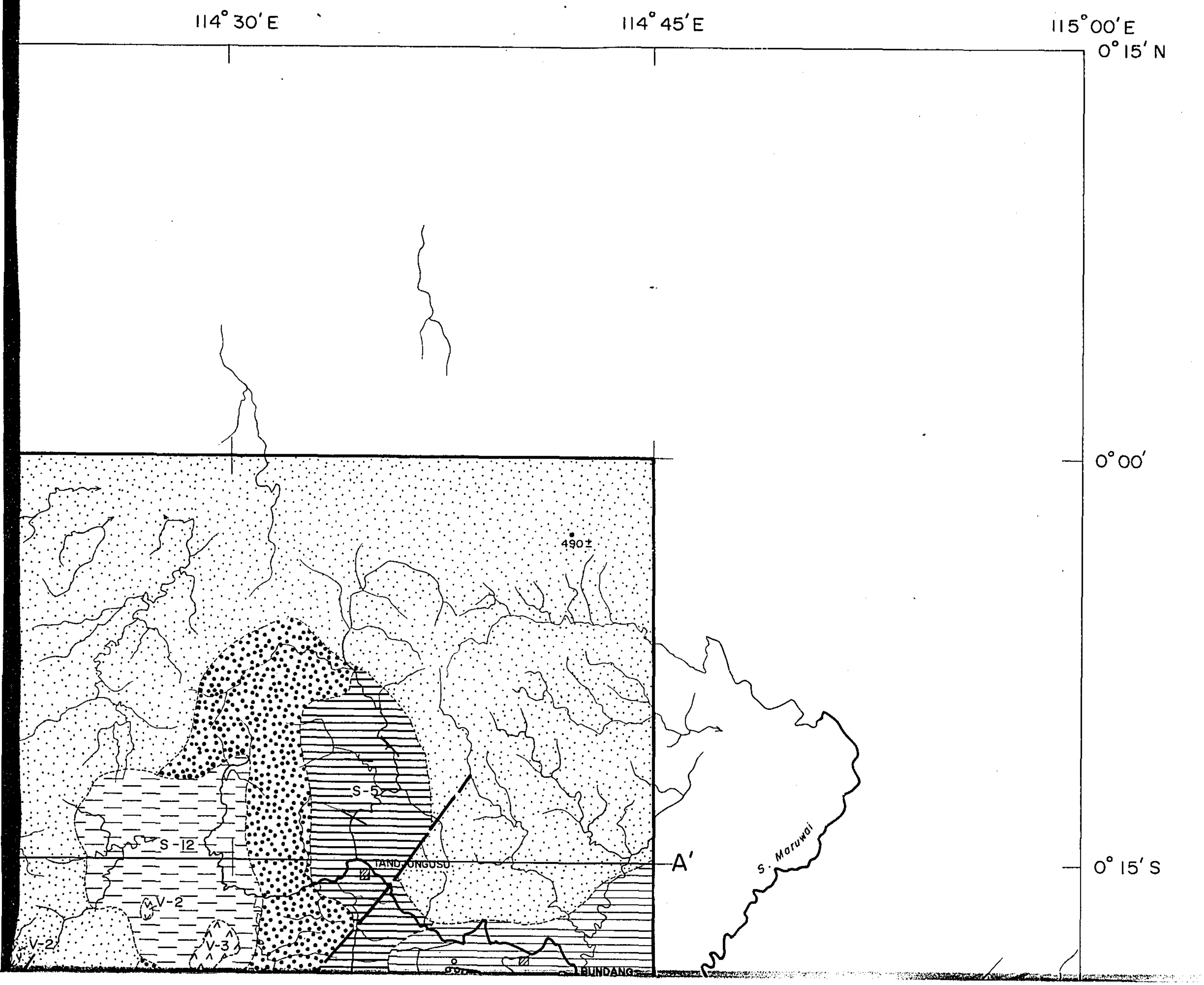

112°15'E
112°30'E
112°45'E
113°00'E
113°15'E
B. SERIGI
995
702
1319
1408
1770
S. Gilang
S. Melawi
C
D
G. BETURAN
1556±
S-3
S-9
V-2
V-3
S. Tepidak
NANGATAHAL
S. Lemasau
S. Gemu
AKAR
B. ALAI
850
SAMBUK
NANING
PONTANG
PAGARSEBATA
NANGA LEKAWAI
NANGAAMBALAU
S. Ambalau
B. RAHANGHADJU
600
S-7
S-6
NANGA JENGUNOI
NANGAURUK
KEPUNGEI
PAHANGAN
1350±
B. LILANGKUNGKAM
S-12
Jengunoi
B. KAHUKU
1305



113°00'E
113°15'E
113°30'E
113°45'E
114°00'E
1770
S. Melawi
S. Busana
D
1350 ±
B. LILANGKUNGKAM
S-12
V-2
S-3
B. KEMINTIN
Jengunoi
S-7
S-6
NANGA JENGUNOI
KEPUNGEI
PAHANGAN
B. KAHUKUNG
1305
S-2
490 ±
S-1
KARIMAI



113°45′E
114°00′E
114°15′E
114°30′E
114°45′E
S. Busana
E
OLONGLIKO
BATUPAO
S. Murung
TANDTUNGTERUSAN
490 ±
490 ±
S-1
S-3
S-5
S-12
V-2
V-3
M
MUARADJULOI
KARIMAI
S. Tabuk
TANDJUNGUSU
A′
S. Maruwai



PL. II

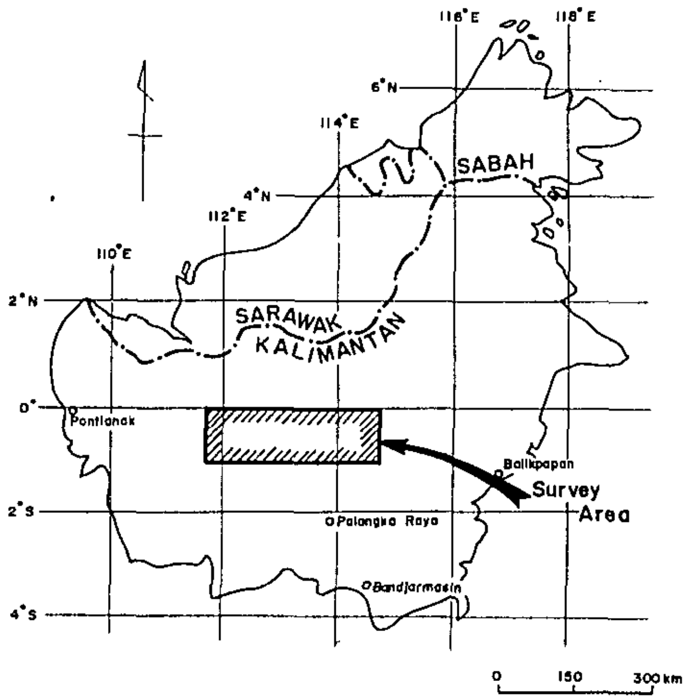
METAL MINING AGENCY OF JAPAN
JAPAN INTERNATIONAL COOPERATION AGENCY — GEOLOGICAL SURVEY OF INDONESIA

PHOTO - GEOLOGICAL SURVEY OF CENTRAL KALIMANTAN INDONESIA

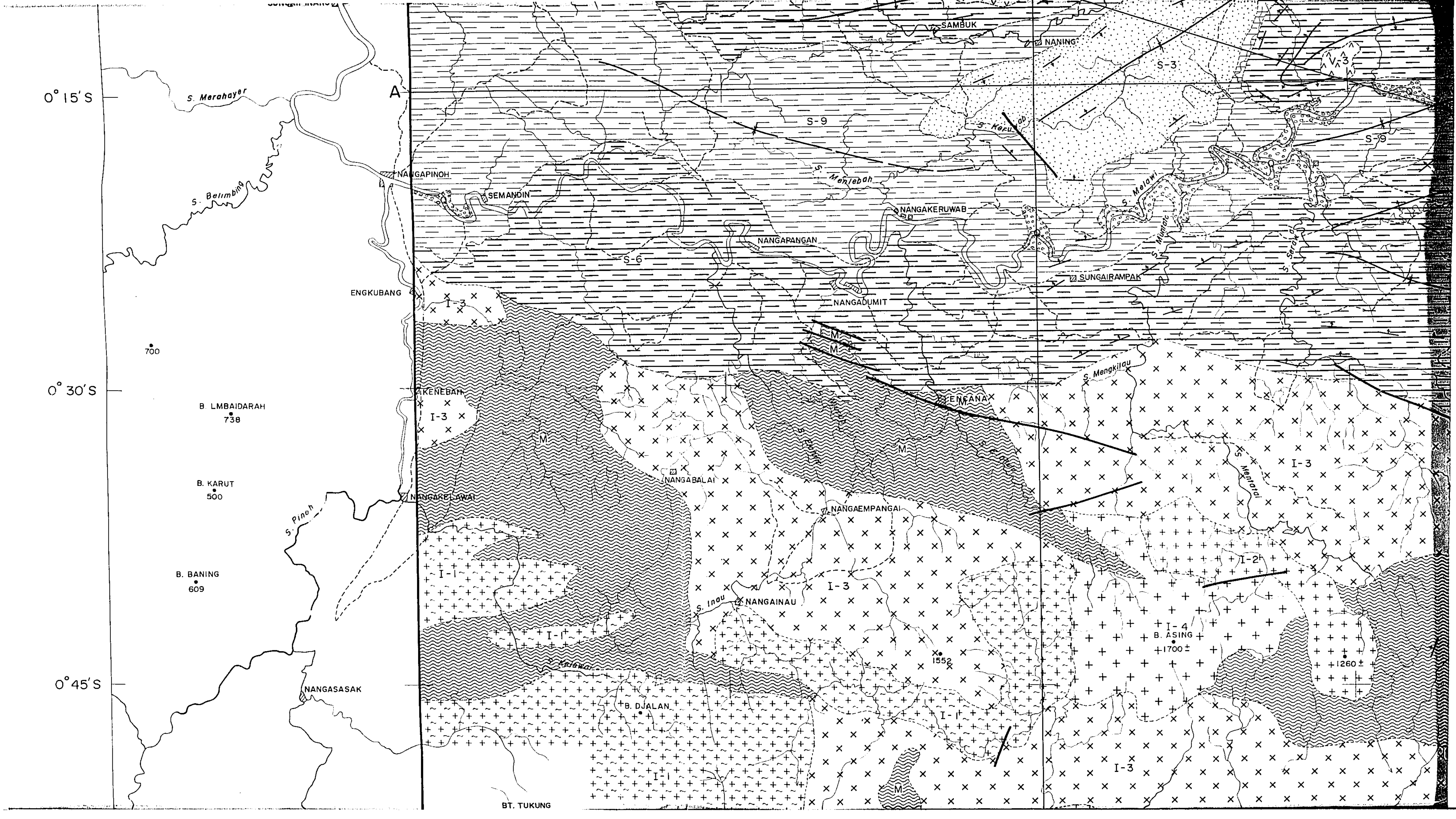
PHOTO - GEOLOGICAL MAP

Scale 1: 250,000

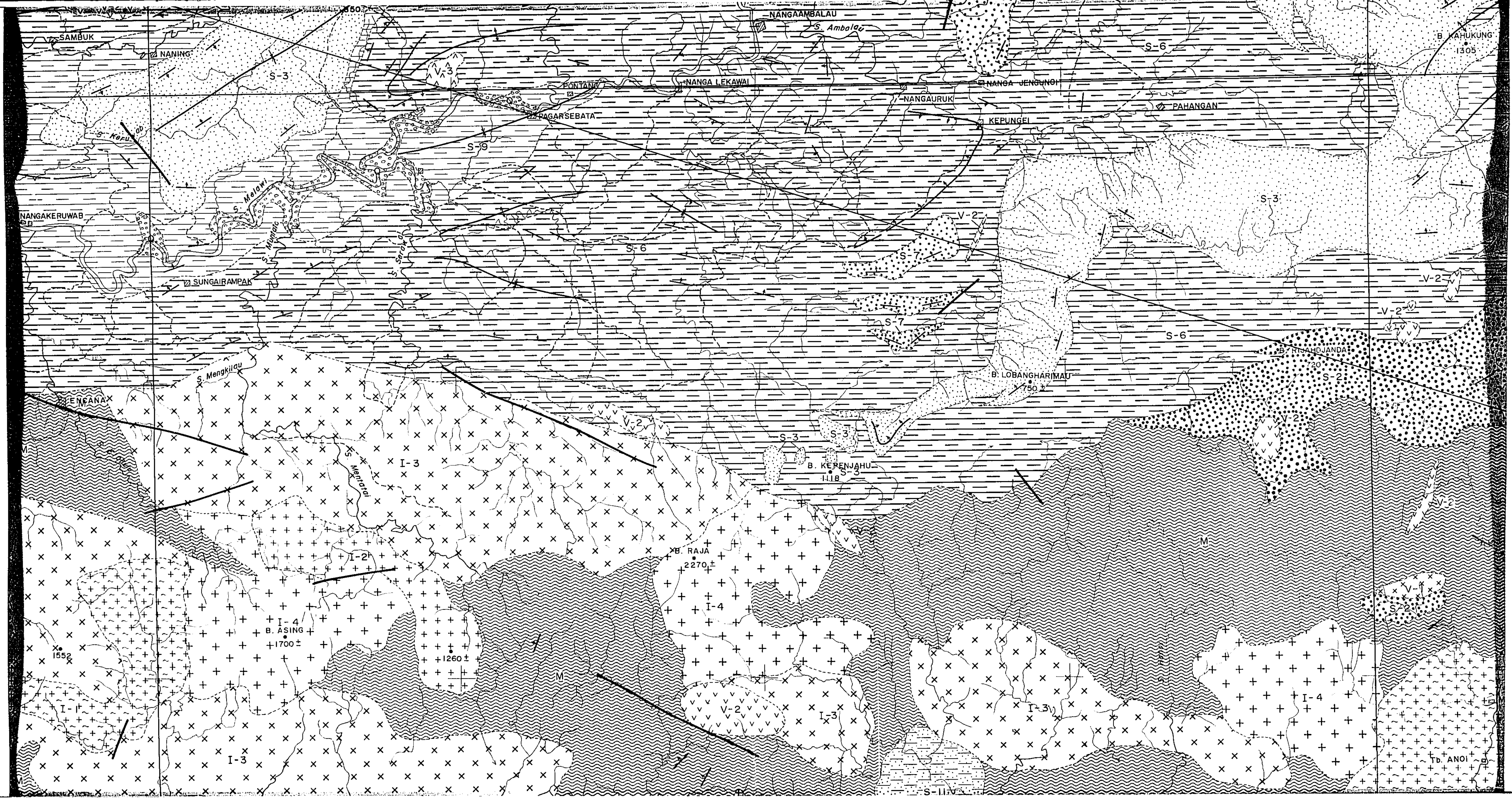
0 5 10 15 20 km

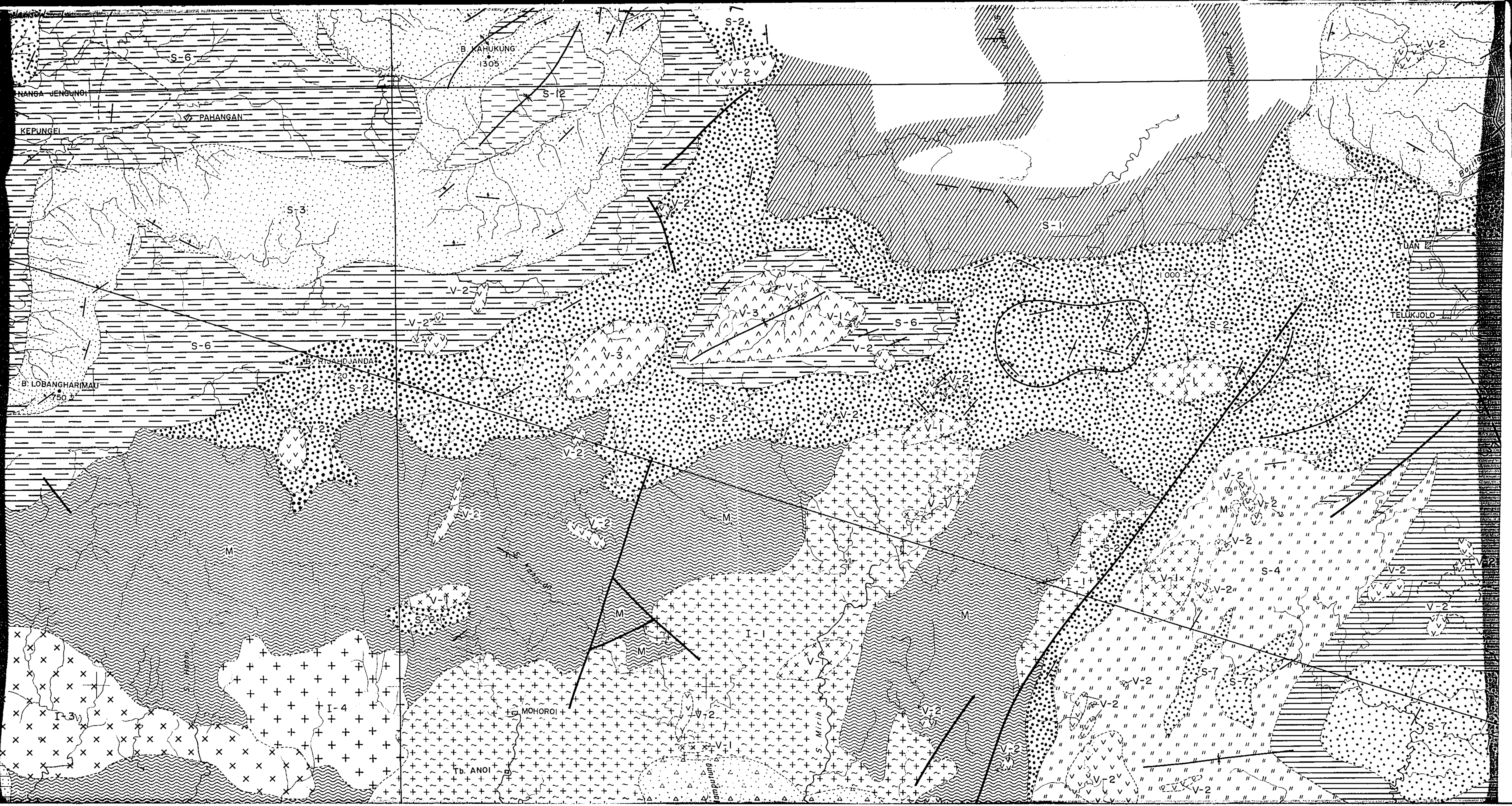


January · 1978

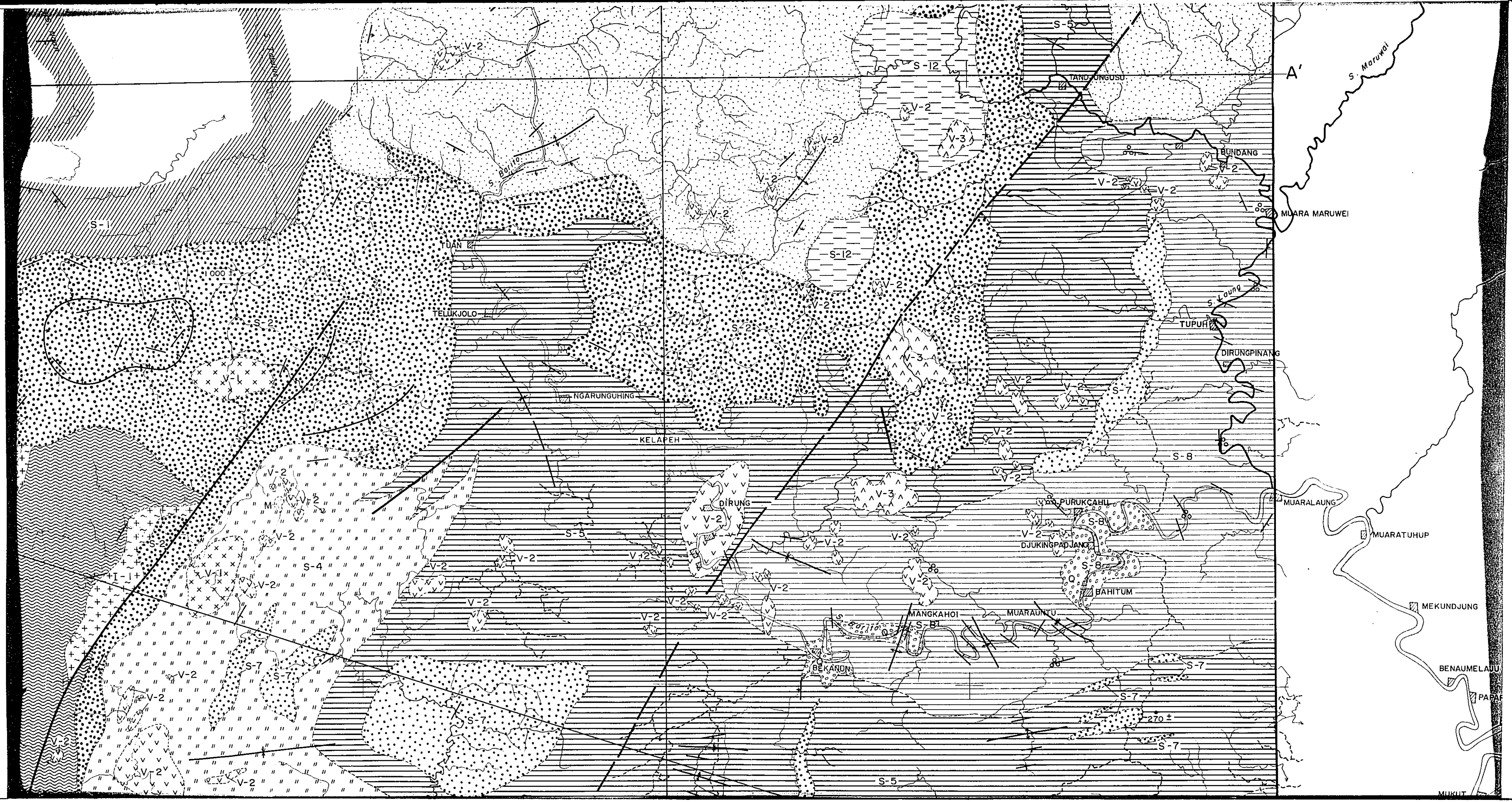


0° 15'S
0° 30'S
0° 45'S
A
S. Merahayer
S. Belimbing
NANGAPINOH
SEMANDIN
ENGKUBANG
KENEBAH
NANGAKELAWAI
S. Pinoh
NANGASASAK
B. LMBAIDARAH
738
700
B. KARUT
500
B. BANING
609
BT. TUKUNG
SAMBUK
NANING
S-3
V3
S-9
S-6
S. Menteba
S. Malawi
NANGAKERUWAB
NANGAPANGAN
NANGADUMIT
SUNGAIRAMPAK
S. Mengkilau
TEMSANA
M
I-3
I-1
I-2
I-4
NANGABALAI
NANGAEMPANGAI
S. Inau
NANGAINAU
B. DJALAN
B. ASING
1700 ±
1260 ±
1552
S. Mentatai

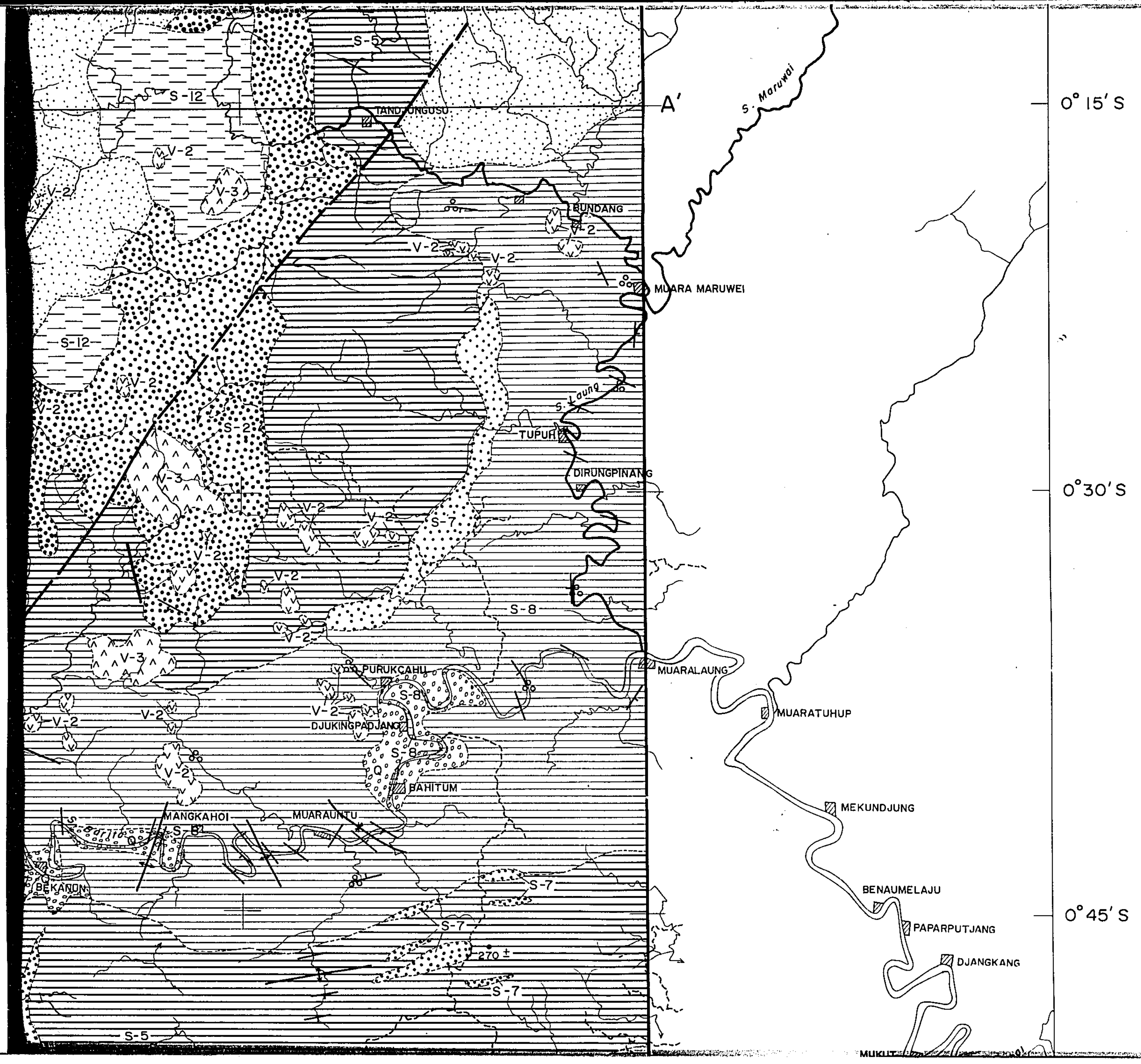

SAMBUK
NANING
S-3
V-3
PONTANG
PAGARSEBATA
NANGAAMBALAU
S. Ambalau
NANGA LEKAWAI
NANGA JENGUNOI
NANGAURUK
PAHANGAN
KEPUNGEI
B. KAHUKUNG
1305
S-6
S-9
NANGAKERUWAB
S. Melawi
SUNGAIRAMPAK
S. Serowai
S-6
V-2
S-7
S-7
S-3
V-2
S-6
S-2
B. LOBANGHARIMAU
750 ±
S-3
S-3
B. KERENJAHU
S-3
1118
S. Mengkilau
M
V-2
I-3
S. Mentatai
I-2
B. RAJA
2270 ±
I-4
M
V-2
M
I-4
B. ASING
1700 ±
1260 ±
1552
M
V-1
S-2
I-1
I-3
V-2
I-3
I-3
I-4
Tb. ANOI
S-11

