

CHAPTER III

IMAGE INTERPRETATION

The use of Remote Sensing and topographic map to study ADL begins from surveying ADL locations, and then locate onto maps. The surveyed ADL is classified according to landform by viewing aerial photographs under stereoscope. The next step is carried out to interpret geological features of the study area. The spatial distributions of ADL relating to geological features are also observed.

3.1 Study of ADL.

3.1.1 Survey of ADL Location.

The topographic map, the Landsat images and aerial photographs covering the study area are used to identify the location of ADL. The known locations of ADL identified by aerial photographs are located onto topographic map of the scale 1:50,000 and the Landsat images. The results of the study came out that the used of topographic map and Landsat images to identify the location of ADL are not consistent when compare to the use of aerial photographs which can be viewed in 3-dimension. Aerial photographs of the scale 1:50,000 then are used to identified the locations of ADL in the study area.

Figure 3.1 demonstrates ADL location appearing on the topographic map. The depression areas are mapped as ponds or marshy areas. ADL appears on topographic map only when the depression area surrounding the mound can be obviously seen, otherwise, it will be missed. Also the fluvial landforms such as oxbow lakes and meandering scars can be easily mis-interpreted as ADL. The method of identification of ADL location by using topographic map is not recommended.

The study of ADL is tried by using satellite images, Spot and Landsat images of different temporal were scanned. The known ADL located by using aerial photographs can be recognized on satellite images. However, it cannot be identified differently from those similar landform as can be done by using aerial photograph. The infrared band (MSS-band 7) of Landsat 3 recorded after rainy season shows the most prominent feature of ADL on images. They are circular lighter tone surrounded by darker tone (see Figure 3.2). The darker tone indicates depression area. This is because of the contrast of soil's moisture or water collected within the low topography would appear in darker tone than higher area in infrared band. However, this is not the best method because in some areas, the mound part (in the middle) and the depressional part have only little moisture's contrast. So, the circular dark tone could not be separated. Therefore not all ADL can be mapped by basing on satellite images interpretation data. The surveying of ADL by basing on computer aid is expected to be better than conventional method, however, it is believed to face the same problem. Thus, the digital analysis are omitted from this study.