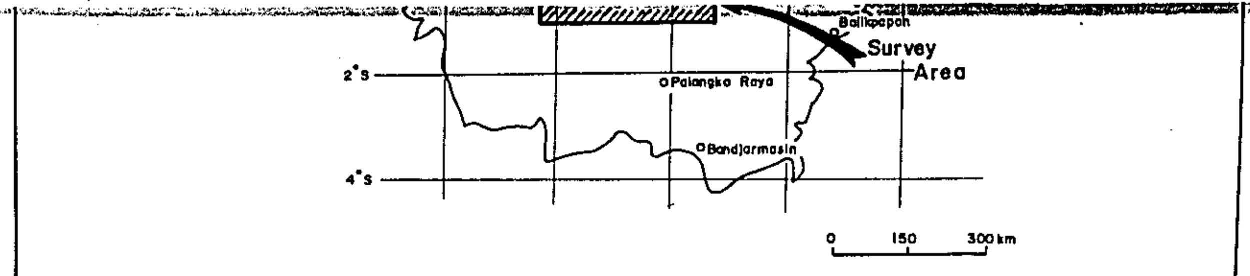


S-2
S-6
B. KAHUKUNG
1305
V-2
S-12
NANGA JENGUNOI
PAHANGAN
KEPUNGEI
S-3
S-1
TUAN
1000
TELUKJOLO
V-1
V-3
S-6
B. RISAHDJANDA
S-2
B. LOBANGHARIMAU
750
V-1
M
S-4
I-1
S-7
I-3
I-4
MOHOROI
Tb. ANOI
S. Mirih



A'
S. Maruwai
TANDJUNGUSU
BUNDANG
MUARA MARUWEI
S. Laung
TUPUH
DIRUNGPINANG
MUARALAUNG
MUARATUHUP
MEKUNDJUNG
BENAUMELAJU
PAPAR
MUKUT
TUAN
TELUKJOLO
NGARUNGUHING
KELAPEH
DIRUNG
PURUKCAHU
DJUKINGPADJANG
BAHITUM
MANGKAHOI
MUARAUNTU
BEKANON
S. Barito
1000 ±
270 ±
S-1
S-2
S-4
S-5
S-7
S-8
S-12
V-1
V-2
V-3
I-1
M
Q

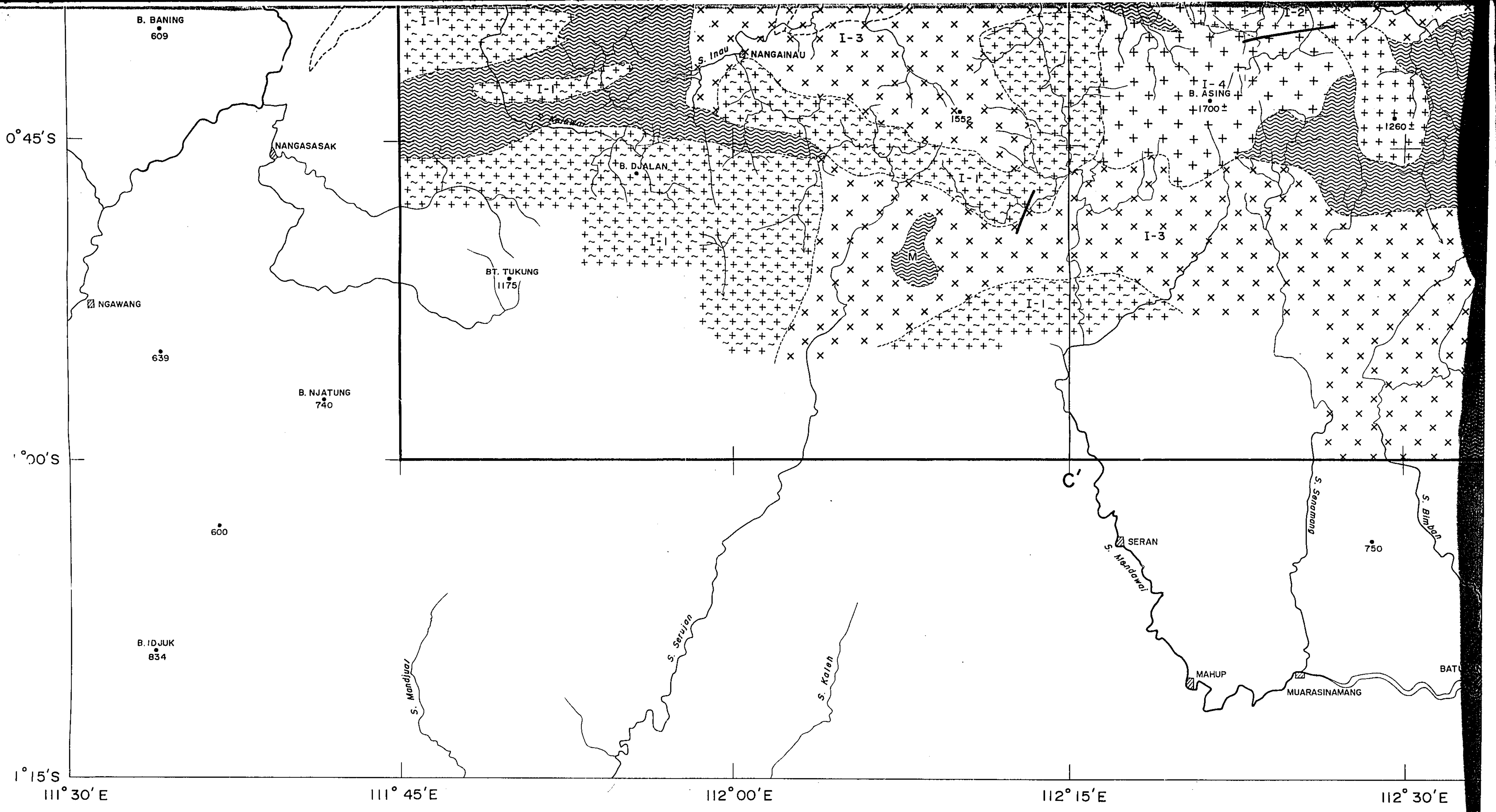




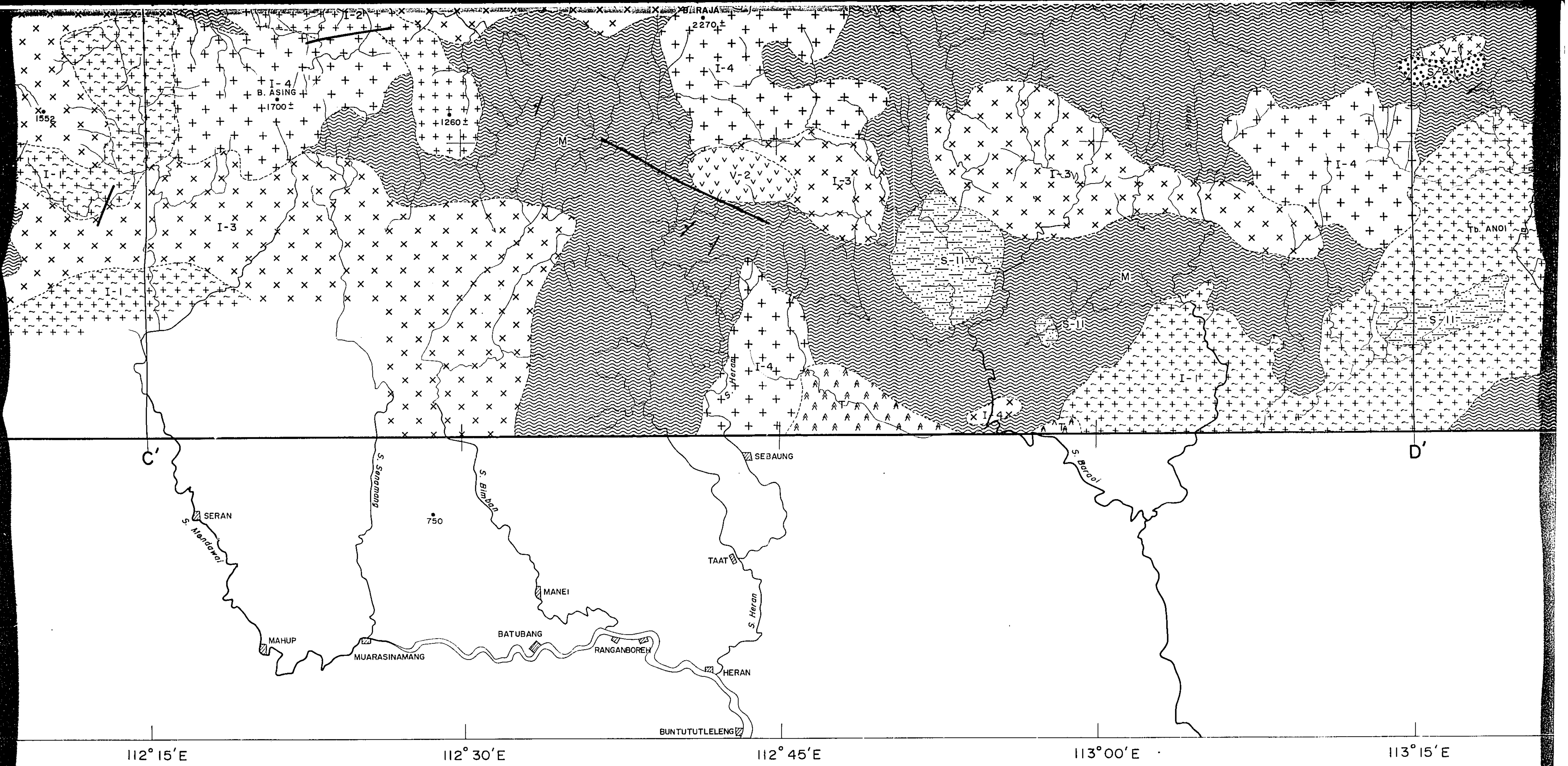
January · 1978

Legend

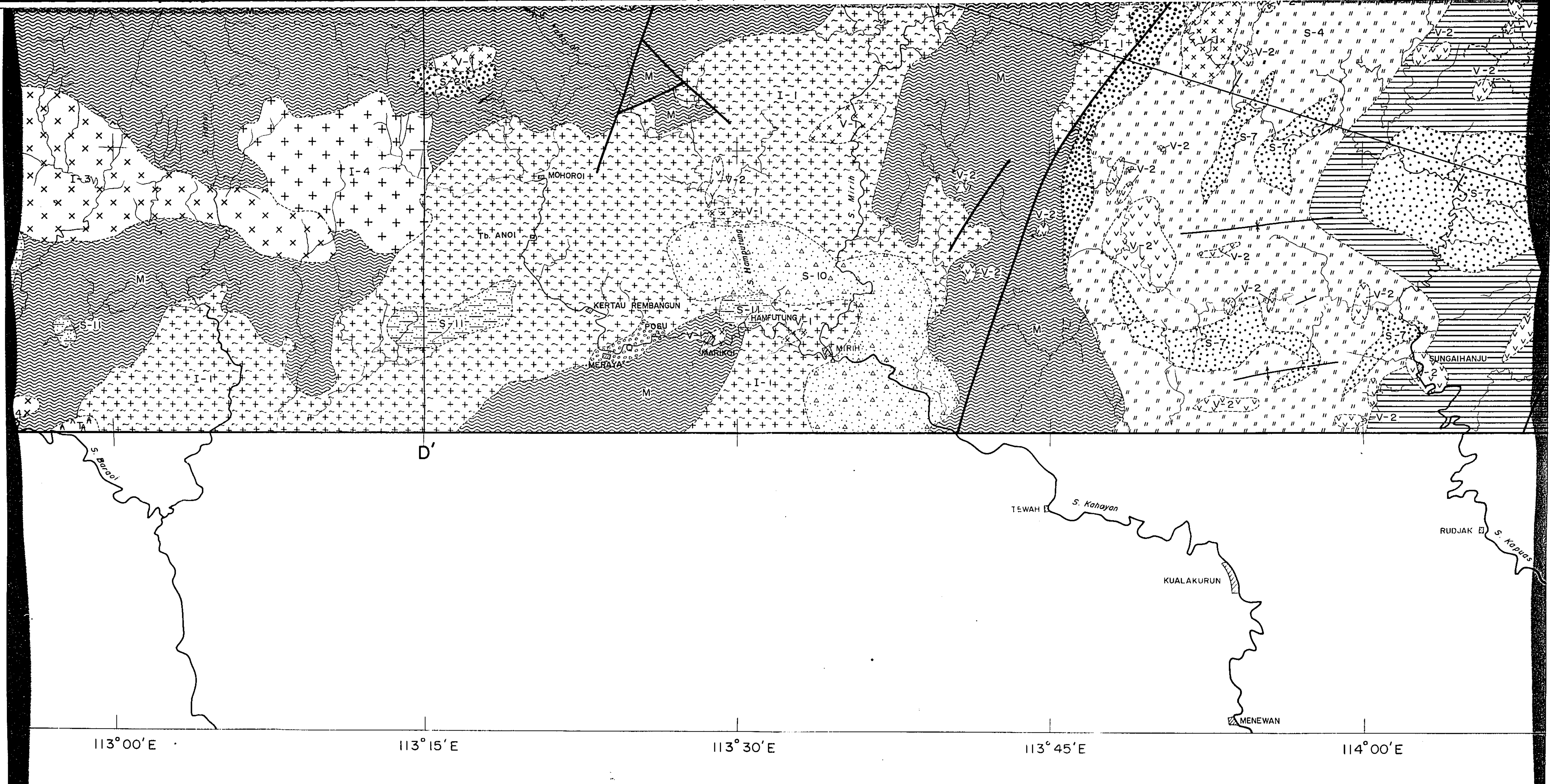
Q	Sand, gravel	
S-12	Silt	
S-11	Sandstone	
S-10	Andesite agglomerate	
S-9	Shale, sandstone, marl	
S-8	Shale, sandstone, limestone	
S-7	Sandstone	
S-6	Shale, sandstone, marl, lignite	
S-5	Shale, sandstone, limestone	
S-4	Pyroclastic rock	
S-3	Sandstone	
S-2	Sandstone, conglomerate	
S-1	Shale, sandstone, limestone	
T	Andesite	
M	Schist, slate, quartzite	
V-3	Andesite ~ basalt	
V-2	Dyke rocks of various component (mainly andesite)	
V-1	Granitic rock	
I-4	Granitic rock	



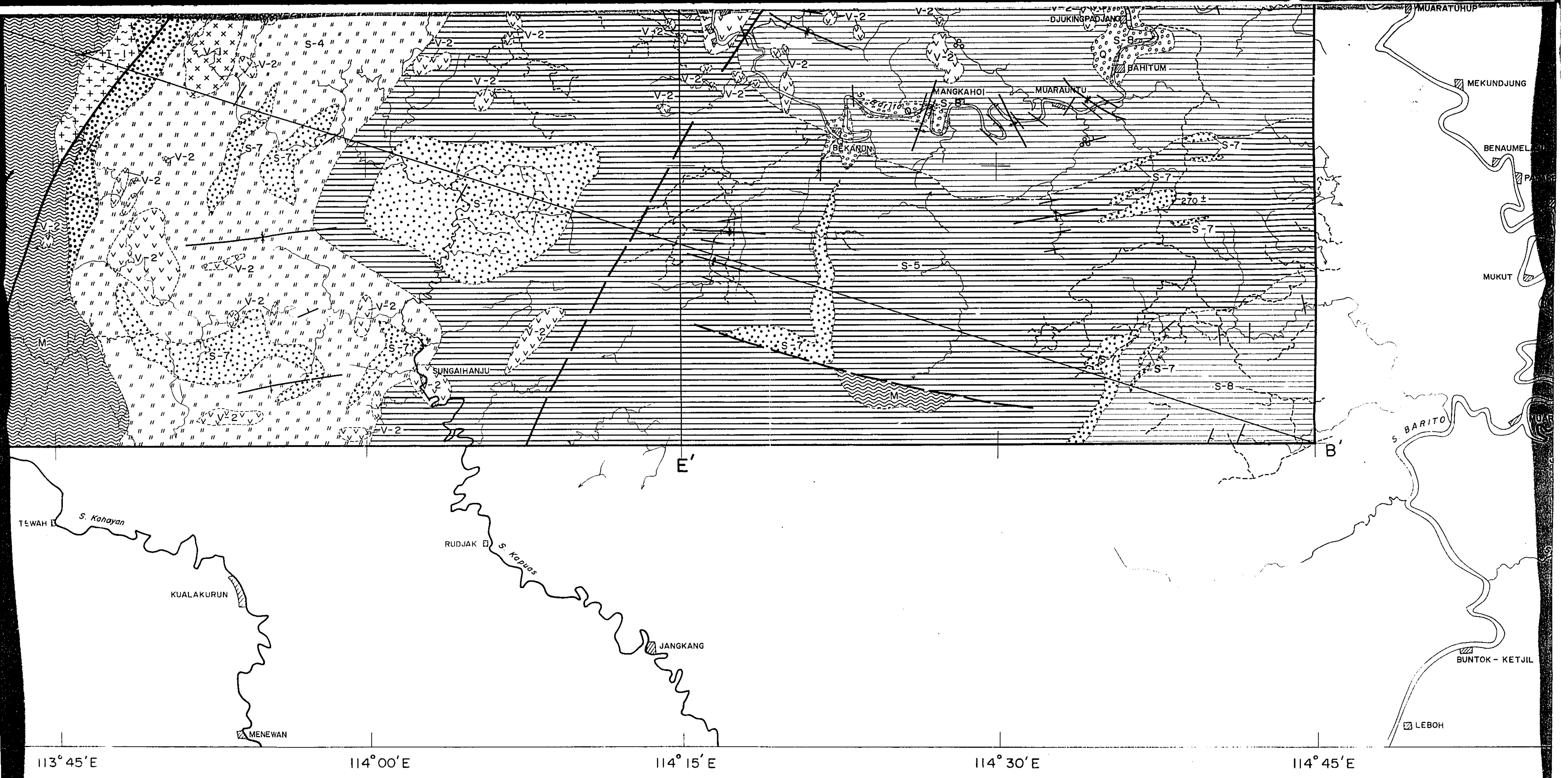
B. BANING
609
NANGASASAK
0°45'S
NGAWANG
639
B. NJATUNG
740
600
B. IDJUK
834
1°15'S
111°30'E
111°45'E
112°00'E
112°15'E
112°30'E
S. Inau
NANGAINAU
I-1
I-2
I-3
I-4
B. ASING
1700±
1260±
1552
B. DJALAN
BT. TUKUNG
1175
M
C'
SERAN
S. Mendawai
S. Senamang
S. Bimban
750
MAHUP
MUARASINAMANG
S. Mandjual
S. Serujan
S. Kalen

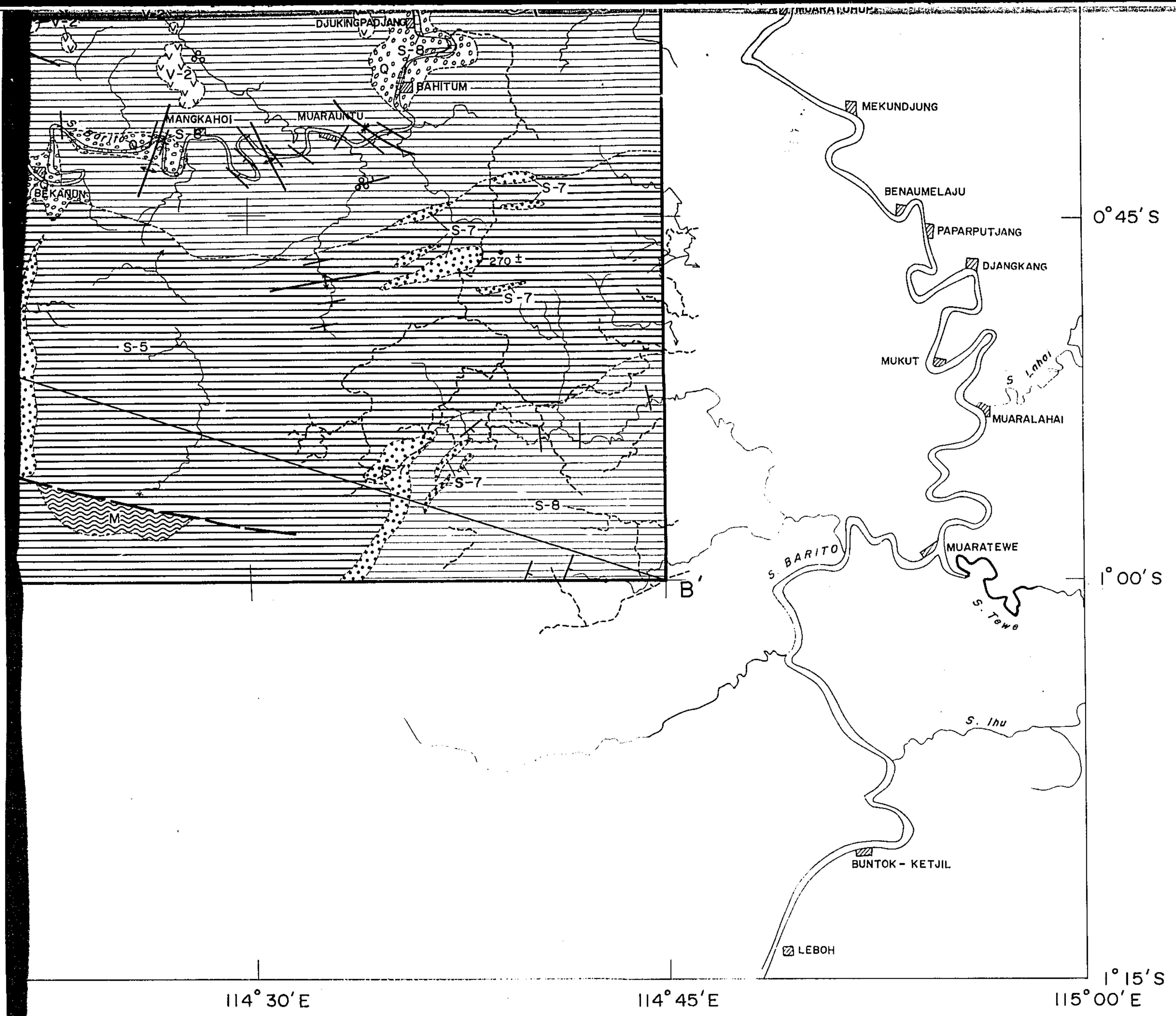


B. RAJA
2270±
I-2
I-4
B. ASING
1700±
1260±
1552
I-1
I-3
M
V-2
V
S-2
Tb. ANOI
S-11
S. Heran
C'
D'
SEBAUNG
S. Senamang
S. Bimban
S. Baraoi
SERAN
S. Mendawai
750
TAAT
MANEI
S. Heran
BATUBANG
MAHUP
MUARASINAMANG
RANGANBOREH
HERAN
BUNTUTUTLELENG
112°15'E
112°30'E
112°45'E
113°00'E
113°15'E



I-1
I-3
I-4
M
S-2
S-4
S-7
S-10
S-11
V-1
V-2
MOHOROI
Tb. ANOI
KERTAU REMBANGUN
POSU
MERAYA
MARIKOI
HAMPUTUNG
MIRIH
S. Hamputung
S. Mirih
SUNGAIHANJU
D′
S. Baraoi
TEWAH
S. Kahayan
KUALAKURUN
MENEWAN
RUDJAK
S. Kapuas
113°00′E
113°15′E
113°30′E
113°45′E
114°00′E


MUARATUHUP
DJUKINGPADJANG
BAHITUM
MEKUNDJUNG
MANGKAHOI
MUARAUNTU
BEKANUN
BENAUMELA
MUKUT
SUNGAIHANJU
S. BARITO
S. Barito
TEWAH
S. Kahayan
KUALAKURUN
MENEWAN
RUDJAK
S. Kapuas
JANGKANG
BUNTOK - KETJIL
LEBOH
S-2
S-4
S-5
S-7
S-8
V-2
I-1
M
Q
270 ±
E′
B′
113° 45′ E
114° 00′ E
114° 15′ E
114° 30′ E
114° 45′ E



S-4	Pyroclastic rock
S-3	Sandstone
S-2	Sandstone, conglomerate
S-1	Shale, sandstone, limestone
T	Andesite
M	Schist, slate, quartzite
V-3	Andesite ~ basalt
V-2	Dyke rocks of various component (mainly andesite)
V-1	Granitic rock
I-4	Granitic rock
I-3	Granitic rock
I-2	Granitic rock
I-1	Gneiss

Fossil

Fault

Anticlinal axis

Synclinal axis

Folded basin

Strike and dip of beds (field data)

Strike and dip of beds (photo data)

PL. III

METAL MINING AGENCY OF JAPAN
JAPAN INTERNATIONAL COOPERATION AGENCY
— GEOLOGICAL SURVEY OF INDONESIA

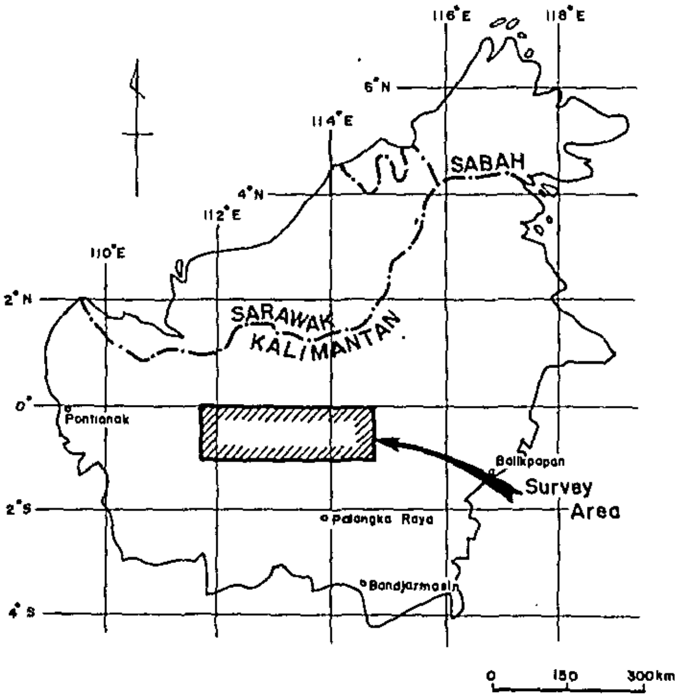
PHOTO - GEOLOGICAL SURVEY OF CENTRAL KALIMANTAN INDONESIA

PHOTO - GEOLOGICAL SECTION

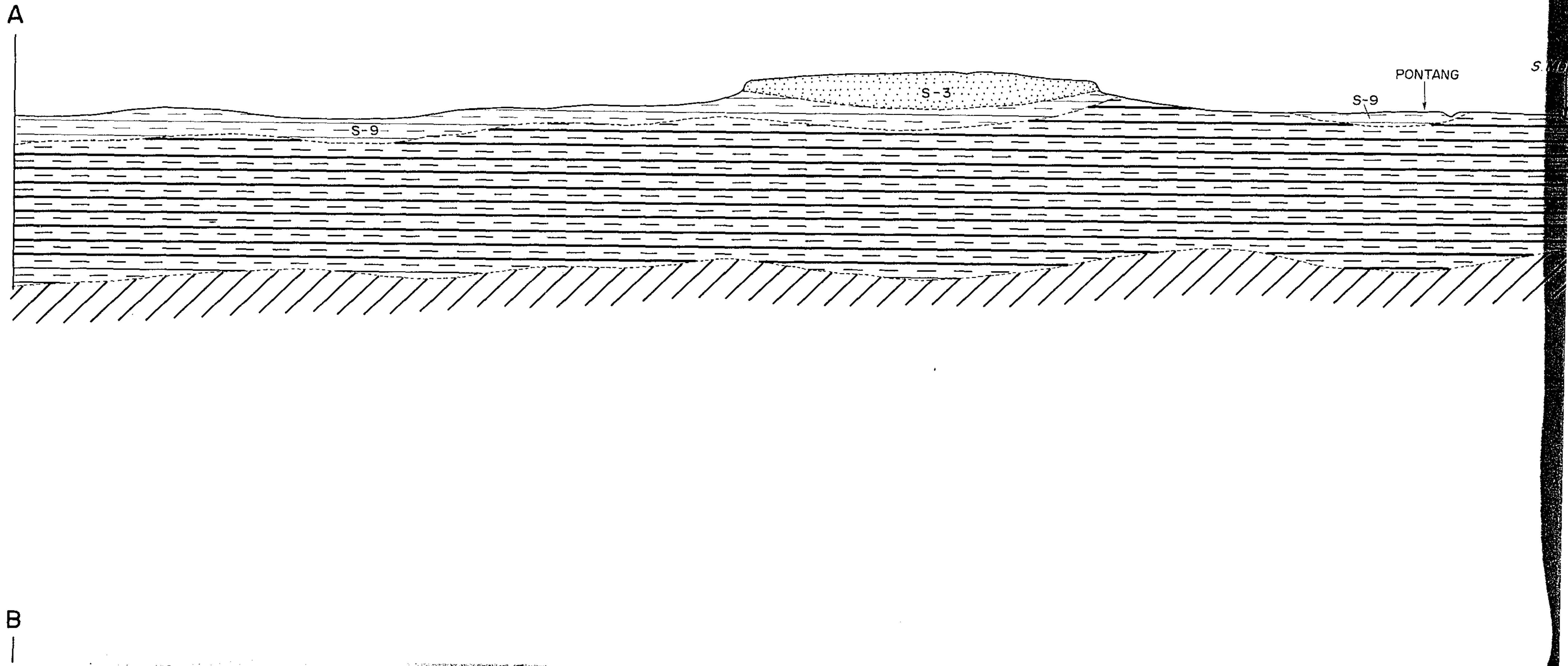
Scale

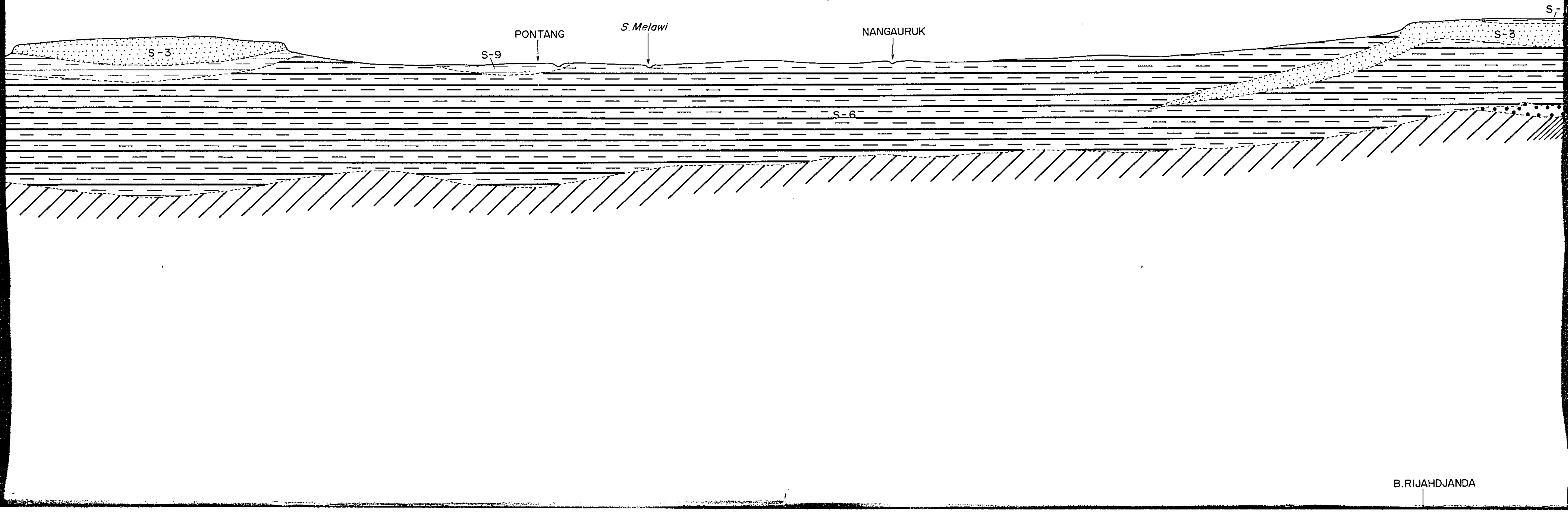
1 : 50,000 — 1 km

1 : 250,000 — 0, 5, 10, 15, 20 km

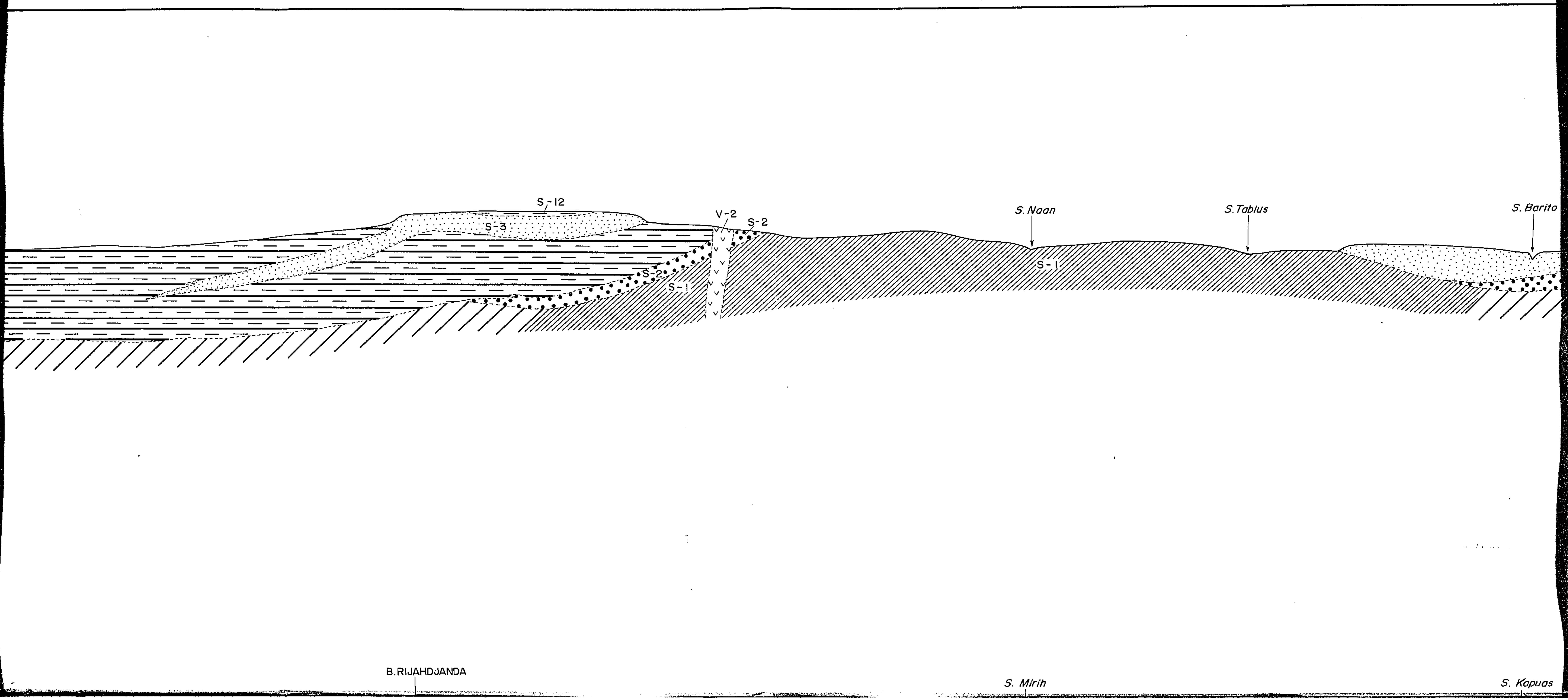


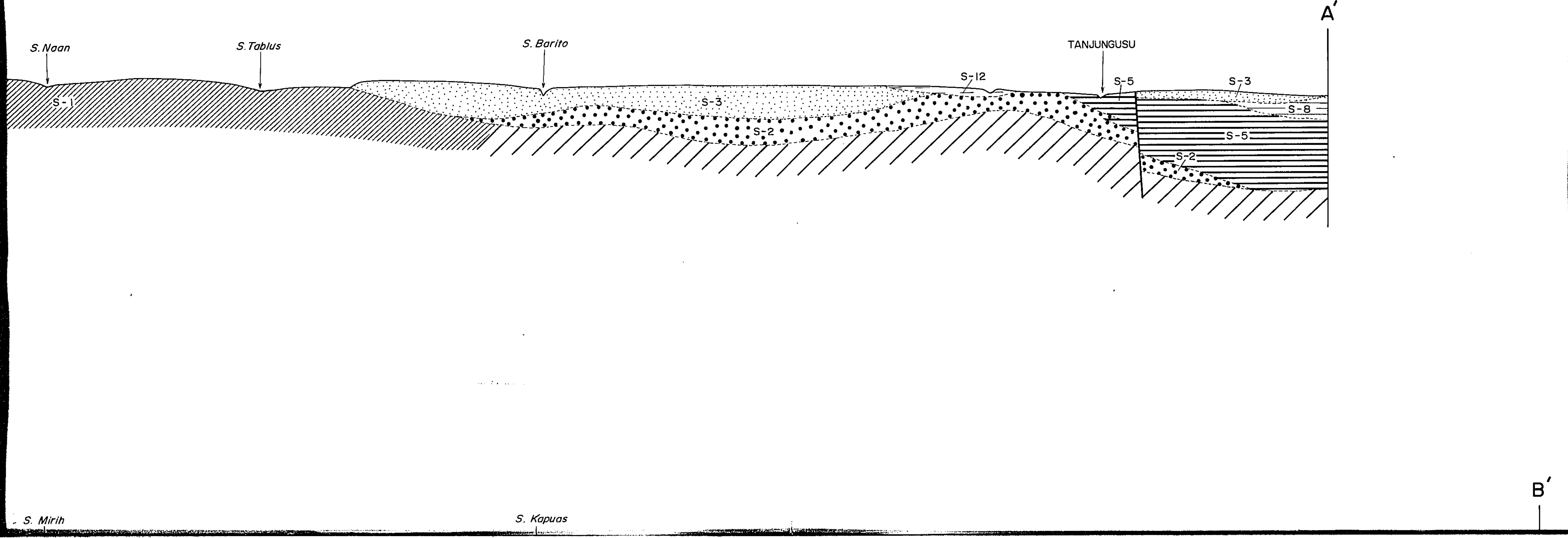
January · 1978


A
S-3
PONTANG
S-9
S-9
B

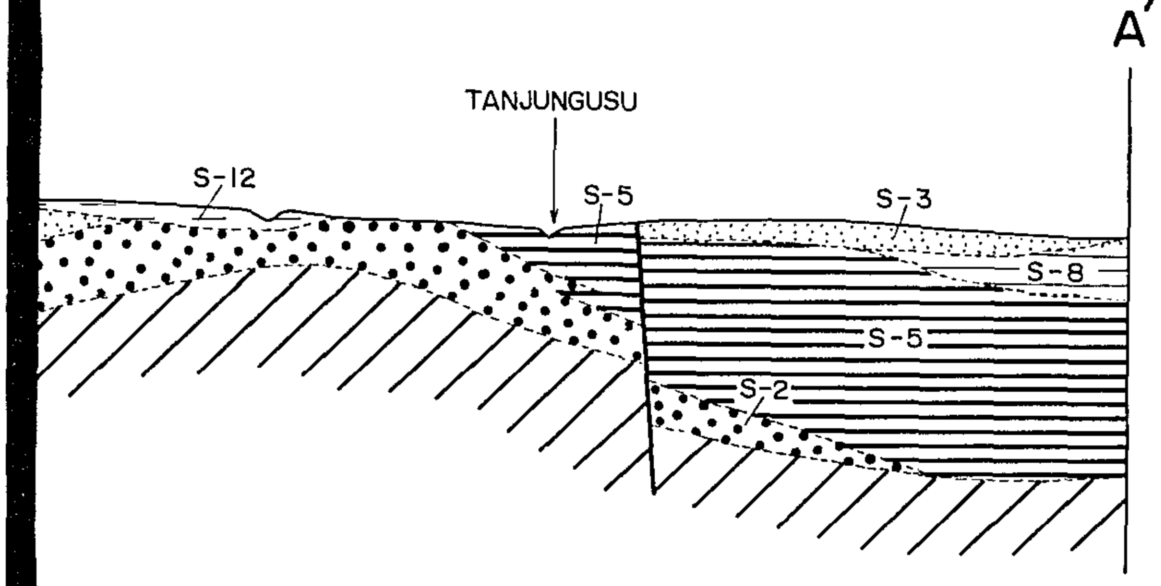


S-3
PONTANG
S-9
S. Melawi
NANGAURUK
S-6
S-3
B. RIJAHDJANDA


S-12
S-3
V-2
S-2
S-2
S-1
S. Naan
S-1
S. Tablus
S. Barito
B. RIJAHDJANDA
S. Mirih
S. Kapuas



A′
S. Naan
S. Tablus
S. Barito
TANJUNGUSU
S-1
S-3
S-2
S-12
S-5
S-3
S-8
S-5
S-2
B′
S. Mirih
S. Kapuas



B′

PL. Ⅲ

METAL MINING AGENCY OF JAPAN
JAPAN INTERNATIONAL COOPERATION AGENCY
— GEOLOGICAL SURVEY OF INDONESIA

PHOTO - GEOLOGICAL SURVEY OF CENTRAL KALIMANTAN INDONESIA

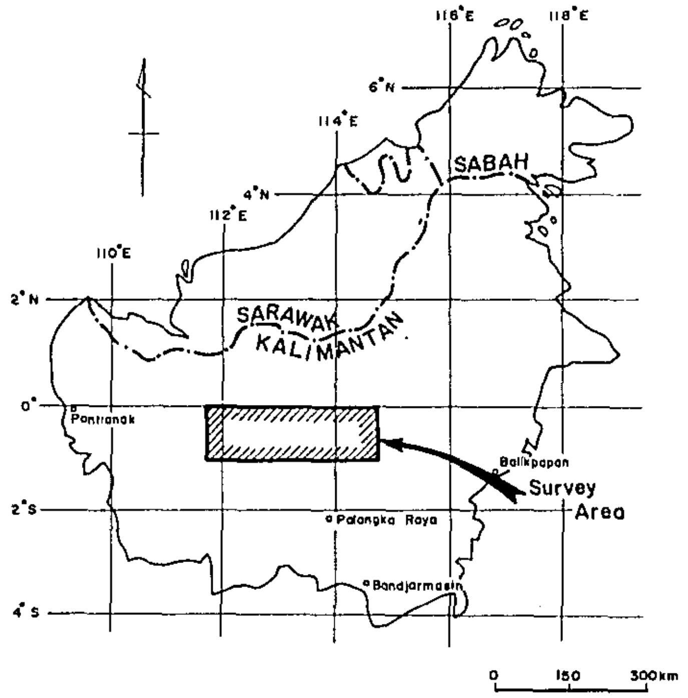
PHOTO - GEOLOGICAL SECTION

1 km
1 : 50,000

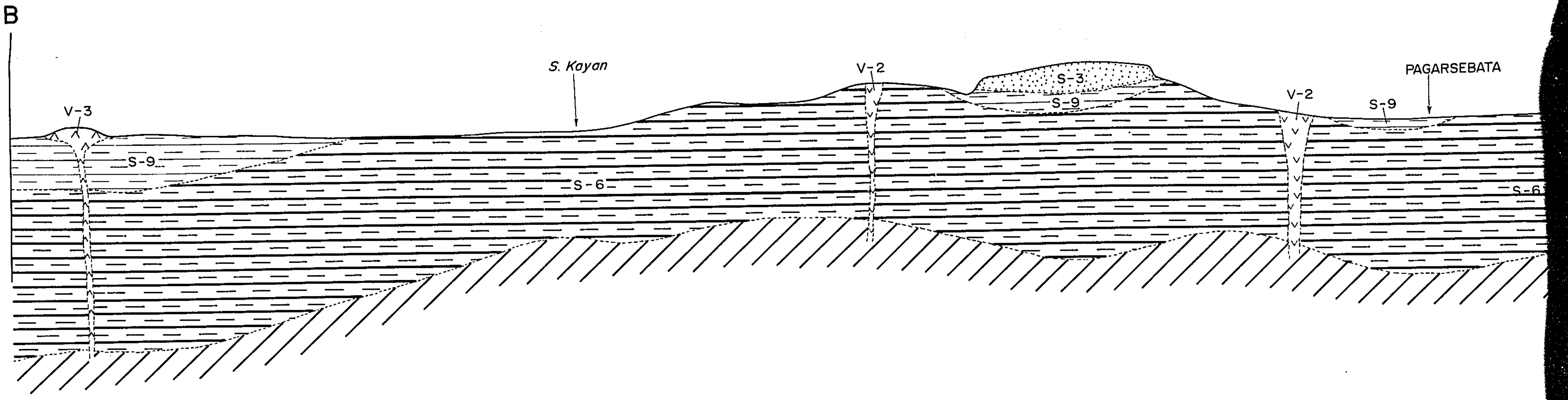
Scale

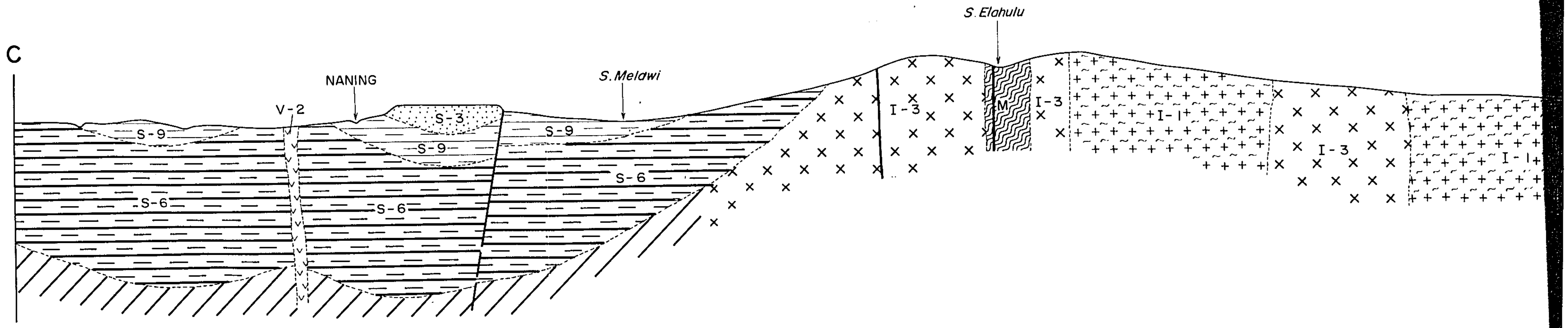
5 10 15 20 km

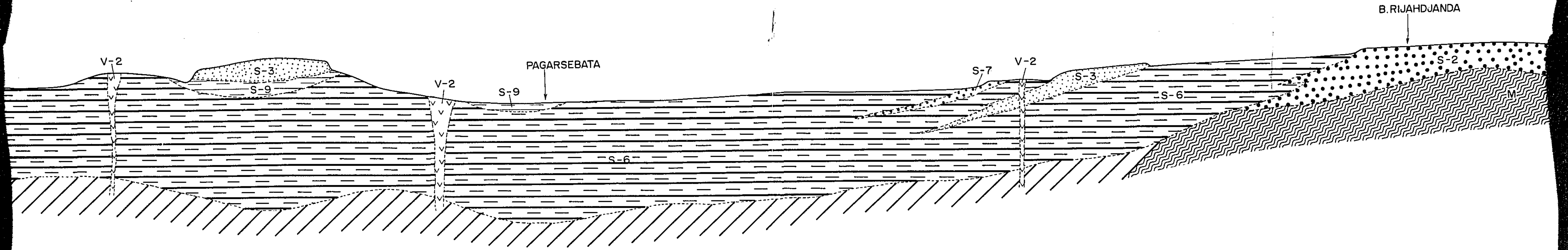
1 : 250,000

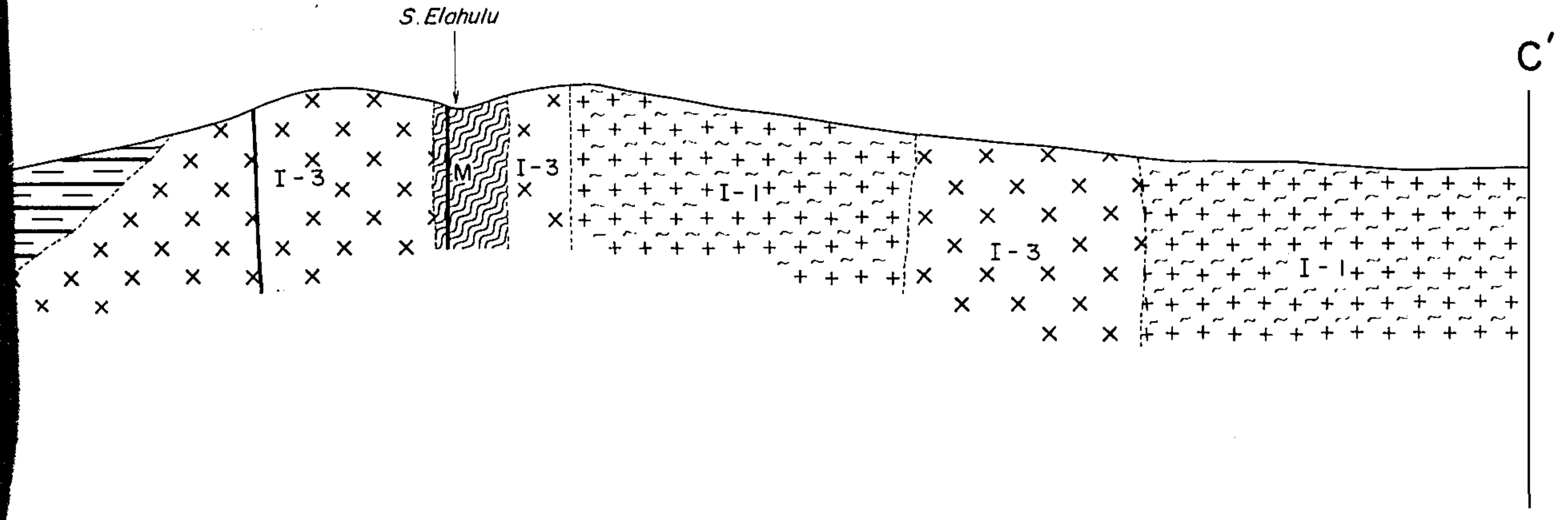


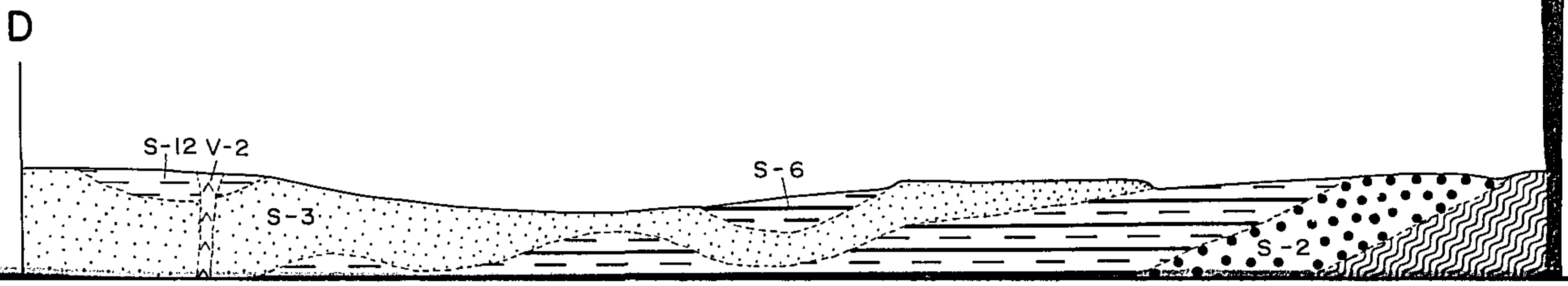
January · 1978

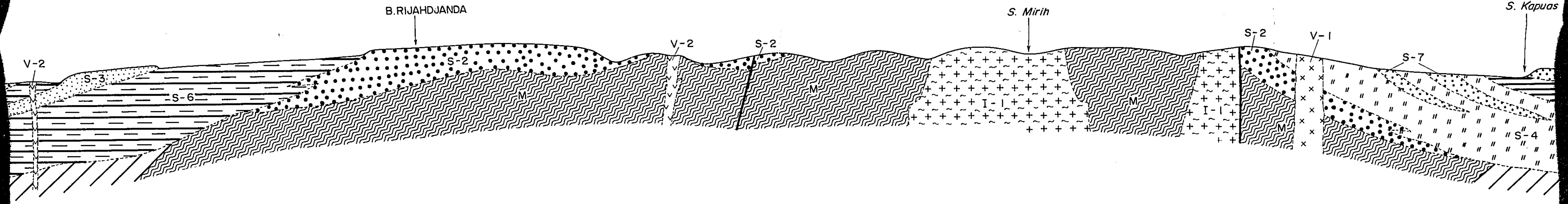

B
S. Kayan
PAGARSEBATA
V-3
V-2
V-2
S-3
S-9
S-9
S-9
S-6
S-6

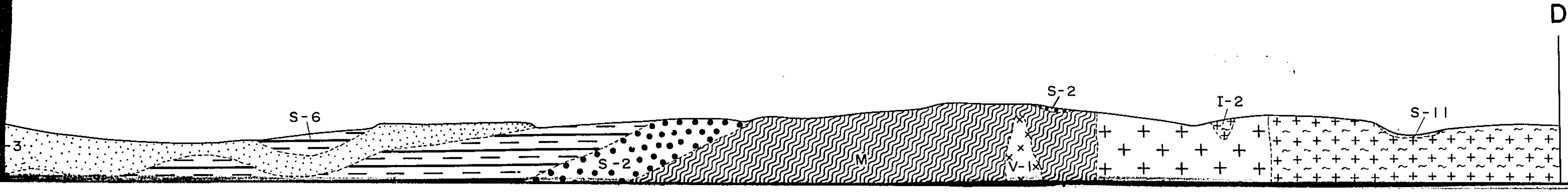

C
S. Elahulu
NANING
S. Melawi
V-2
S-3
S-9
S-9
S-9
S-6
S-6
S-6
I-3
I-3
I-1
I-3
I-1
M