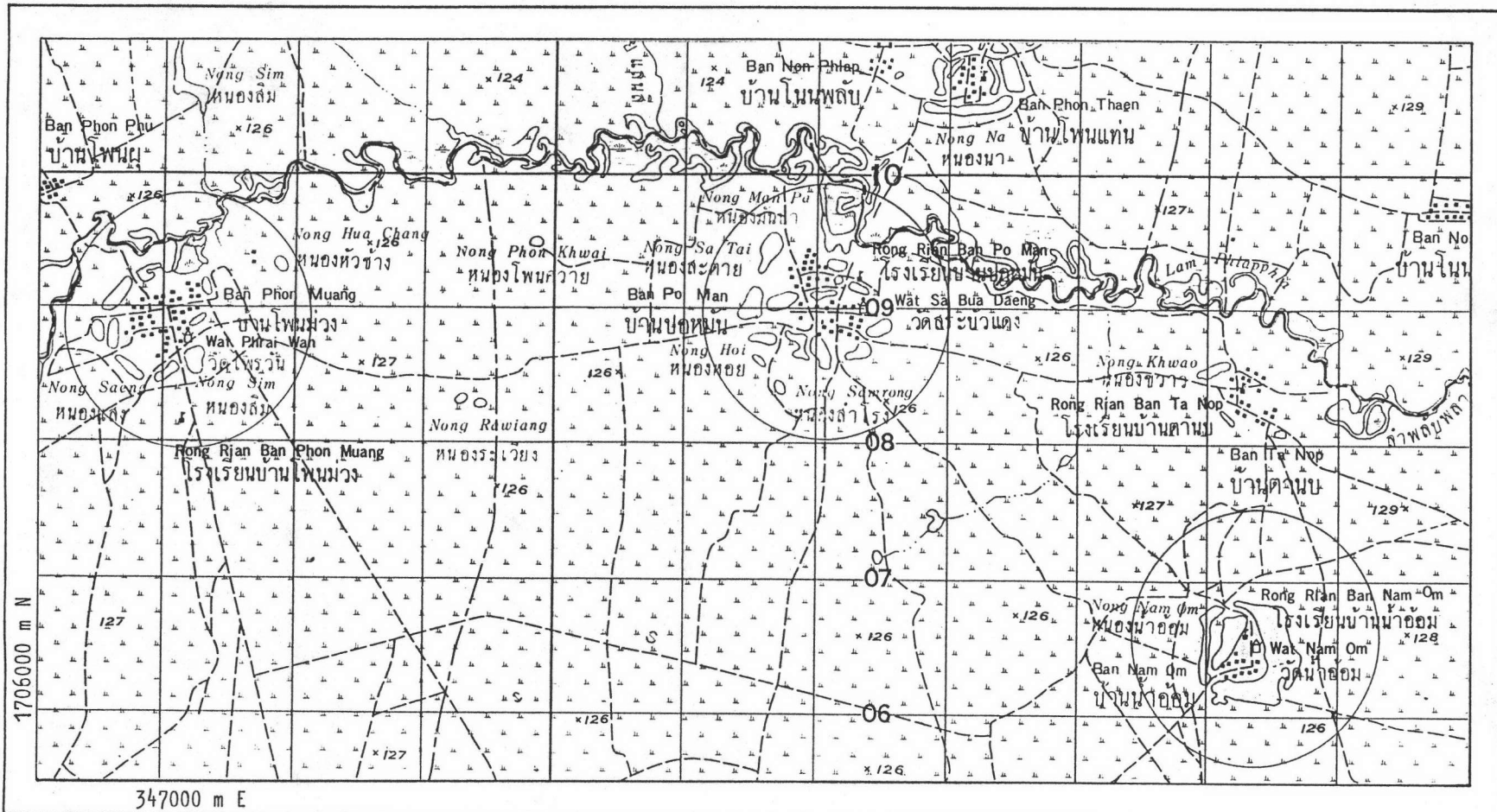


Figure 3.1 Demonstrating of A.D.L. on topographic map 1:50,000 scale, the depression is mapped as natural ponds surrounding mound.

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○ Location of A.D.L.