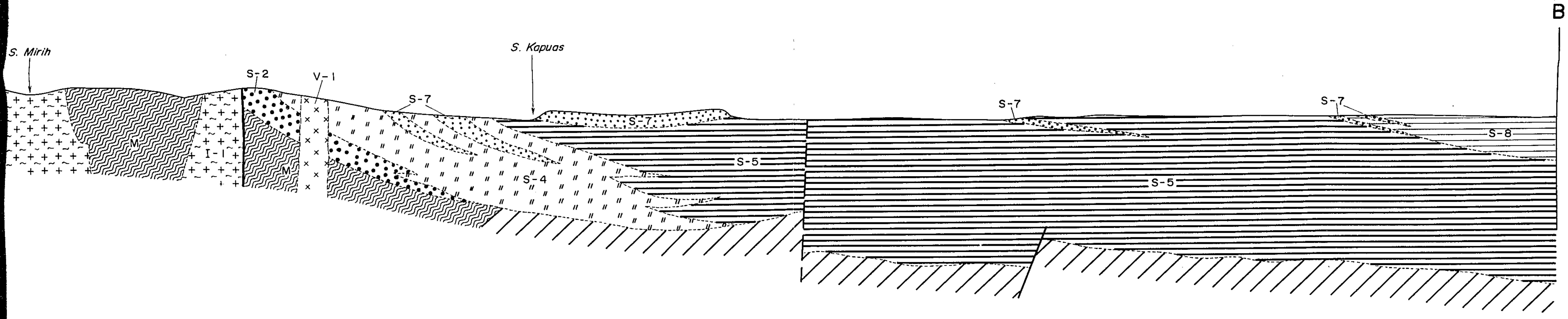

V-2
S-3
S-9
V-2
S-9
PAGARSEBATA
S-6
S-7
V-2
S-3
S-6
B. RIJAHDJANDA
S-2
M

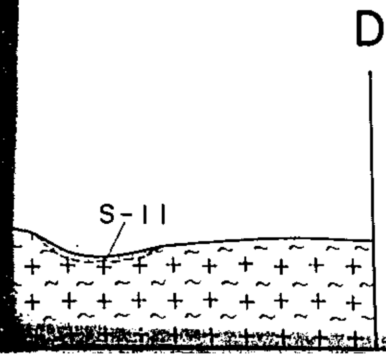

S. Elahulu
C′
I-3
M
I-3
I-1
I-3
I-1


D
S-12 V-2
S-3
S-6
S-2

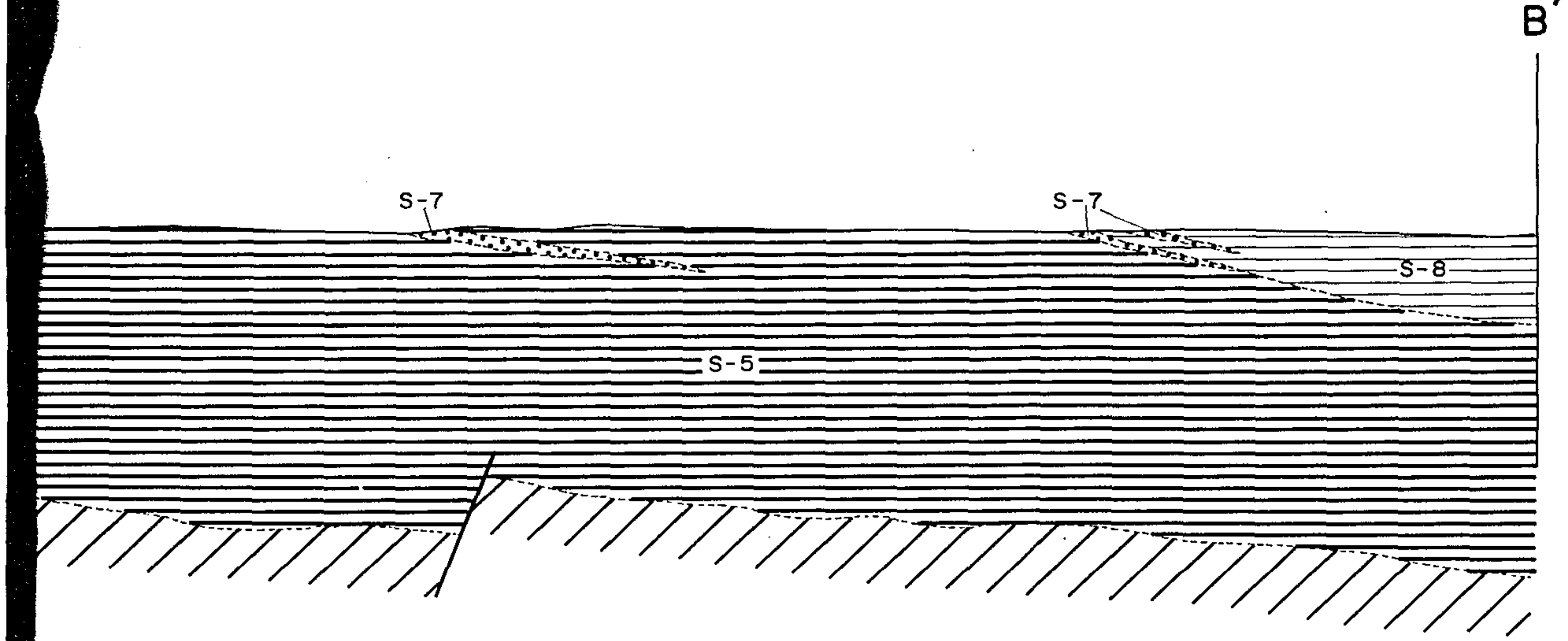

B.RIJAHDJANDA
S. Mirih
S. Kapuas
V-2
S-3
S-6
S-2
M
V-2
S-2
M
I-1
M
S-2
I-1
M
V-1
S-7
S-4

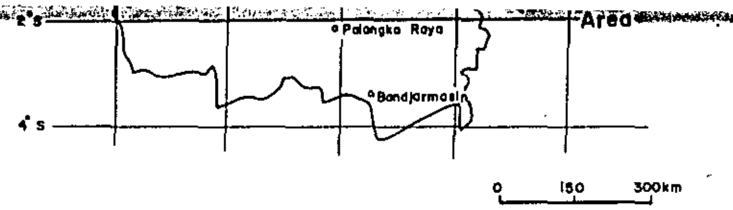

S-6
S-2
M
S-2
V-1
I-2
S-11
D′





S. Barito





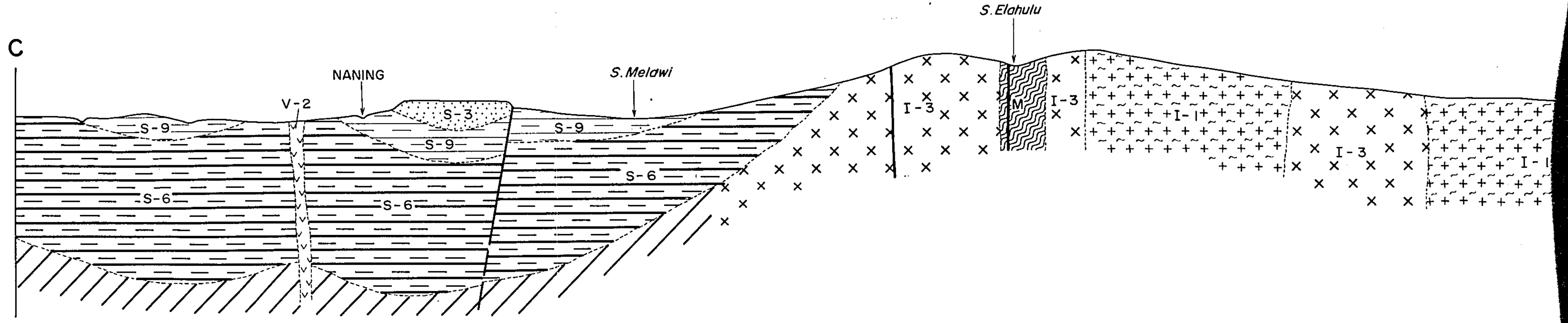
January · 1978

Legend

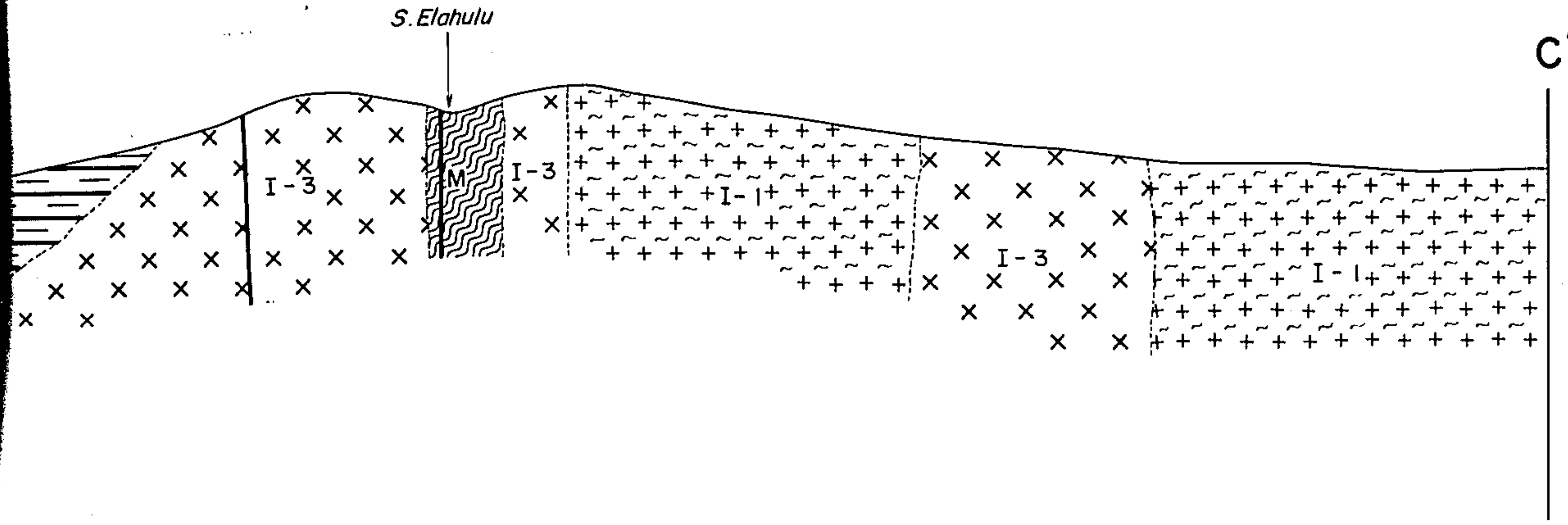
Q	Sand , gravel
S-12	Silt
S-11	Sandstone
S-10	Andesite agglomerate
S-9	Shale, sandstone, marl
S-8	Shale, sandstone, limestone
S-7	Sandstone
S-6	Shale, sandstone, marl, lignite
S-5	Shale, sandstone, limestone
S-4	Pyroclastic rock
S-3	Sandstone
S-2	Sandstone , conglomerate
S-1	Shale , sandstone , limestone
T	Andesite
M	Schist, slate, quartzite
V-3	Andesite ~ basalt
V-2	Dyke rocks of various component (mainly andesite)
V-1	Granitic rock
I-4	Granitic rock
I-3	Granitic rock

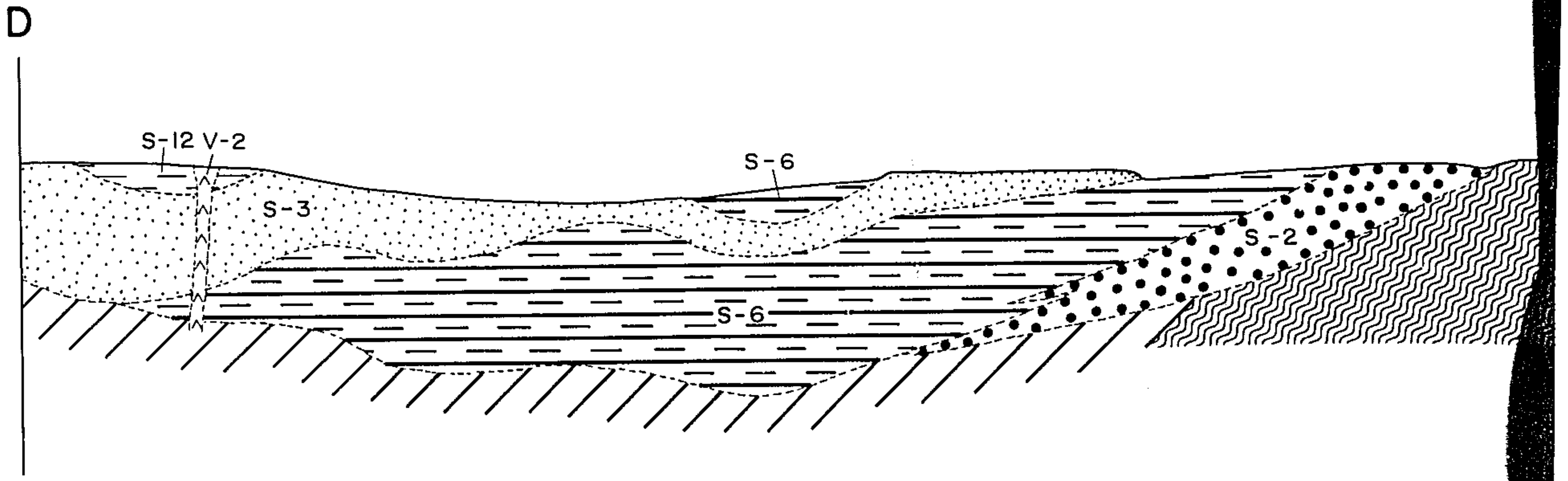
S. Barito

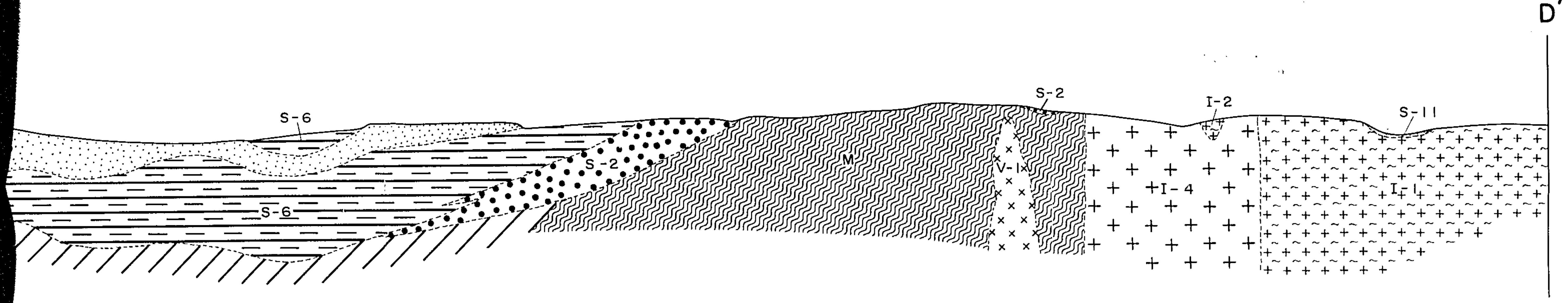
E′



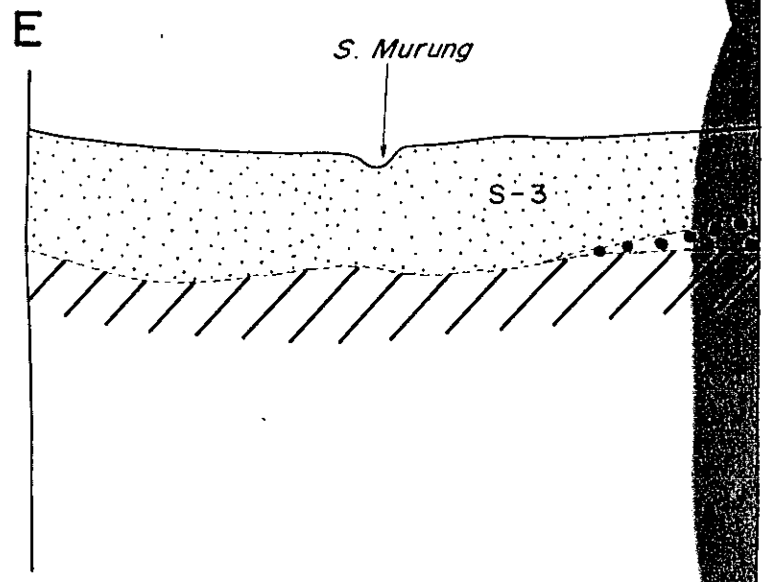
C
NANING
S. Melawi
S. Elahulu
V-2
S-9
S-3
S-9
S-9
S-6
S-6
S-6
I-3
M
I-3
I-1
I-3
I-1


S. Elahulu
C′
I-3
M
I-3
I-1
I-3
I-1

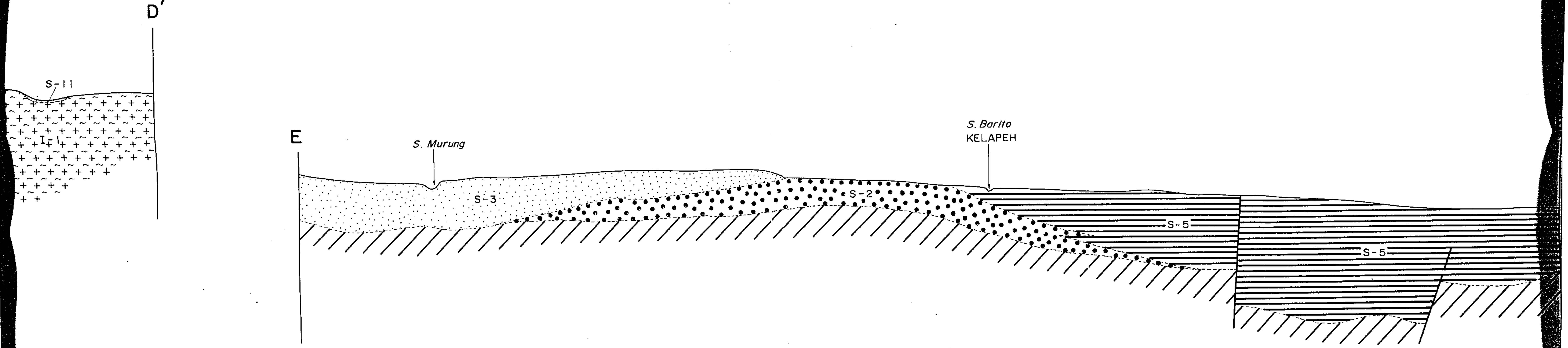

D
S-12 V-2
S-6
S-3
S-2
S-6



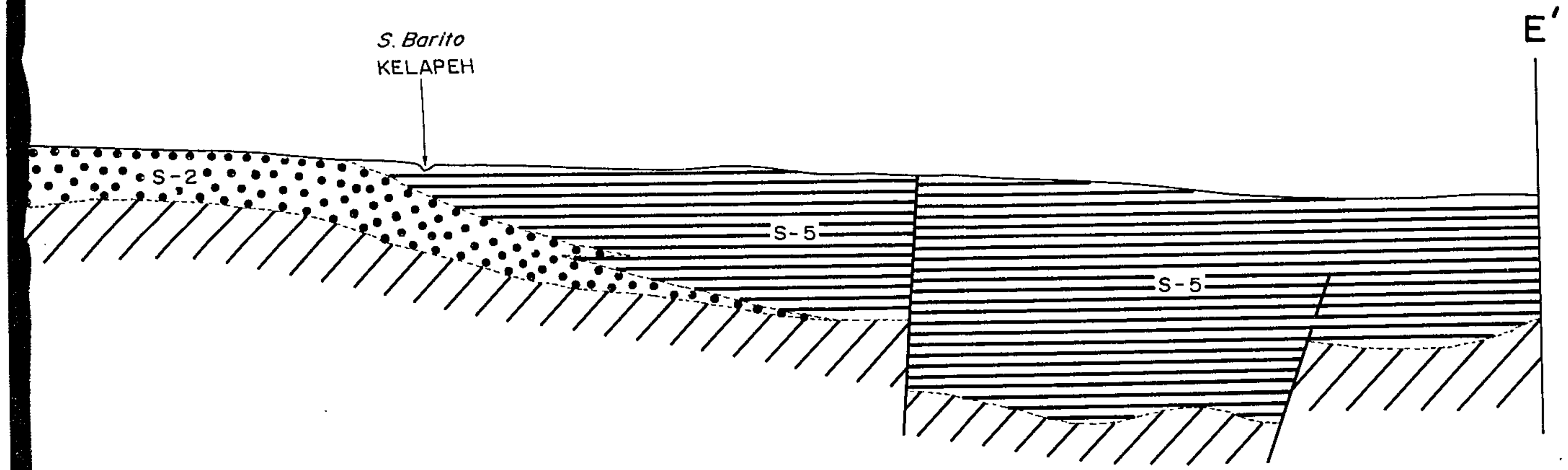
D′
S-6
S-2
I-2
S-11
S-2
M
V-1
I-4
I-1
S-6



E
S. Murung
S-3



D'
S-11
I-1
E
S. Murung
S. Barito
KELAPEH
S-3
S-2
S-5
S-5



S-4	Pyroclastic rock
S-3	Sandstone
S-2	Sandstone, conglomerate
S-1	Shale, sandstone, limestone
T	Andesite
M	Schist, slate, quartzite
V-3	Andesite ~ basalt
V-2	Dyke rocks of various component (mainly andesite)
V-1	Granitic rock
I-4	Granitic rock
I-3	Granitic rock
I-2	Granitic rock
I-1	Gneiss
	Fault
	Undifferenciated pre-Tertiary rocks

PL. IV

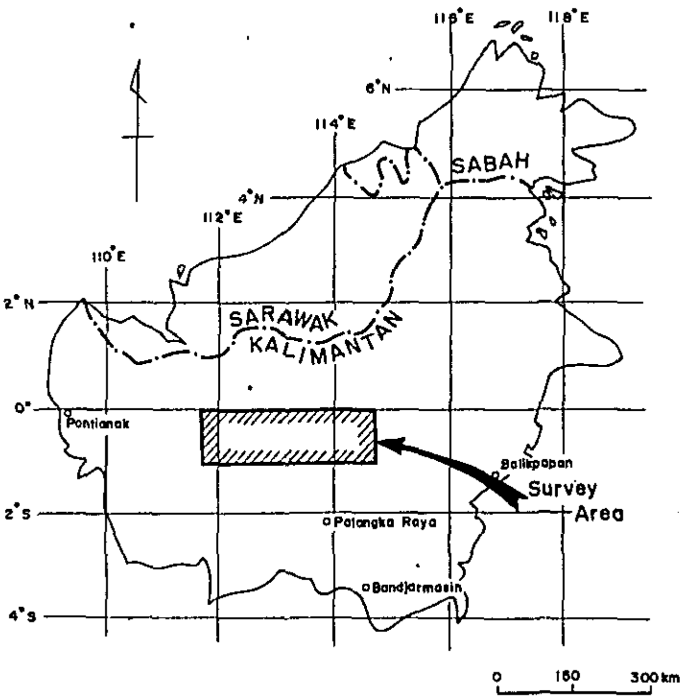
METAL MINING AGENCY OF JAPAN
JAPAN INTERNATIONAL COOPERATION AGENCY
— GEOLOGICAL SURVEY OF INDONESIA

PHOTO - GEOLOGICAL SURVEY OF CENTRAL KALIMANTAN, INDONESIA

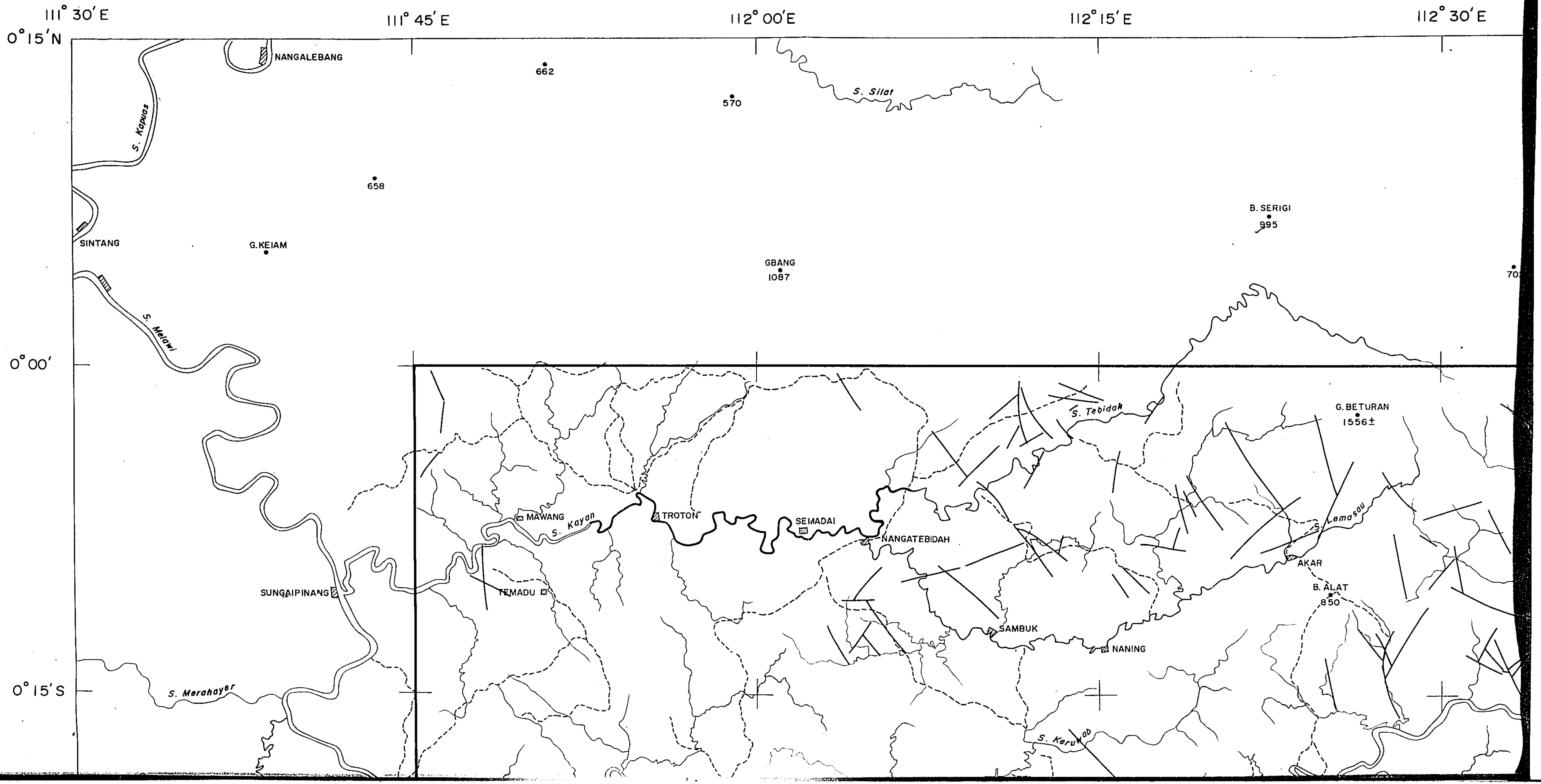
LINEAMENT MAP

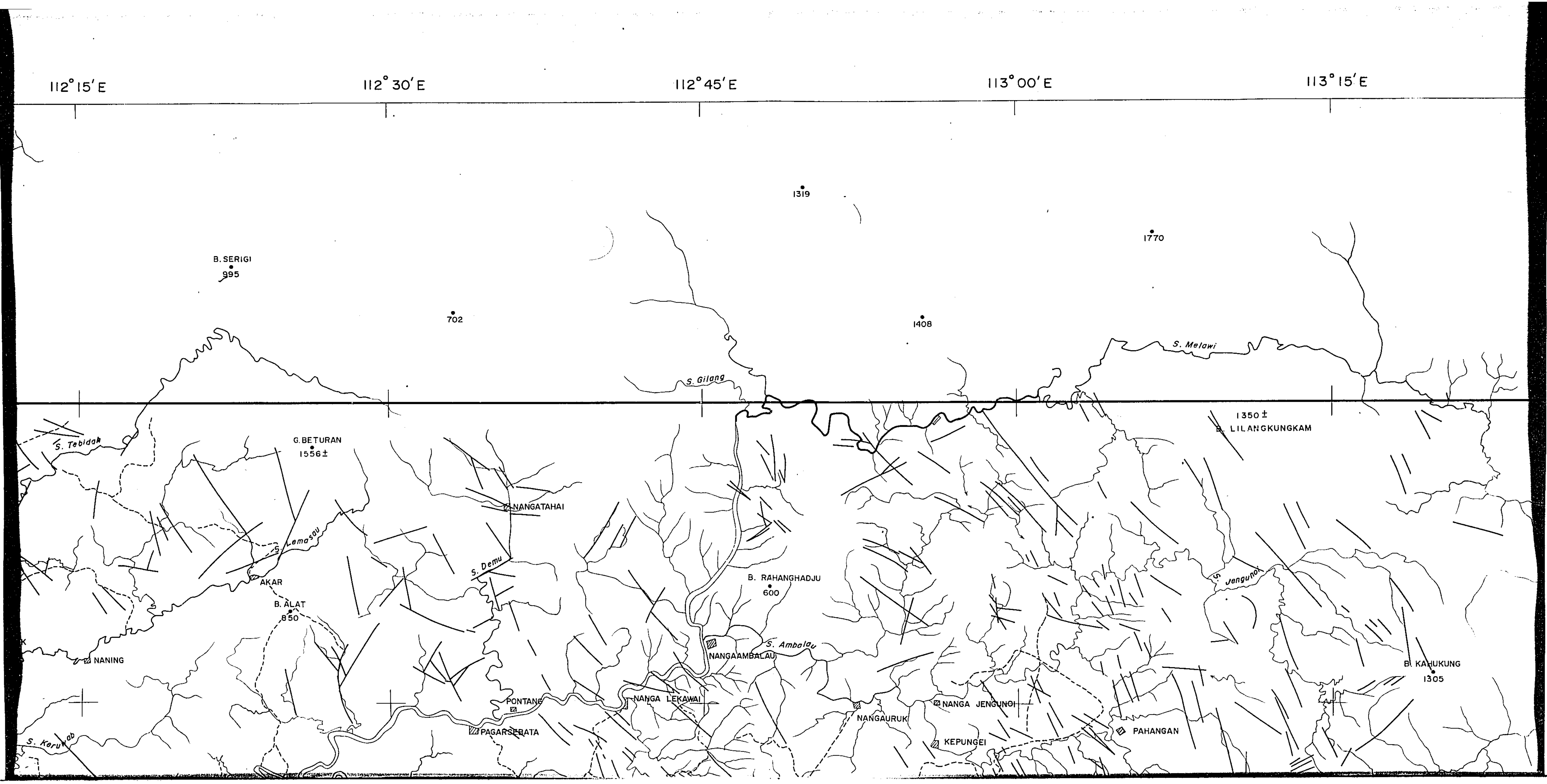
Scale 1: 250,000

0 5 10 15 20 km

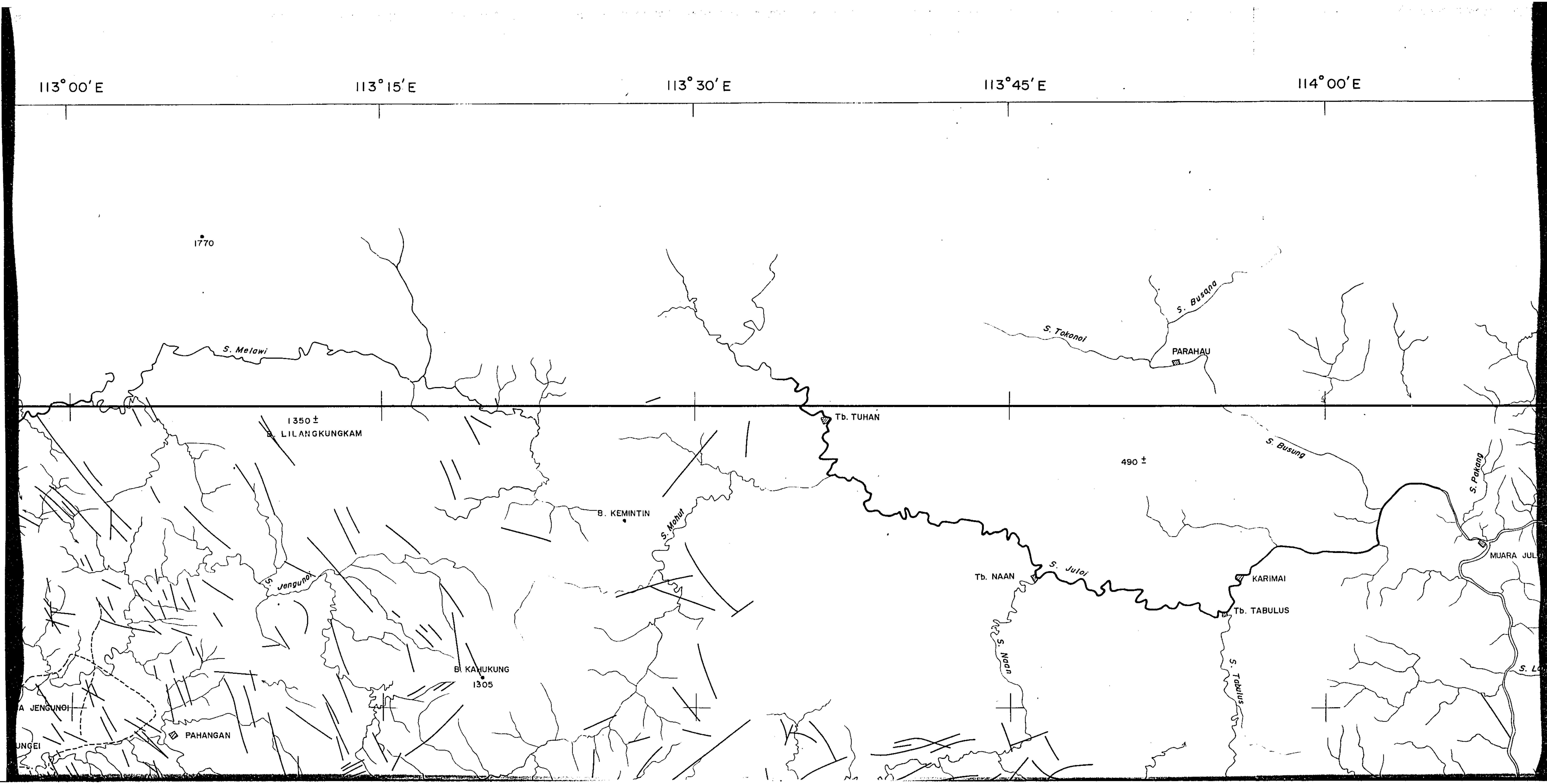


January · 1978

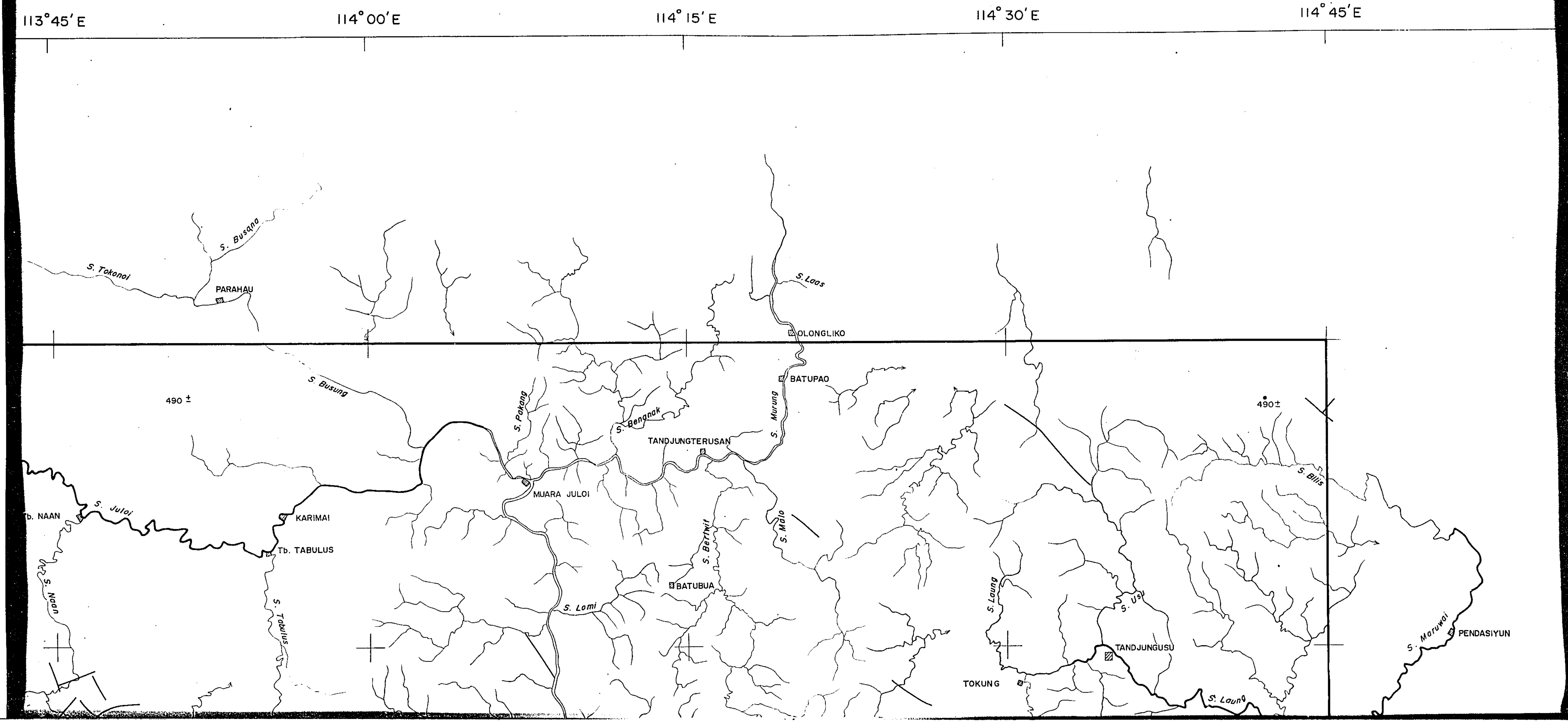

111° 30' E
111° 45' E
112° 00' E
112° 15' E
112° 30' E
0° 15' N
0° 00'
0° 15' S
NANGALEBANG
662
570
S. Silat
S. Kapuas
658
SINTANG
G. KEIAM
GBANG
1087
B. SERIGI
995
S. Melawi
G. BETURAN
1556±
S. Tebidah
MAWANG
S. Kayan
TROTON
SEMADAI
NANGATEBIDAH
S. Lemasau
AKAR
B. ALAT
850
TEMADU
SUNGAIPINANG
SAMBUK
NANING
S. Merahayer
S. Keruwab



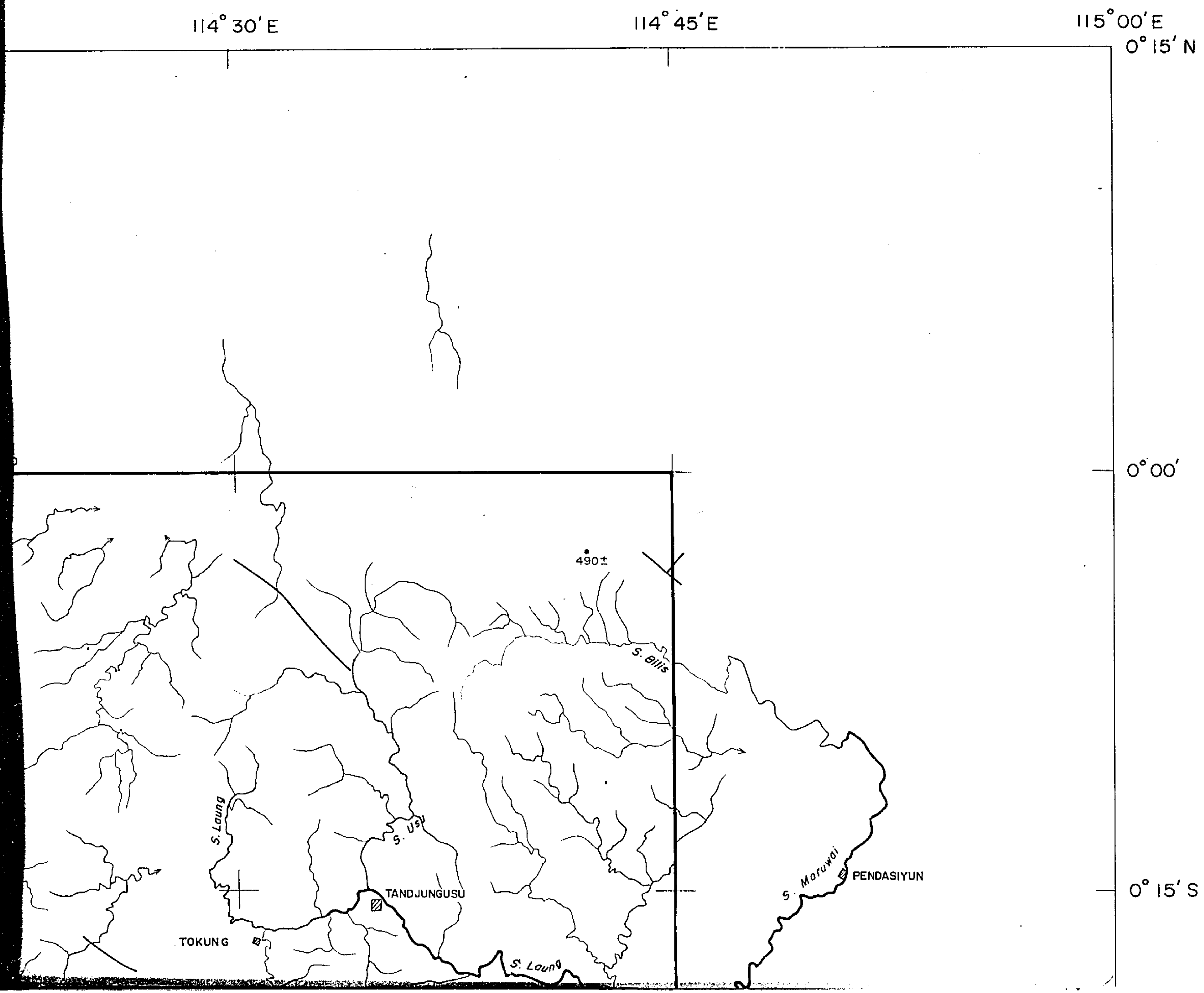
112°15'E
112°30'E
112°45'E
113°00'E
113°15'E
1319
1770
B. SERIGI
995
702
1408
S. Melawi
S. Gilang
1350 ±
B. LILANGKUNGKAM
S. Tebidak
G. BETURAN
1556 ±
NANGATAHAI
S. Lemasau
S. Demu
AKAR
B. ALAT
850
B. RAHANGHADJU
600
S. Jengunoi
S. Ambalau
NANGAAMBALAU
NANING
B. KAHUKUNG
1305
PONTANG
NANGA LEKAWAI
NANGAURUK
NANGA JENGUNOI
PAGARSEBATA
KEPUNGEI
PAHANGAN
S. Keruhab



113° 00′ E
113° 15′ E
113° 30′ E
113° 45′ E
114° 00′ E
1770
S. Melawi
S. Tokonoi
S. Busana
PARAHAU
Tb. TUHAN
1350 ±
B. LILANGKUNGKAM
S. Busung
490 ±
S. Pakang
B. KEMINTIN
S. Mohut
S. Jengunoi
Tb. NAAN
S. Juloi
KARIMAI
MUARA JUL
Tb. TABULUS
S. Naan
S. Tabulus
B. KAHUKUNG
1305
A JENGUNOI
PAHANGAN
UNGEI



113°45'E
114°00'E
114°15'E
114°30'E
114°45'E
S. Busana
S. Tokonoi
PARAHAU
S. Laas
OLONGLIKO
BATUPAO
S. Busung
490 ±
S. Pakang
S. Benanak
S. Murung
TANDJUNGTERUSAN
490±
S. Bilis
MUARA JULOI
S. Juloi
Tb. NAAN
KARIMAI
Tb. TABULUS
S. Malo
S. Beriwit
S. Naan
S. Tabulus
BATUBUA
S. Lomi
S. Laung
S. Usi
TANDJUNGUSU
S. Maruwai
PENDASIYUN
TOKUNG
S. Laung



PL. IV

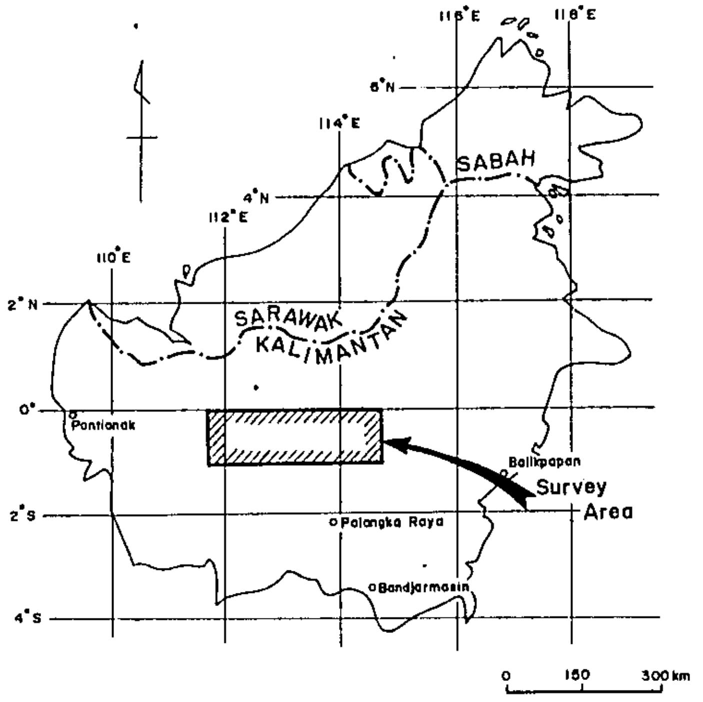
METAL MINING AGENCY OF JAPAN
JAPAN INTERNATIONAL COOPERATION AGENCY
— GEOLOGICAL SURVEY OF INDONESIA

PHOTO - GEOLOGICAL SURVEY OF CENTRAL KALIMANTAN, INDONESIA

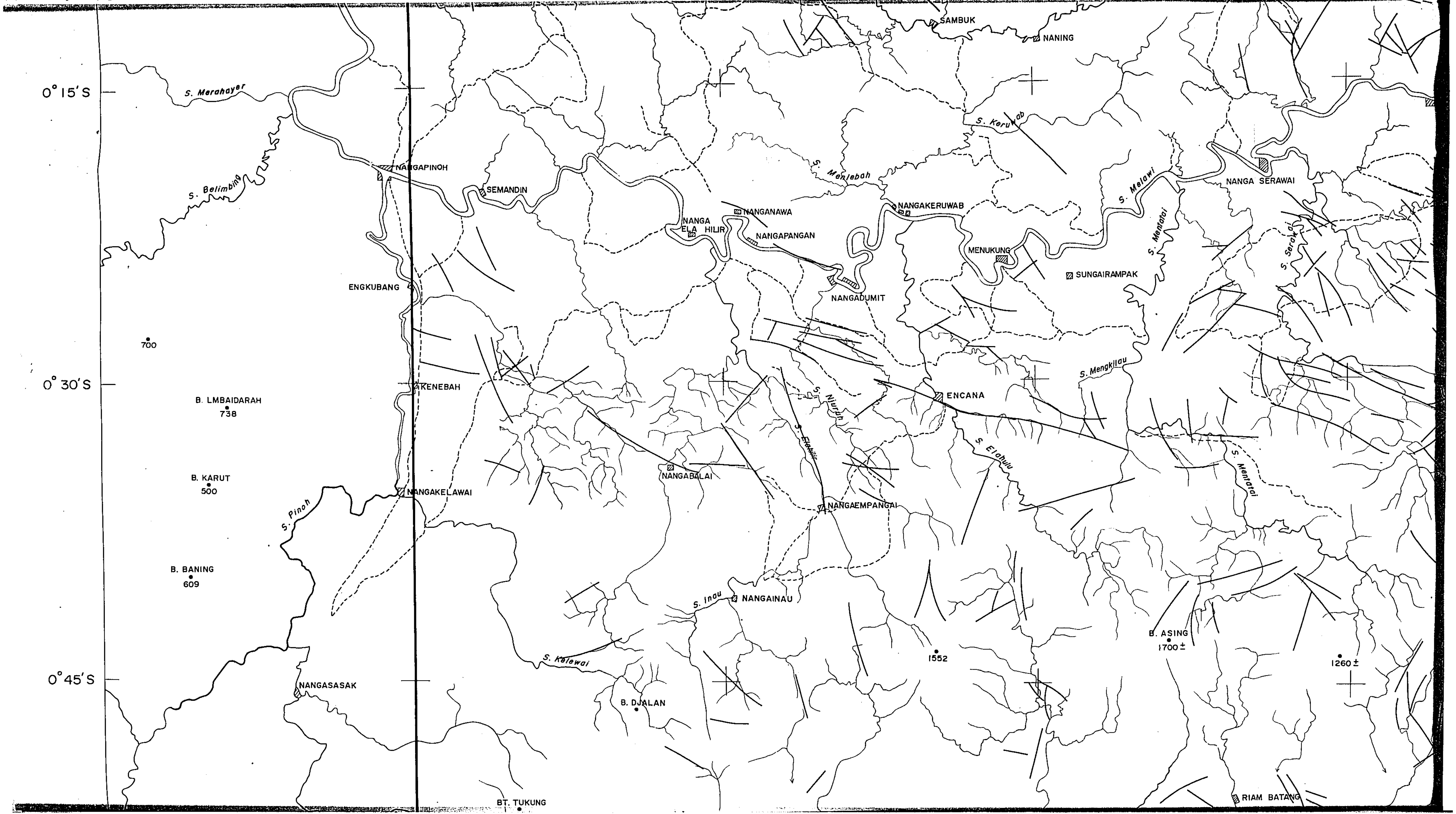
LINEAMENT MAP

Scale 1: 250,000

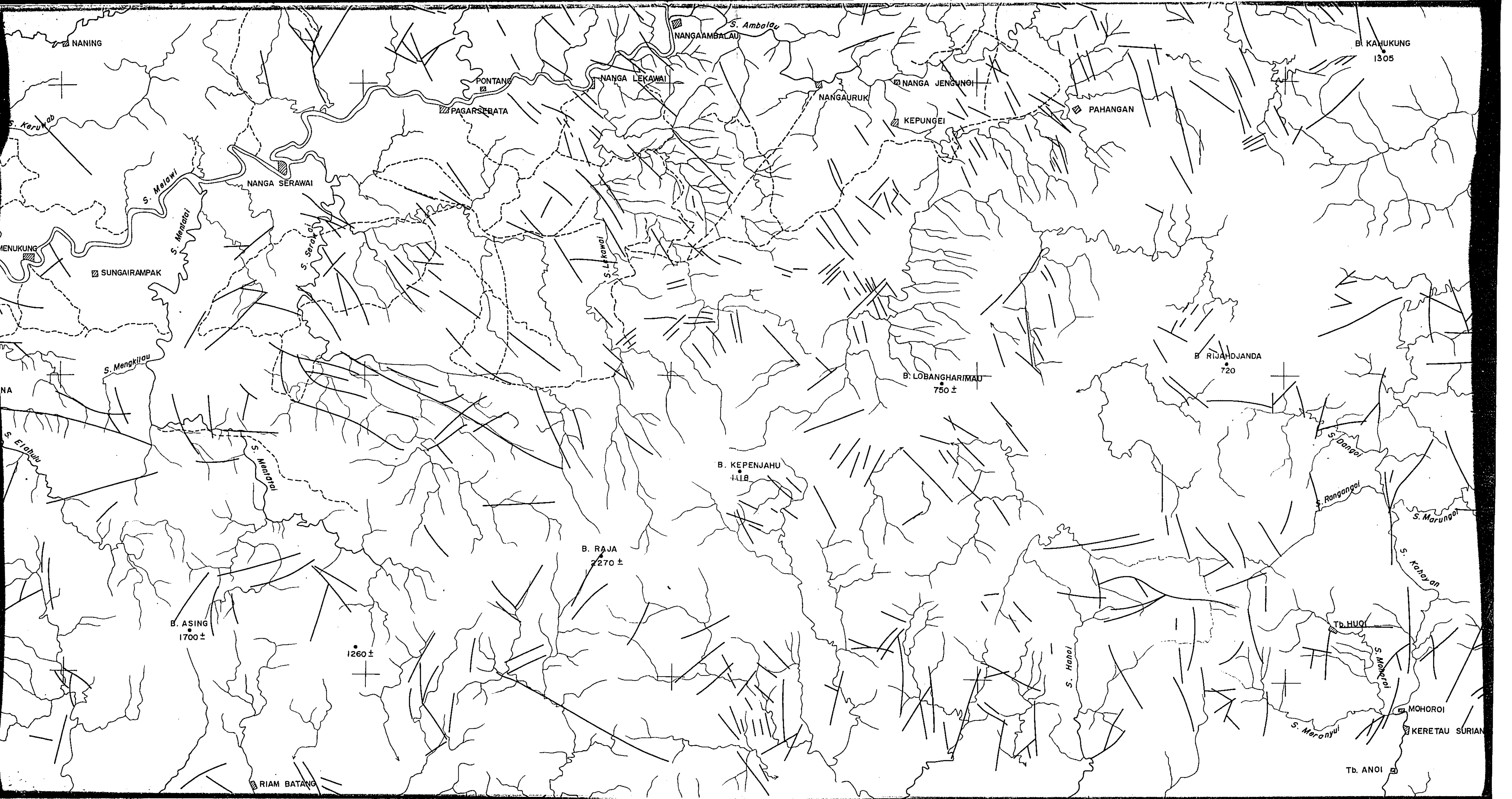
0 5 10 15 20 km



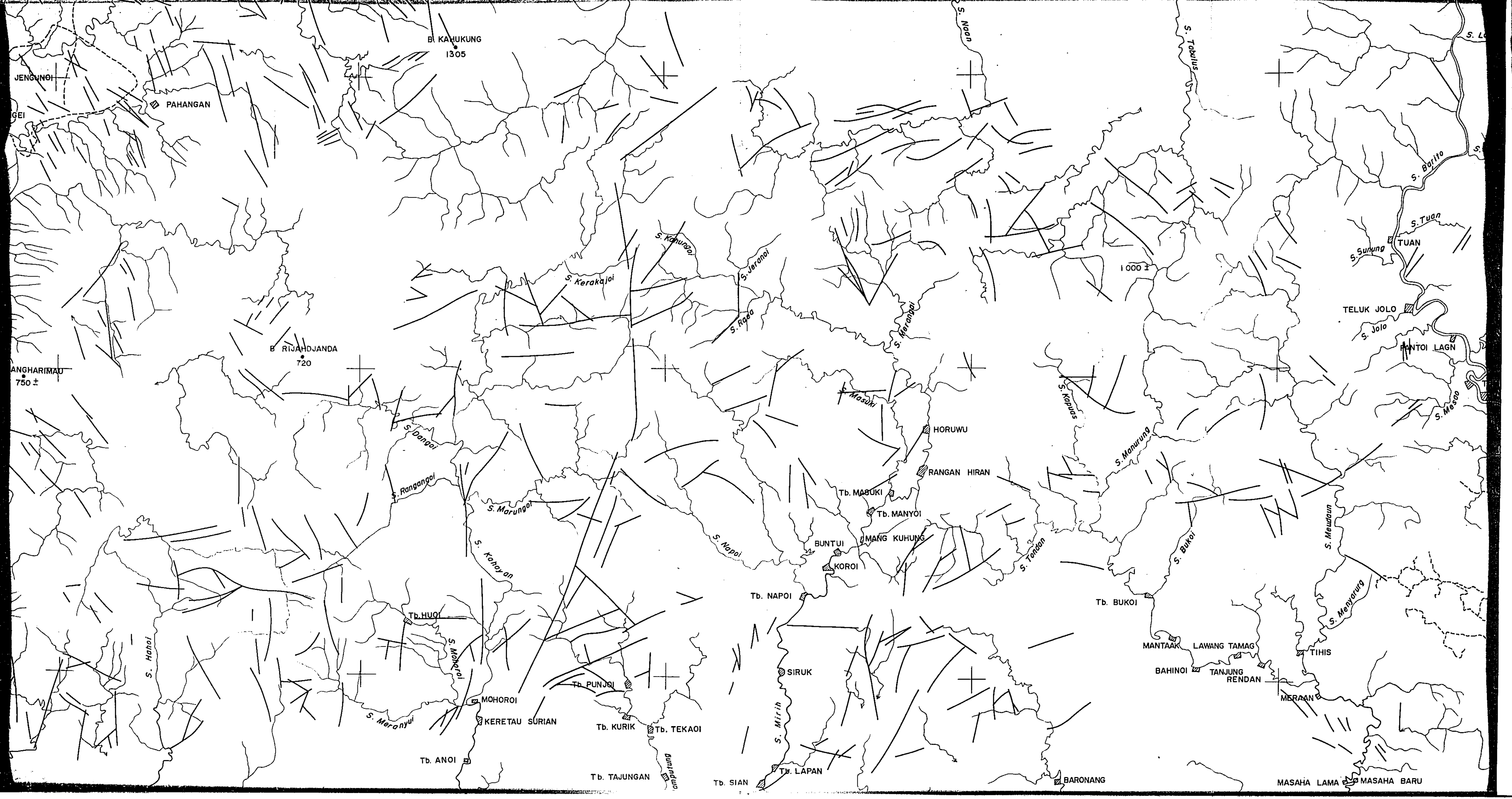
January · 1978

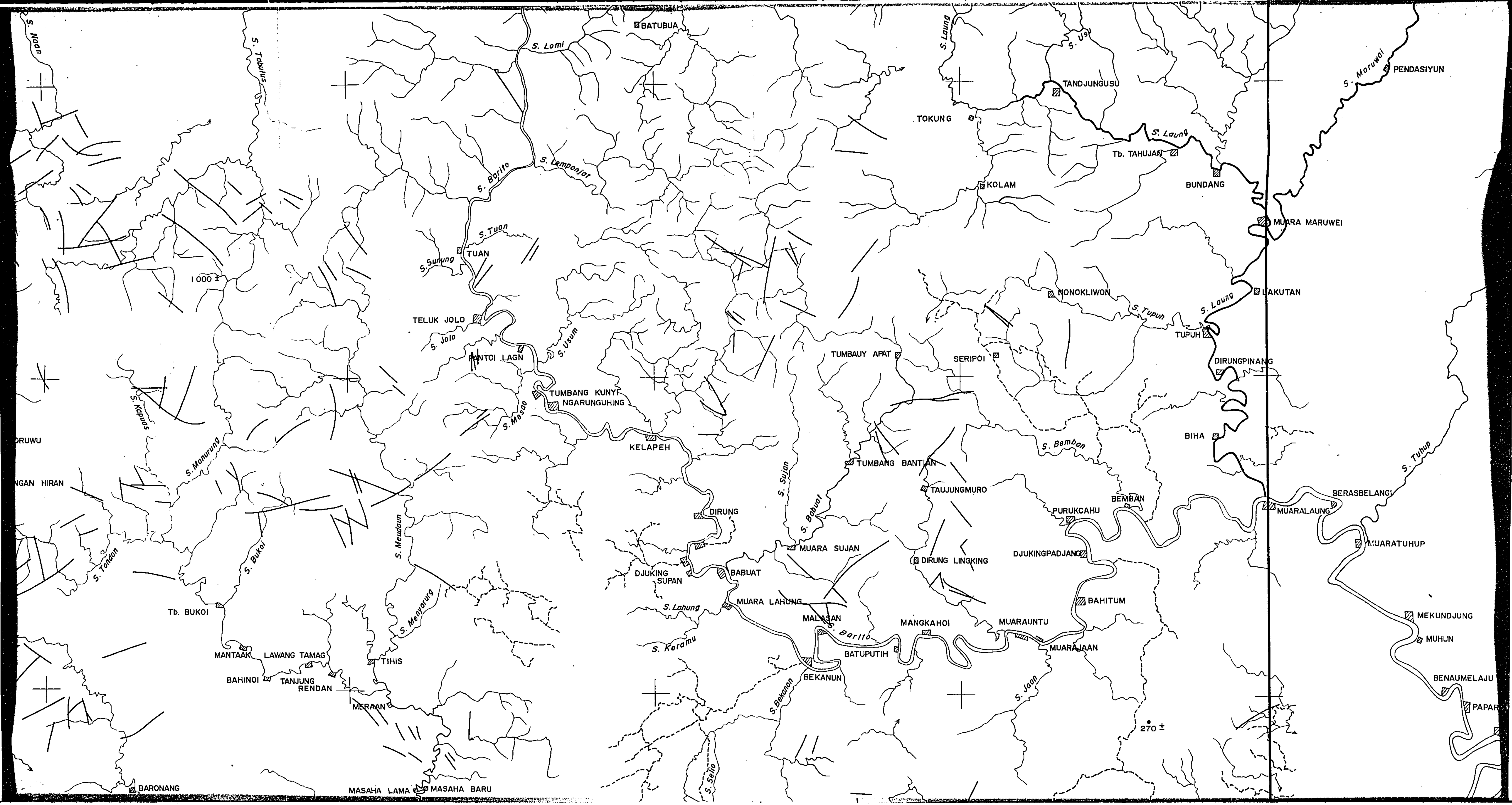


0° 15'S
0° 30'S
0° 45'S
SAMBUK
NANING
S. Merahayer
S. Keruwab
S. Belimbing
NANGAPINOH
SEMANDIN
S. Menlebah
S. Melawi
NANGA SERAWAI
NANGAKERUWAB
NANGANAWA
NANGA
ELA HILIR
NANGAPANGAN
MENUKUNG
S. Mentatai
S. Serakai
SUNGAIRAMPAK
ENGKUBANG
NANGADUMIT
700
S. Mengkilau
KENEBAH
ENCANA
S. Njuruh
B. LMBAIDARAH
738
S. Elahilir
S. Elahulu
S. Mentatai
B. KARUT
500
NANGABALAI
NANGAKELAWAI
NANGAEMPANGAI
S. Pinoh
B. BANING
609
S. Inau
NANGAINAU
B. ASING
1700 ±
1552
1260 ±
S. Kelewai
NANGASASAK
B. DJALAN
BT. TUKUNG
RIAM BATANG

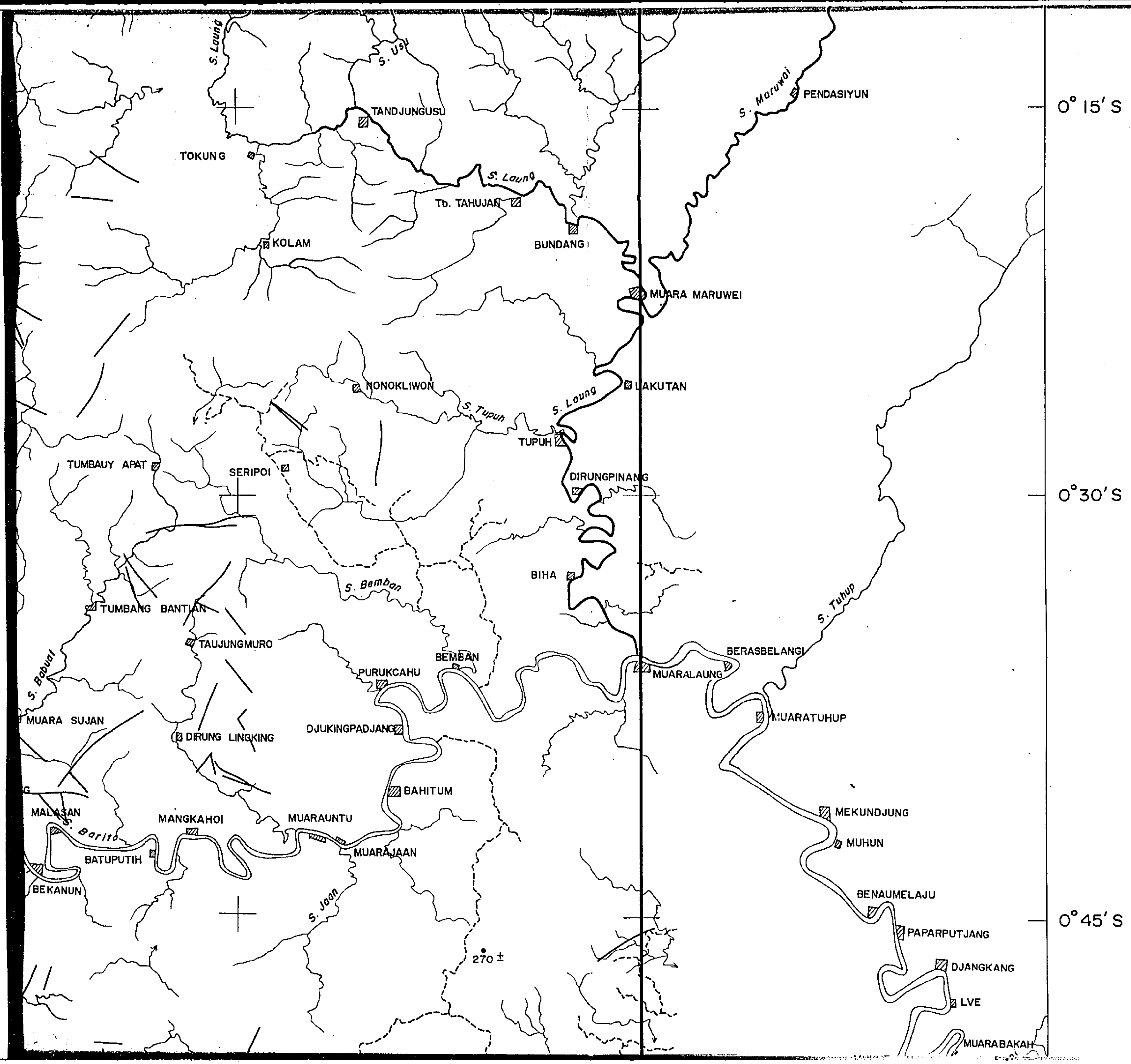


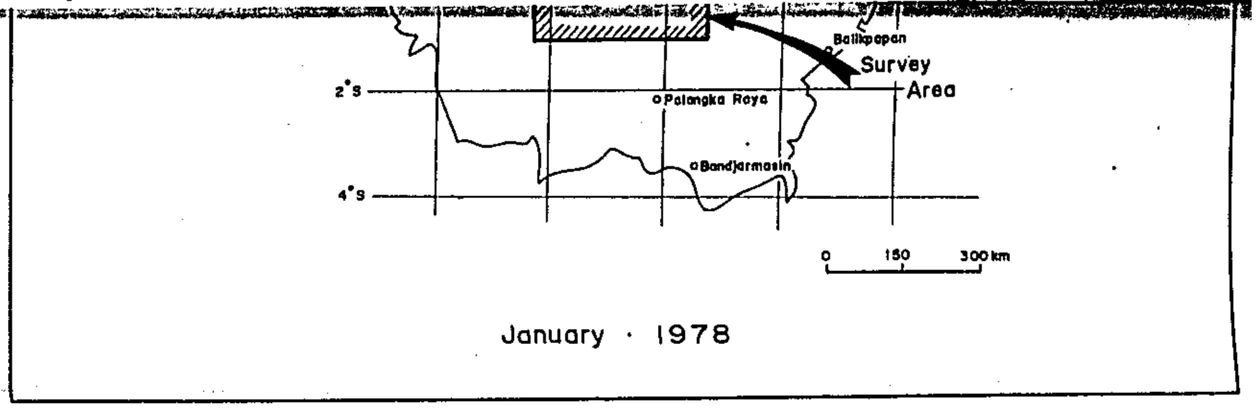
NANING
S. Ambalau
NANGAAMBALAU
B. KAHUKUNG
1305
PONTANG
NANGA LEKAWAI
NANGA JENGUNOI
NANGAURUK
PAGARSEBATA
PAHANGAN
KEPUNGEI
S. Keruwab
S. Melawi
NANGA SERAWAI
S. Mentatai
MENUKUNG
SUNGAIRAMPAK
S. Serawai
S. Lekawai
S. Mengkitau
B. RIJAHDJANDA
720
B. LOBANGHARIMAU
750 ±
NA
S. Elahulu
S. Mentatai
B. KEPENJAHU
1118
S. Dangoi
S. Rangangoi
S. Marungoi
S. Kahayan
B. RAJA
2270 ±
B. ASING
1700 ±
1260 ±
Tb. HUOI
S. Hahoi
S. Mohoroi
MOHOROI
S. Meranyui
KERETAU SURIAN
Tb. ANOI
RIAM BATANG


JENGUNOI
GEI
PAHANGAN
B. KAHUKUNG
1305
S. Naan
S. Tobulus
S. Barito
S. Tuan
S. Sunung
TUAN
1000 ±
TELUK JOLO
S. Jolo
PANTOI LAGN
S. Mesao
S. Kahungoi
S. Kerakajoi
S. Jeranoi
S. Rada
S. Marangai
B. RIJAHDJANDA
720
ANGHARIMAU
750 ±
S. Masuki
HORUWU
S. Kapuas
S. Manurung
RANGAN HIRAN
S. Dangai
S. Rangangoi
S. Marungoi
Tb. MASUKI
Tb. MANYOI
MANG KUHUNG
BUNTUI
KOROI
S. Napoi
S. Tondan
S. Bukoi
S. Meudaun
S. Kahayan
Tb. NAPOI
Tb. BUKOI
S. Menyarung
Tb. HUOI
S. Mohoroi
S. Hahoi
MANTAAK
LAWANG TAMAG
TIHIS
BAHINOI
TANJUNG
RENDAN
MERAAN
SIRUK
Tb. PUNJOI
MOHOROI
KERETAU SURIAN
S. Meranyui
Tb. KURIK
Tb. TEKAOI
S. Mirih
Tb. ANOI
Tb. TAJUNGAN
Tb. SIAN
Tb. LAPAN
BARONANG
MASAHA LAMA
MASAHA BARU



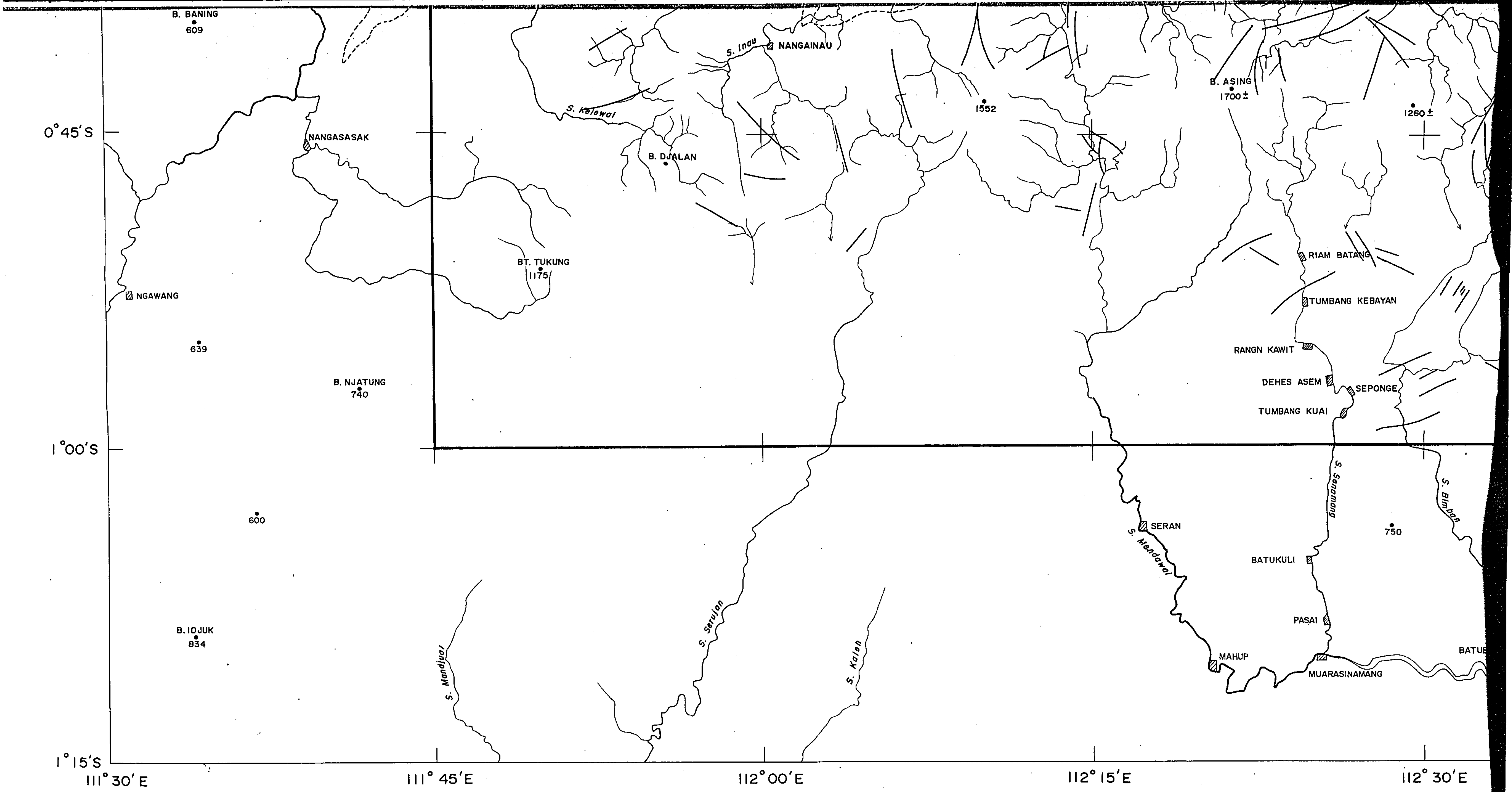
S. Naan
S. Tabulus
S. Lomi
BATUBUA
S. Laung
S. Usu
S. Maruwai
PENDASIYUN
TANDJUNGUSU
TOKUNG
S. Laung
Tb. TAHUJAN
BUNDANG
S. Barito
S. Lemponjat
KOLAM
MUARA MARUWEI
S. Tuan
S. Sunung
TUAN
1 000 ±
NONOKLIWON
S. Tupuh
S. Laung
LAKUTAN
TELUK JOLO
S. Jolo
PANTOI LAGN
S. Usum
TUPUH
TUMBAUY APAT
SERIPOI
DIRUNGPINANG
TUMBANG KUNYI
NGARUNGUHING
S. Mesao
S. Kapuas
KELAPEH
BIHA
S. Bemban
S. Manurung
TUMBANG BANTIAN
S. Sujan
TAUJUNGMURO
S. Tuhup
BERASBELANGI
BEMBAN
PURUKCAHU
MUARALAUNG
DIRUNG
S. Babuat
S. Meudaun
MUARATUHUP
MUARA SUJAN
DJUKINGPADJANG
DIRUNG LINGKING
S. Tondon
S. Bukoi
DJUKING SUPAN
BABUAT
S. Menyarug
BAHITUM
Tb. BUKOI
S. Lahung
MUARA LAHUNG
MALASAN
MANGKAHOI
MUARAUNTU
MEKUNDJUNG
S. Barito
MUHUN
MANTAAK
LAWANG TAMAG
TIHIS
S. Keramu
BATUPUTIH
MUARAJAAN
BAHINOI
TANJUNG RENDAN
BEKANUN
BENAUMELAJU
MERAAN
S. Jaan
S. Bekanan
270 ±
S. Selio
BARONANG
MASAHA LAMA
MASAHA BARU

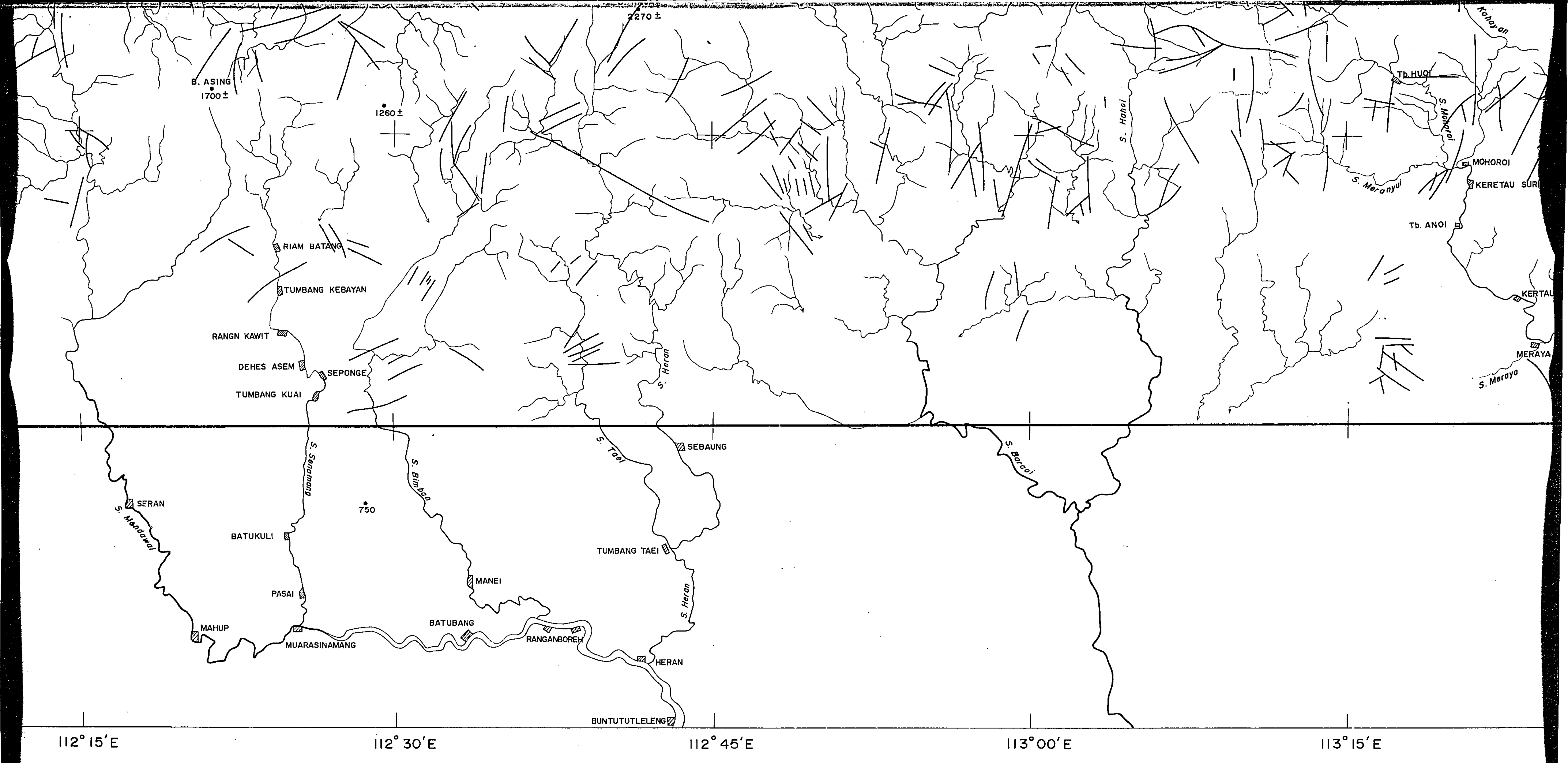




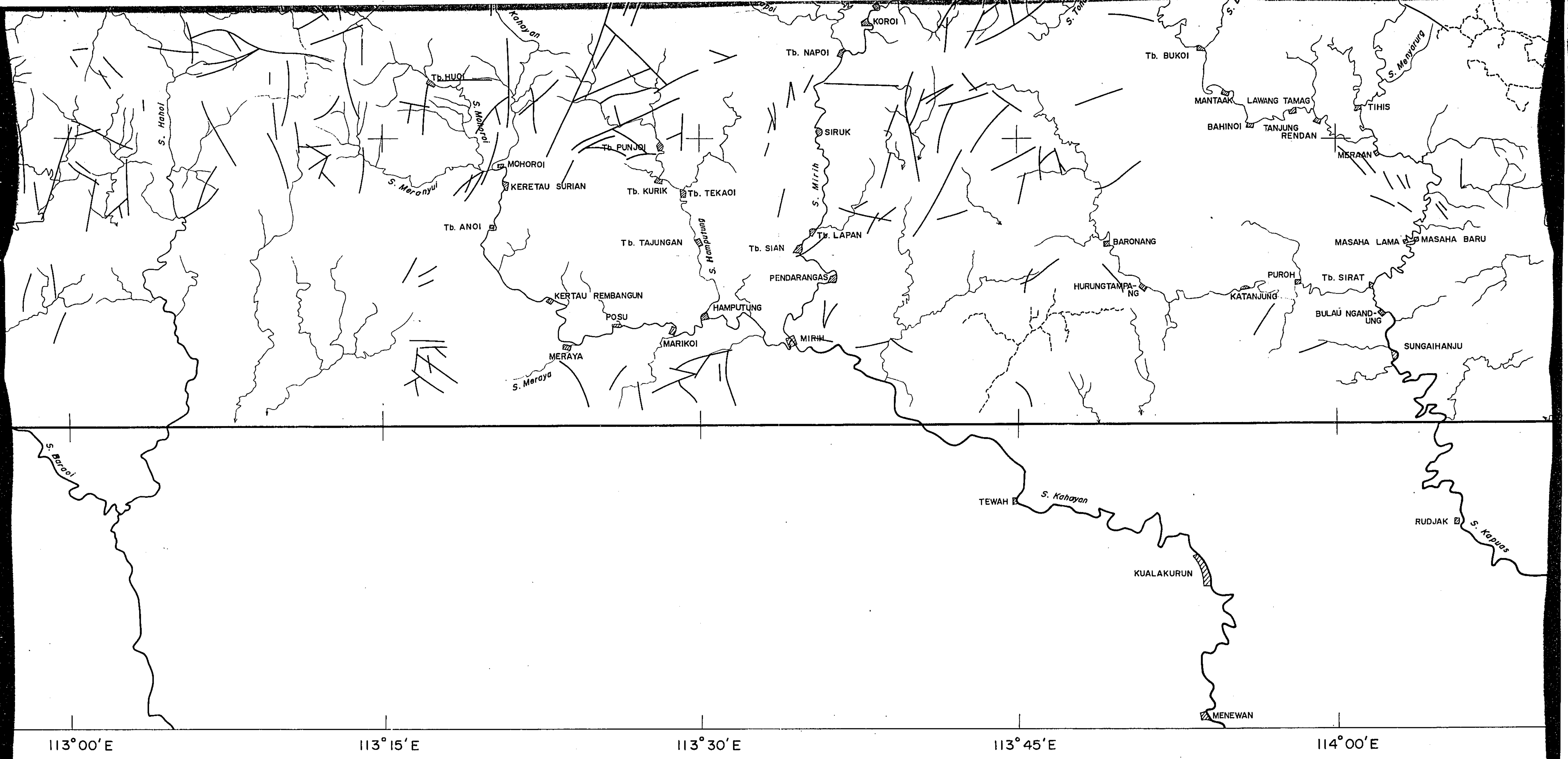
Legend

Lineament

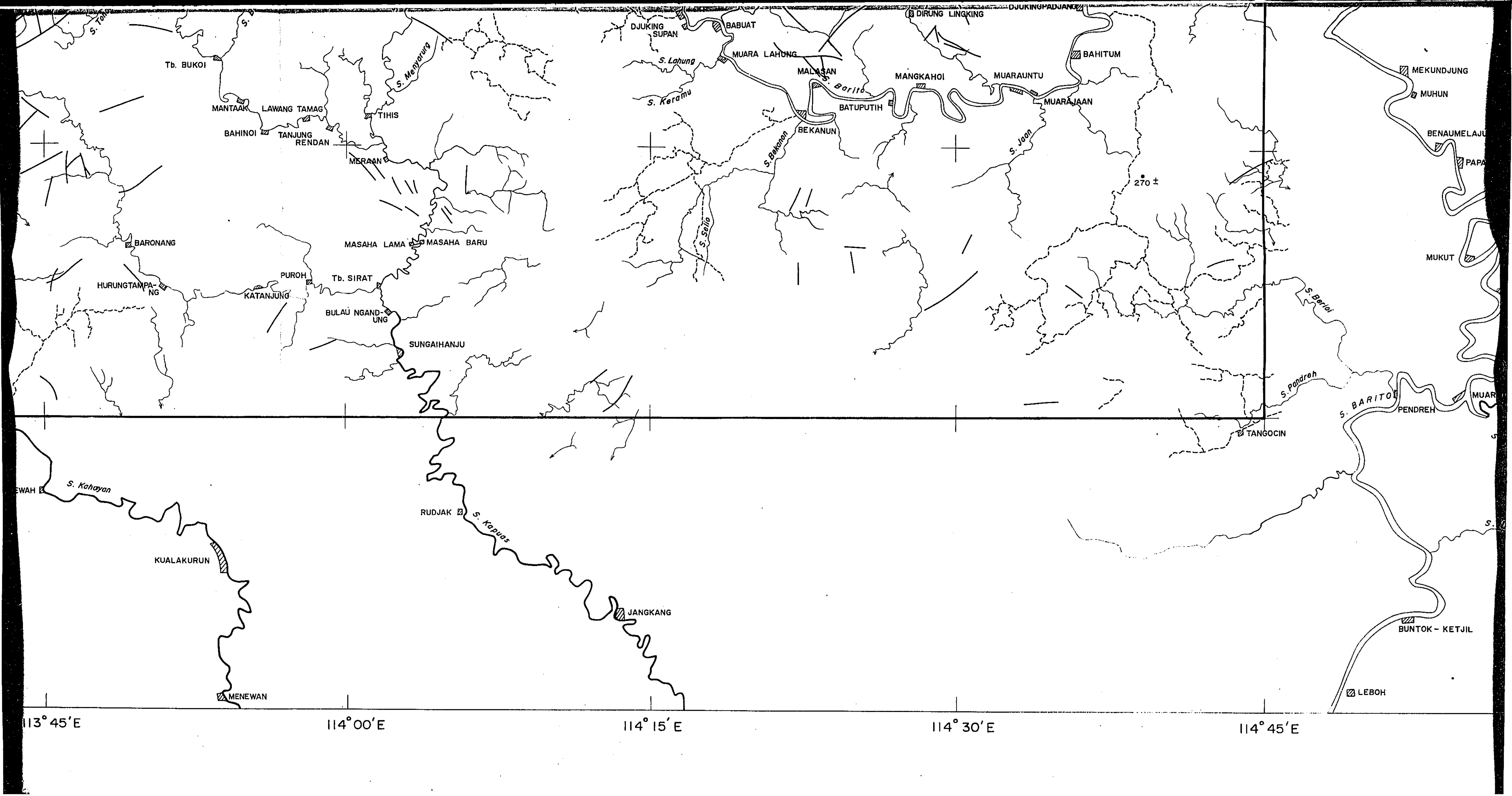

B. BANING
609
NANGAINAU
S. Inau
S. Kalewai
B. ASING
1700 ±
1552
1260 ±
0°45'S
NANGASASAK
B. DJALAN
BT. TUKUNG
1175
NGAWANG
RIAM BATANG
TUMBANG KEBAYAN
639
RANGN KAWIT
B. NJATUNG
740
DEHES ASEM
SEPONGE
TUMBANG KUAI
1°00'S
S. Senamang
S. Bimban
600
SERAN
S. Mendawai
750
BATUKULI
S. Serujan
S. Kaleh
PASAI
B. IDJUK
834
S. Mandjual
MAHUP
MUARASINAMANG
BATUE
1°15'S
111°30'E
111°45'E
112°00'E
112°15'E
112°30'E

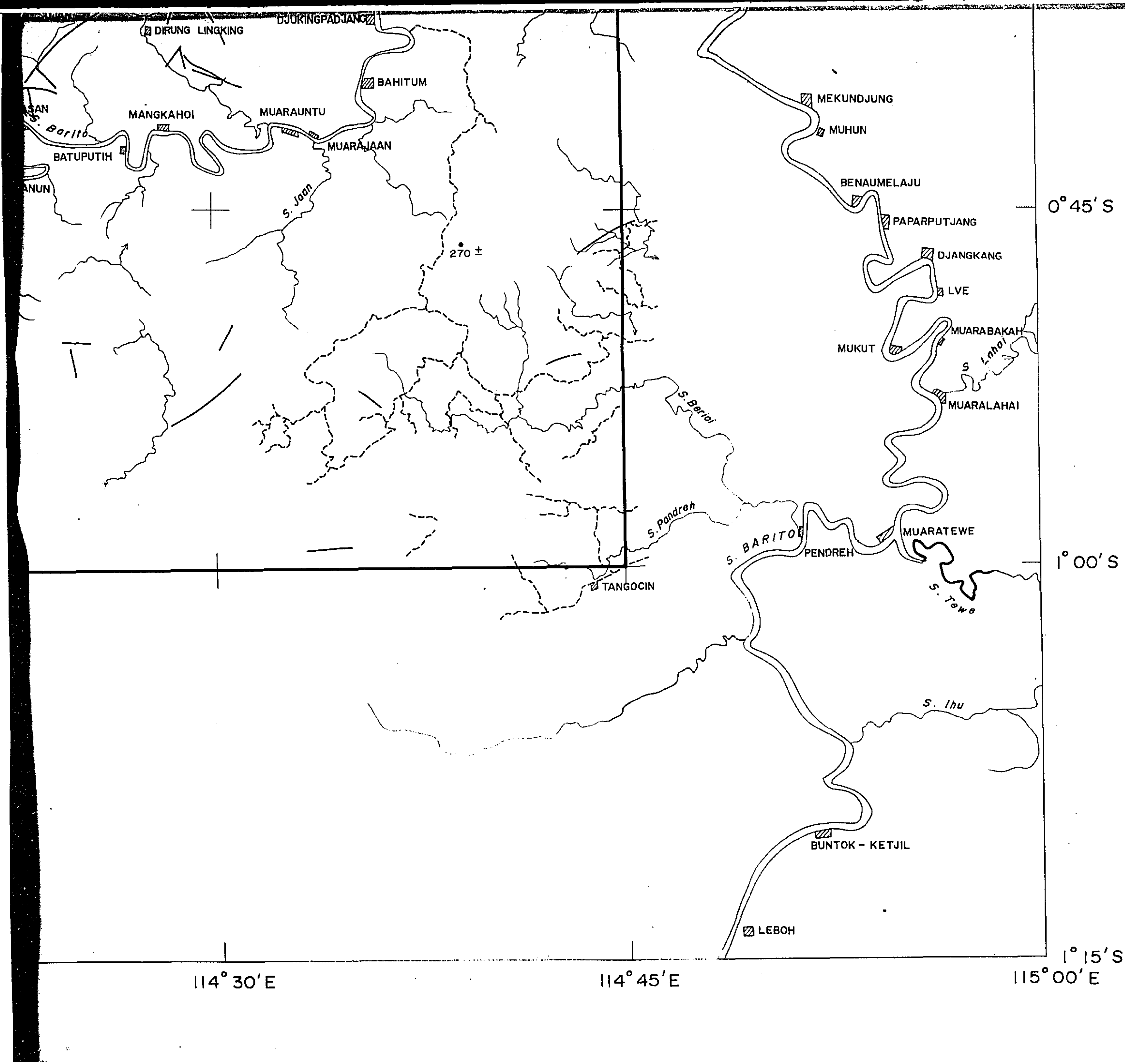


2270 ±
B. ASING
1700 ±
1260 ±
Kahayan
Tb. HUOI
S. Mohoroi
S. Hahoi
MOHOROI
KERETAU
S. Meranyui
Tb. ANOI
RIAM BATANG
TUMBANG KEBAYAN
RANGN KAWIT
DEHES ASEM
SEPONGE
TUMBANG KUAI
S. Heran
KERTAU
MERAYA
S. Meraya
S. Senamang
S. Bimban
S. Taei
SEBAUNG
S. Baraoi
SERAN
S. Mendawai
750
BATUKULI
TUMBANG TAEI
MANEI
PASAI
S. Heran
MAHUP
BATUBANG
MUARASINAMANG
RANGANBOREH
HERAN
BUNTUTUTLELENG
112° 15′E
112° 30′E
112° 45′E
113° 00′E
113° 15′E



KOROI
Tb. NAPOI
Tb. BUKOI
Kahayan
Tb. HUOI
S. Mohoroi
S. Hahoi
S. Menyarung
MANTAAK
LAWANG TAMAG
TIHIS
BAHINOI
TANJUNG RENDAN
MERAAN
SIRUK
Tb. PUNJOI
MOHOROI
KERETAU SURIAN
S. Meranyui
Tb. KURIK
Tb. TEKAOI
S. Mirih
Tb. ANOI
Tb. LAPAN
Tb. TAJUNGAN
Tb. SIAN
S. Hamputung
BARONANG
MASAHA LAMA
MASAHA BARU
PENDARANGAS
PUROH
Tb. SIRAT
HURUNGTAMPA-NG
KATANJUNG
KERTAU REMBANGUN
HAMPUTUNG
POSU
BULAU NGAND-UNG
MIRIH
MARIKOI
SUNGAIHANJU
MERAYA
S. Meraya
S. Barooi
TEWAH
S. Kahayan
RUDJAK
S. Kapuas
KUALAKURUN
MENEWAN
113°00'E
113°15'E
113°30'E
113°45'E
114°00'E


Tb. BUKOI
MANTAAK
LAWANG TAMAG
BAHINOI
TANJUNG RENDAN
TIHIS
S. Menyarung
MERAAN
BARONANG
MASAHA LAMA
MASAHA BARU
PUROH
Tb. SIRAT
HURUNGTAMPA-NG
KATANJUNG
BULAU NGAND-UNG
SUNGAIHANJU
DJUKING SUPAN
BABUAT
DIRUNG LINGKING
DJUKINGPADJANG
S. Lahung
MUARA LAHUNG
S. Keramu
MALASAN
S. Barito
MANGKAHOI
MUARAUNTU
BAHITUM
BATUPUTIH
MUARAJAAN
BEKANUN
S. Bekanon
S. Jaan
S. Selio
270 ±
MEKUNDJUNG
MUHUN
MUKUT
S. Barioi
S. Pandreh
S. BARITO
PENDREH
TANGOCIN
S. Kahayan
KUALAKURUN
RUDJAK
S. Kapuas
JANGKANG
MENEWAN
BUNTOK - KETJIL
LEBOH
113° 45' E
114° 00' E
114° 15' E
114° 30' E
114° 45' E


DIRUNG LINGKING
DJUKINGPADJANG
BAHITUM
MANGKAHOI
MUARAUNTU
MUARAJAAN
S. Barito
BATUPUTIH
S. Jaan
270 ±
MEKUNDJUNG
MUHUN
BENAUMELAJU
PAPARPUTJANG
DJANGKANG
LVE
MUARABAKAH
S. Lahai
MUKUT
MUARALAHAI
S. Beriai
S. Pandreh
S. BARITO
PENDREH
MUARATEWE
S. Tewe
TANGOCIN
S. Ihu
BUNTOK - KETJIL
LEBOH
0°45'S
1°00'S
1°15'S
114°30'E
114°45'E
115°00'E

PL. V

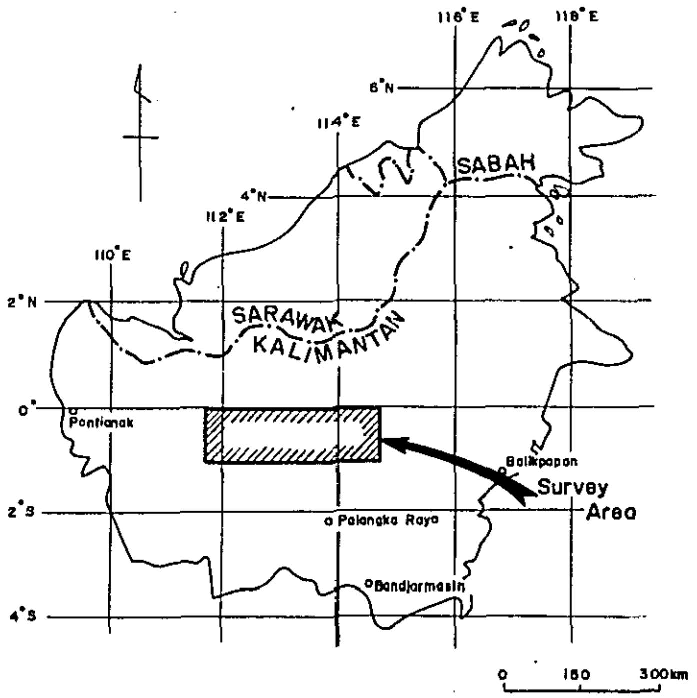
METAL MINING AGENCY OF JAPAN — GEOLOGICAL SURVEY OF INDONESIA
JAPAN INTERNATIONAL COOPERATION AGENCY

PHOTO - GEOLOGICAL SURVEY OF CENTRAL KALIMANTAN INDONESIA

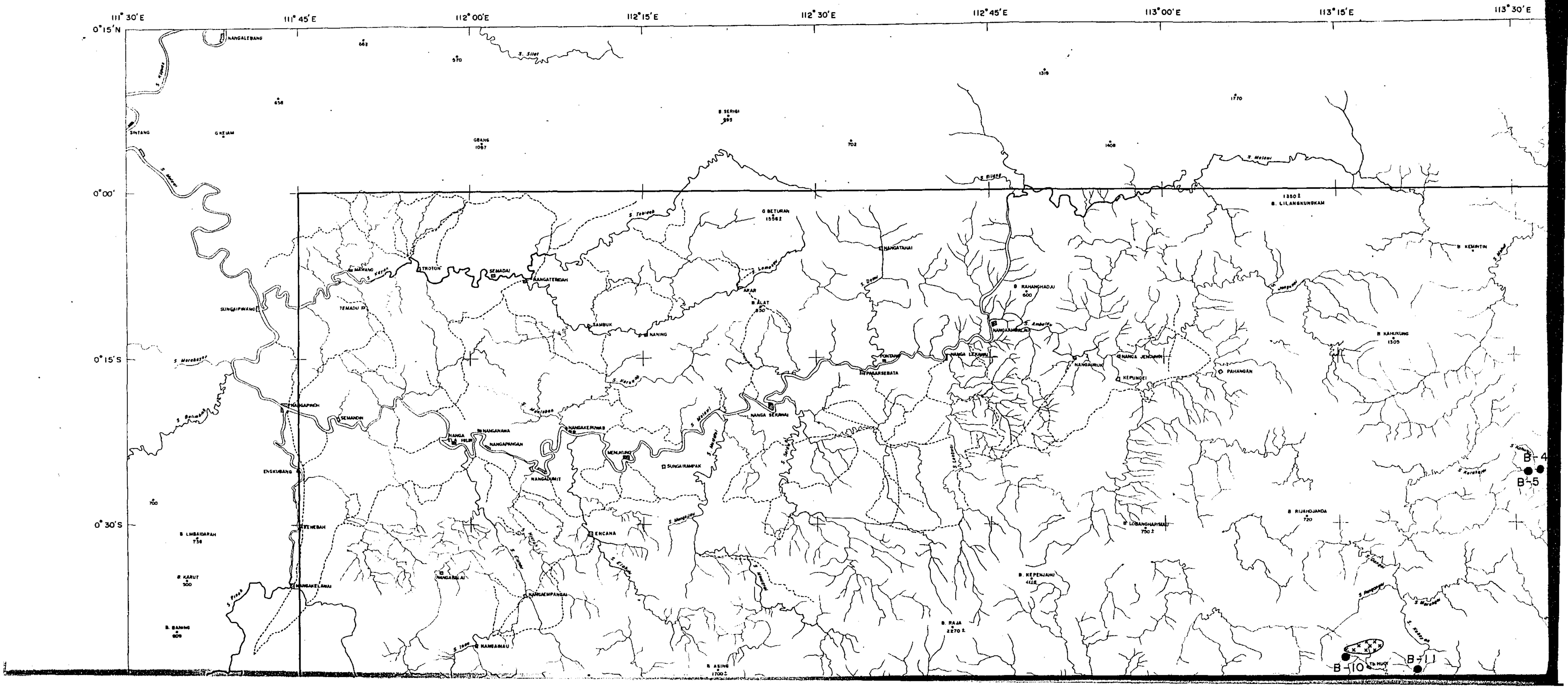
LOCATION MAP OF ECONOMIC MINERALS

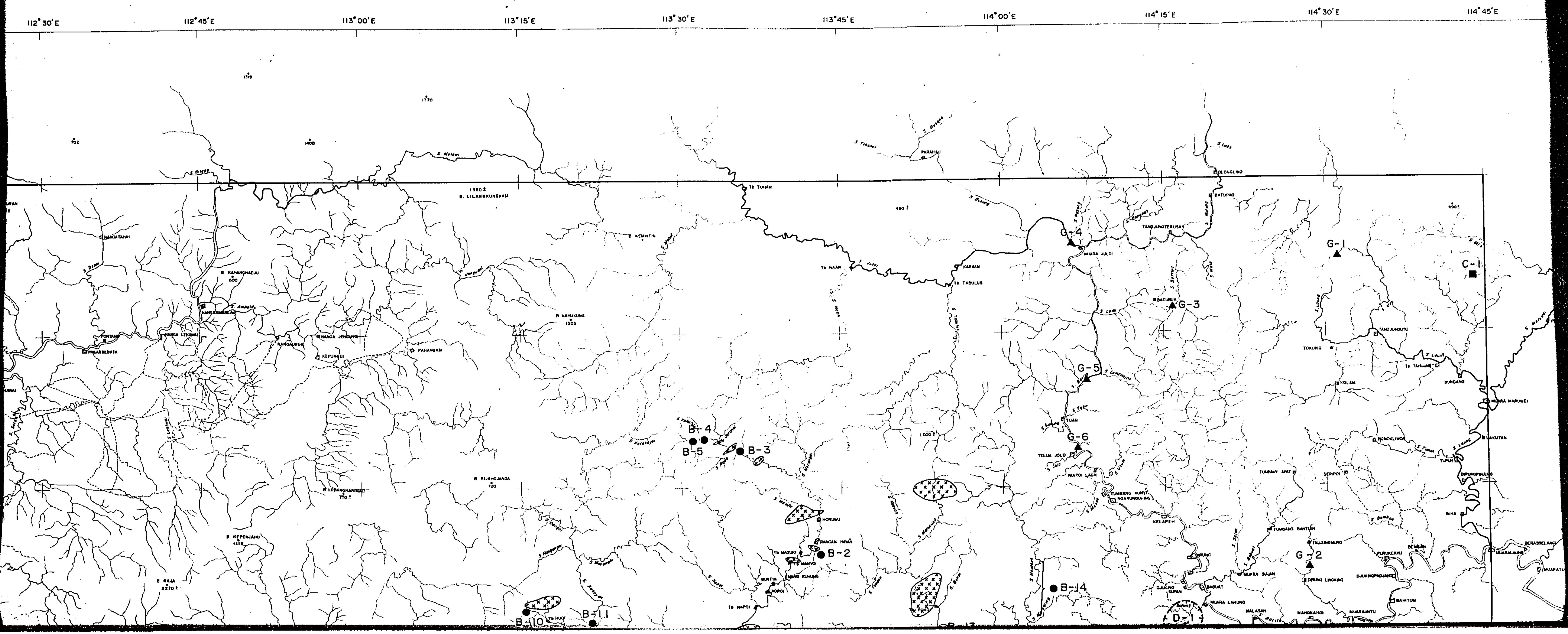
Scale 1 : 500,000

0 10 20 30 40km

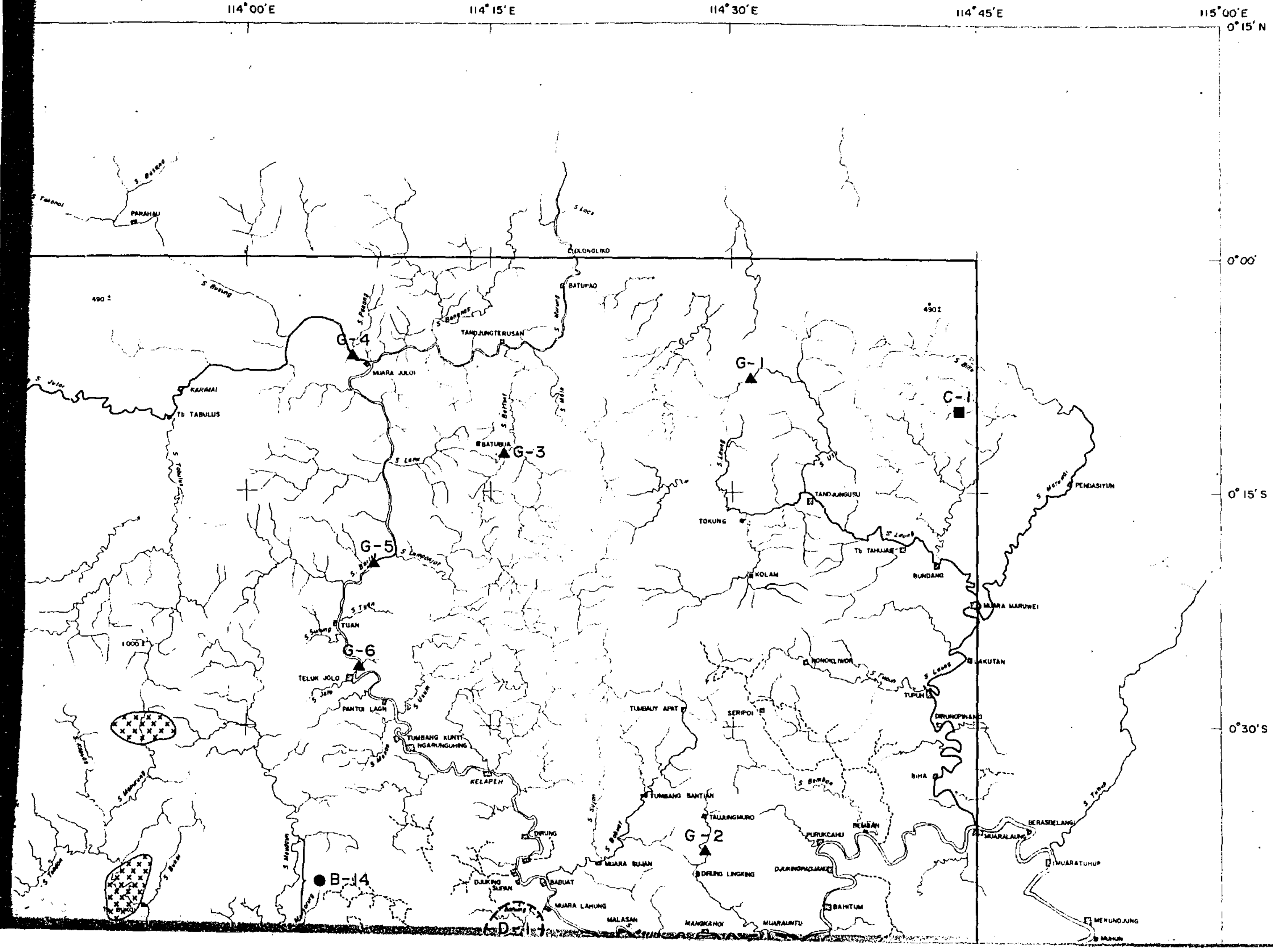


January · 1978


111° 30'E
111° 45'E
112° 00'E
112° 15'E
112° 30'E
112° 45'E
113° 00'E
113° 15'E
113° 30'E
0° 15'N
0° 00'
0° 15'S
0° 30'S
B-4
B-5
B-10
B-11



112° 30' E
112° 45' E
113° 00' E
113° 15' E
113° 30' E
113° 45' E
114° 00' E
114° 15' E
114° 30' E
114° 45' E
G-1
C-1
G-3
G-4
G-5
G-6
G-2
B-4
B-5
B-3
B-2
B-14
B-10
B-11
D-1
B. LILANGKUNGKAM
B. KAHUKUNG
B. RAHANGHADJU
B. RIJAHOJANDA
B. LOBANGHARIMAU
B. KEPENJAHU
B. RAJA
MUARA JULOI
TANDJUNGTERUSAN
BATUPAO
BATUBUA
TOKUNG
KOLAM
BUNDANG
MUARA MARUWEI
JAKUTAN
TELUK JOLO
PANTOI LAGN
KELAPEH
HORUWU
RANGAN HIRAN
BUNTUK
KOROI
Tb NAPOI
TUMBANG BANTIAN
TUMBAY APAT
SERIPOI
TUPUH
DIRUNGPINANG
BIHA
PURUKCAHU
BERASBELANGI
MUARA SUJAN
MUARA LAHUNG
MALASAN
MANGKAHOI
MUARAUNTU
BAHITUM
NANGA LEKAWAI
NANGA JENGAWAI
KEPUNGEI
PAHANGAN
NANGAURUK
PONTANG
NANGATAHAI



PL. V

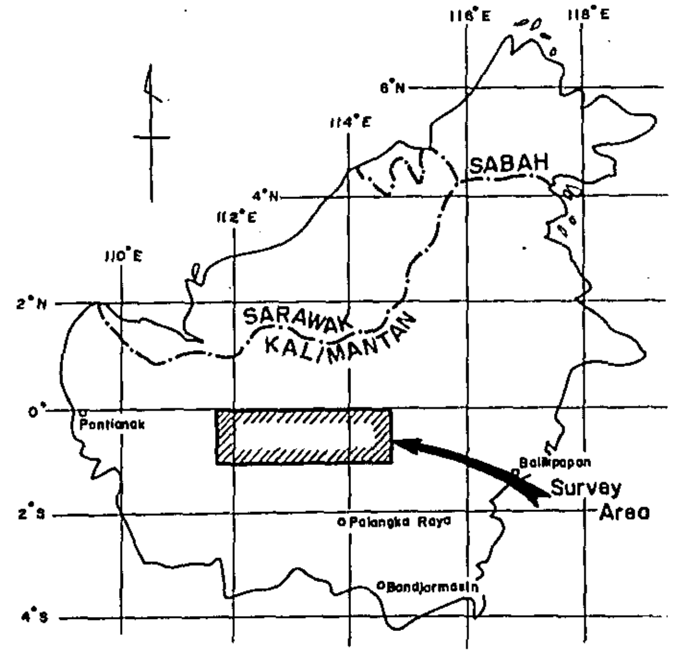
METAL MINING AGENCY OF JAPAN
JAPAN INTERNATIONAL COOPERATION AGENCY
— GEOLOGICAL SURVEY OF INDONESIA

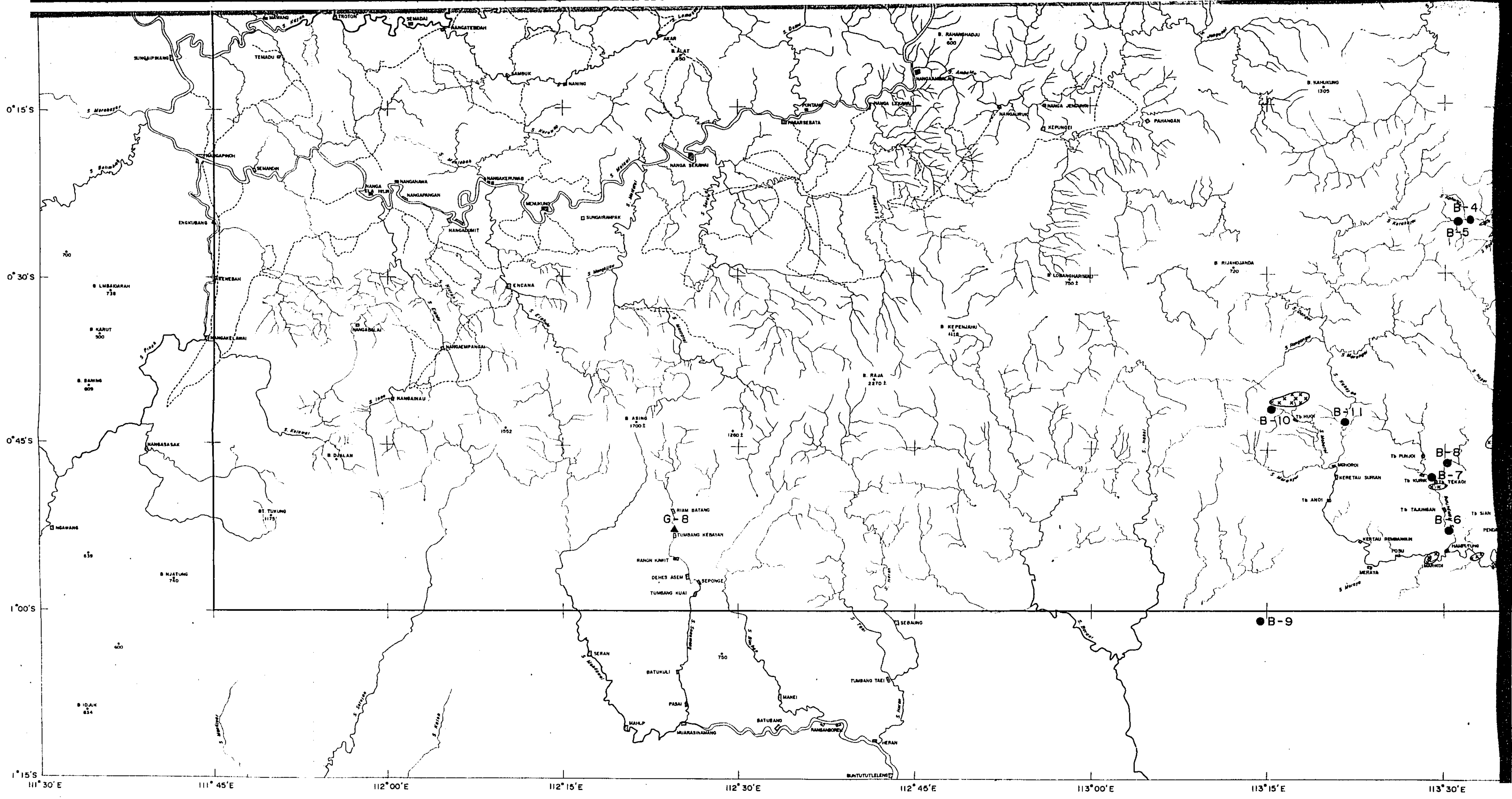
PHOTO - GEOLOGICAL SURVEY OF CENTRAL KALIMANTAN INDONESIA

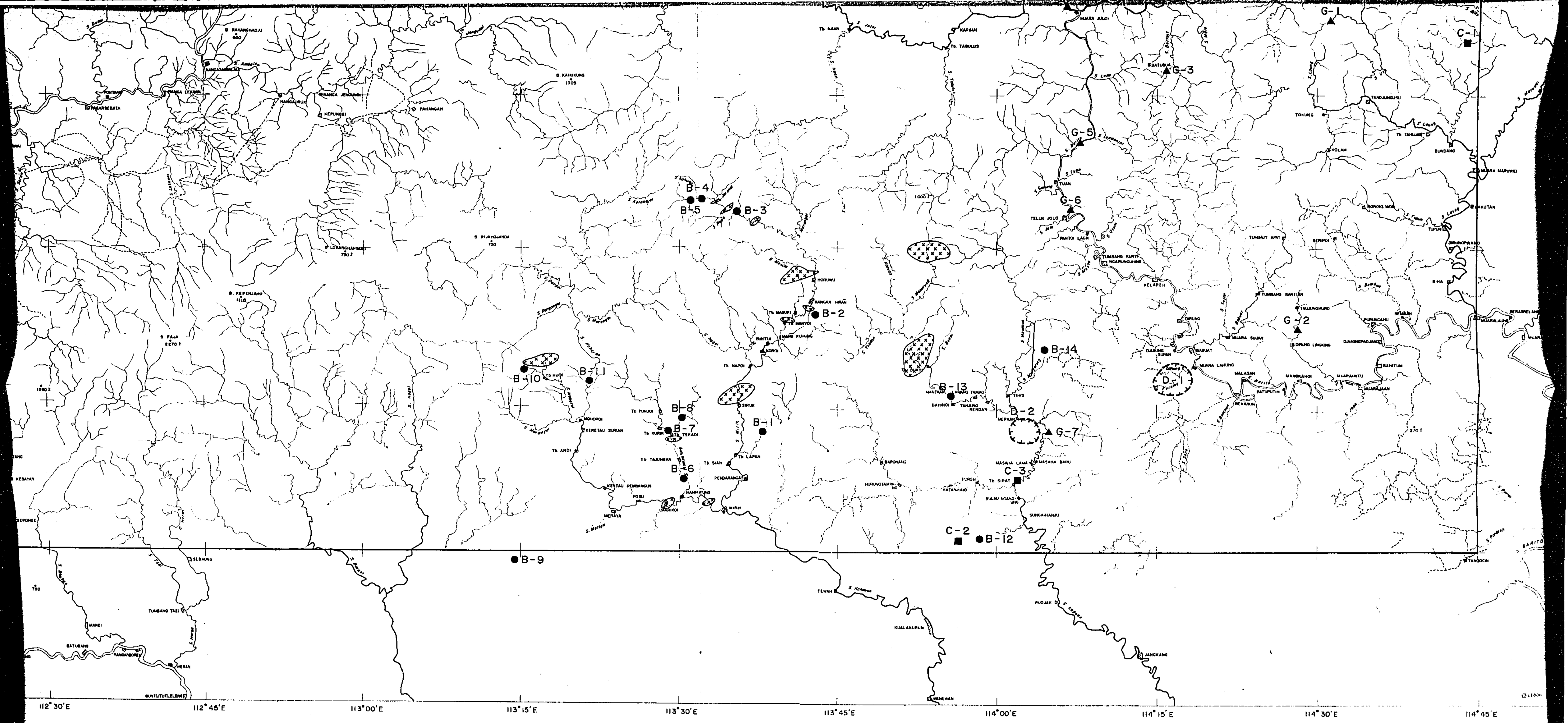
LOCATION MAP OF ECONOMIC MINERALS

Scale 1: 500,000

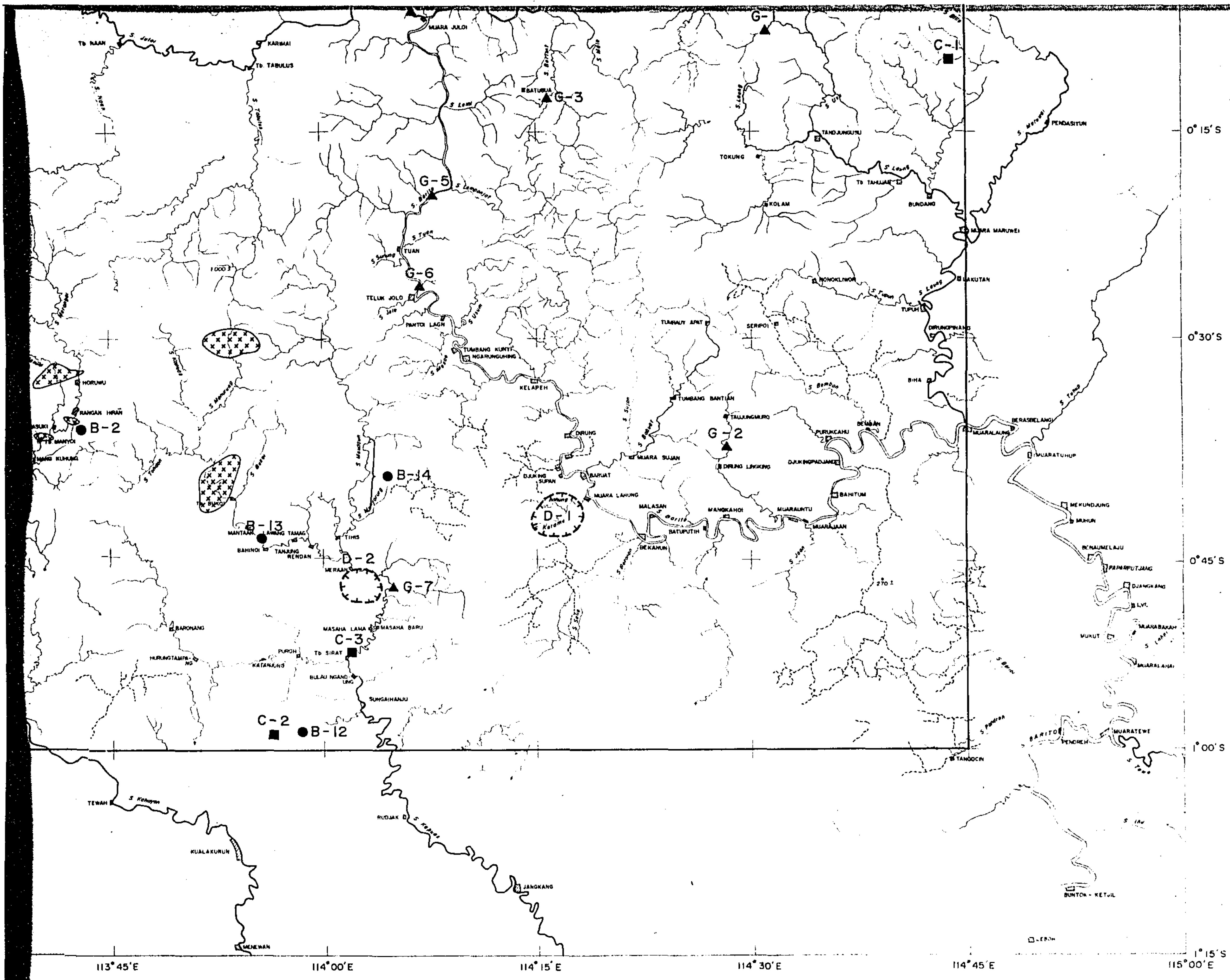
0 10 20 30 40km

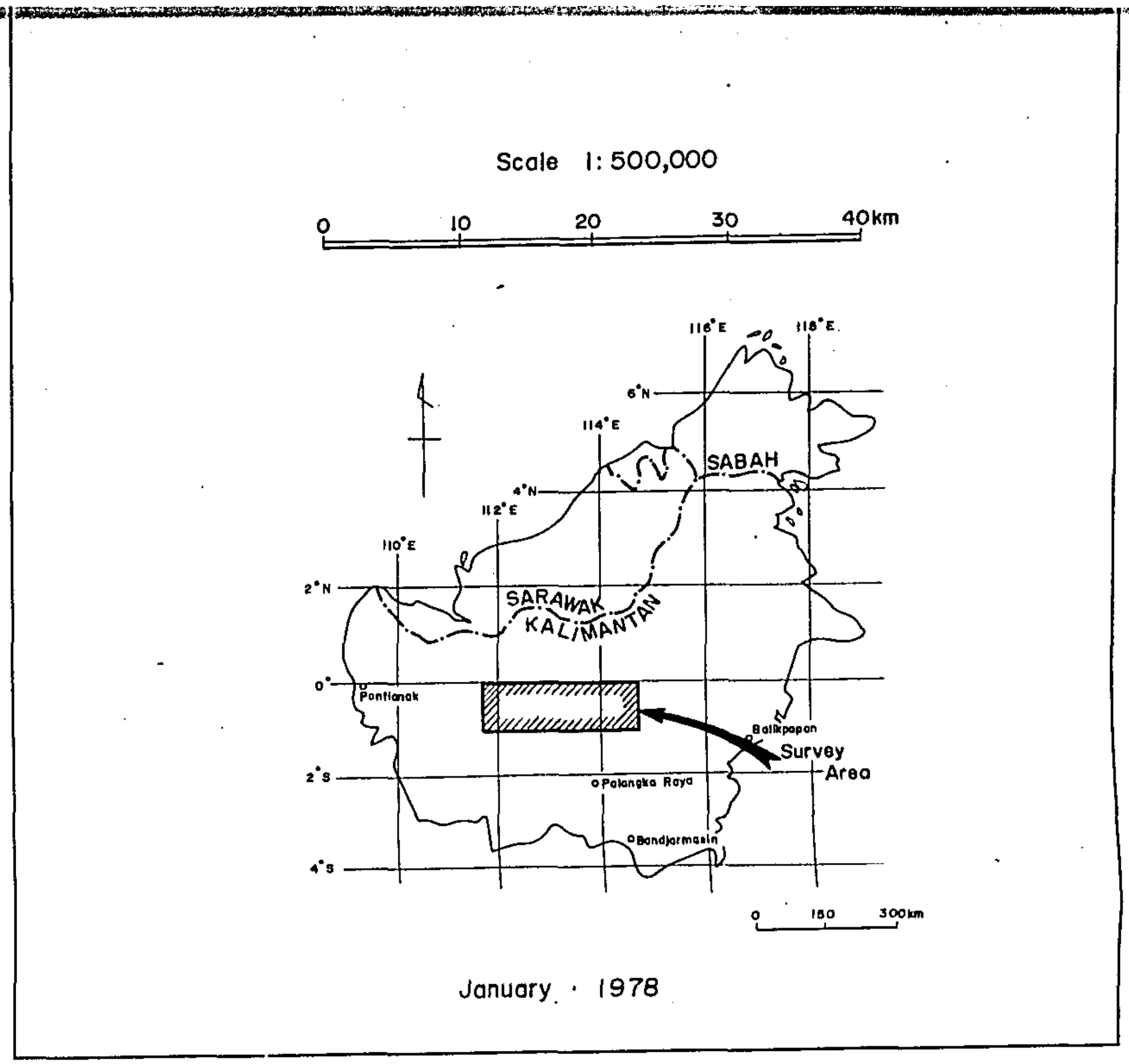



0°15'S
0°30'S
0°45'S
1°00'S
1°15'S
111°30'E
111°45'E
112°00'E
112°15'E
112°30'E
112°45'E
113°00'E
113°15'E
113°30'E
B-4
B-5
B-10
B-11
B-8
B-7
B-6
B-9
G-8
NANGA SERAWAI
ENCANA
B. RAJA
2270 ±
B. ASING
1700 ±
B. KEPENJAHU
RIAM BATANG
TUMBANG KEBAYAN
TUMBANG KUAI
SEPONGE
BATUKULI
PASAI
MANEI
TUMBANG TAEI
HERAN
SEBAUNG
SERAN
NANGAPINOH
NANGA LEKAWAI
KERETAU SURIAN
MONOROI
PAHANGAN
KEPUNGEI



G-1
C-1
G-3
G-5
G-6
G-2
G-7
B-4
B-5
B-3
B-2
B-14
B-13
B-10
B-11
B-8
B-7
B-1
B-6
D-1
D-2
C-3
C-2
B-12
B-9
MUARA JULOI
KARIMAI
Tb. TABULUS
BATUBUA
TANDJUNGUNG
TOKUNG
KOLAM
BUNDANG
MUARA MARUWEI
JAKUTAN
TUPUH
TUAN
TELUK JOLO
PANTOI LAGN
TUMBANG KUNYI
KELAPEH
HORUWU
RANGAN HIRAN
BUNTUI
KOROI
Tb NAPOI
SIRUK
MOHOROI
KERETAU SURIAN
Tb ANDI
Tb PUNJOI
Tb KURIK
Tb TAJUNGAN
Tb SIAN
Tb LAPAN
PENDARANGAN
KERITAU REMBANGUN
POSU
MERAYA
MIRIH
BARONANG
PUROH
Tb SIRAT
MASAHA LAMA
MASAHA BARU
SUNGAIHANJAI
KATANJUNG
MANTAAR
BAHINOI
TANJUNG RENDAN
MERAAN
DIRUNG
MUARA SUJAN
MUARA LAHUNG
MALASAN
BATUPUTIH
BEKANUN
MANGKAHOI
MUARAINTU
MUARAJAAN
PURUKCAHU
BAHITUM
MUARALAUNG
TUMBANG BANTIAN
TALLUNGMURO
DIRUNG LINGKING
B. RAHANGHADJU
600
B. KAHUKUNG
1305
B. RIJAHOJANGA
B. KEPENJAHU
B. RAJA
2270
1000
TEWAH
KUALAKURUN
PUOJAK
JANGKANG
MENEWAN
SERAUNG
TUMBANG TAEI
MANEI
BATUBANG
HERAN
750
270
112° 30'E
112° 45'E
113° 00'E
113° 15'E
113° 30'E
113° 45'E
114° 00'E
114° 15'E
114° 30'E
114° 45'E





Legend

- ● Base metal
- ▲ Gold
- Diamond
- ■ Coal
- Tertiary granite

国際協力事業団	
受入月日	
登録No.	