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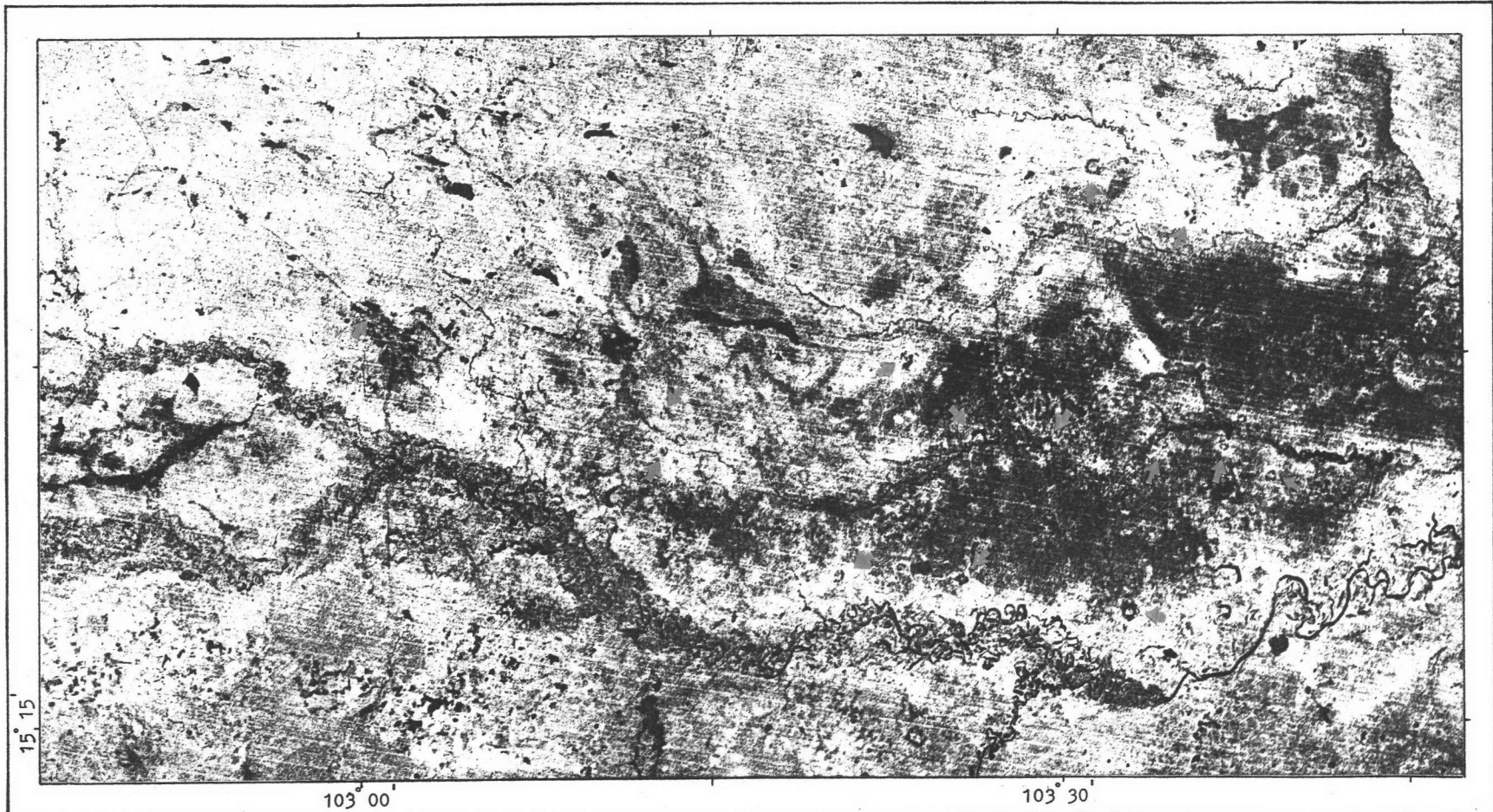


Figure 3.2 Showing A D L as illustrated of infrared band (Landsat 3) circular dark tone (the point at arrow tip) locating the depression area.

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Landsat 3 Band 7

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The best method for observation of the ADL locations is the use of aerial photographs and the aerialphoto mosaics of the scale 1:250,000 prepared by the Military Survey Department. First step, the photo-mosaic is scanned to locate the possible ADL features. Second step, select the aerial photographs of that particular area manifest ADL features, are selected and viewed under the stereoscope. The 3-dimensions model shall facilitate interpretation of ADL. Third step, furthermore the ADL positions are located onto topographic map of the scale 1:50,000. The ADL locations then are transferred onto 1:250,000 map through UTM co-ordinate, and then be reduced to the appropriate scale prepared for further correlation.

Figure 3.3a demonstrates the ADL feature at Ban Muang Hong, Amphoe Chaturaphak Phiman, Changwat Roi Et. The depression area can be delineated by the aid of stereoscopic viewing. The barbed line pointed to the depression. Figure 3.3b demonstrates a similar feature of ADL but can not be identified as ADL by viewing 3-dimensions.

The total of 142 ADL locations are located in the study area by the use of aerialphoto interpretation. The locations of ADL are shown on the map demonstrated in Figure 3.4. The map showing ADL's positions of the study area demonstrates the distribution of ADL which will be used for mastering the further study of ADL, such as classification, correlation, and selection of ADL for gravity survey etc.

3.1.2 Classification of ADL.

The total of 142 ADL locations discovered in the section 3.1.1 are identified by using aerial photographs of the scale

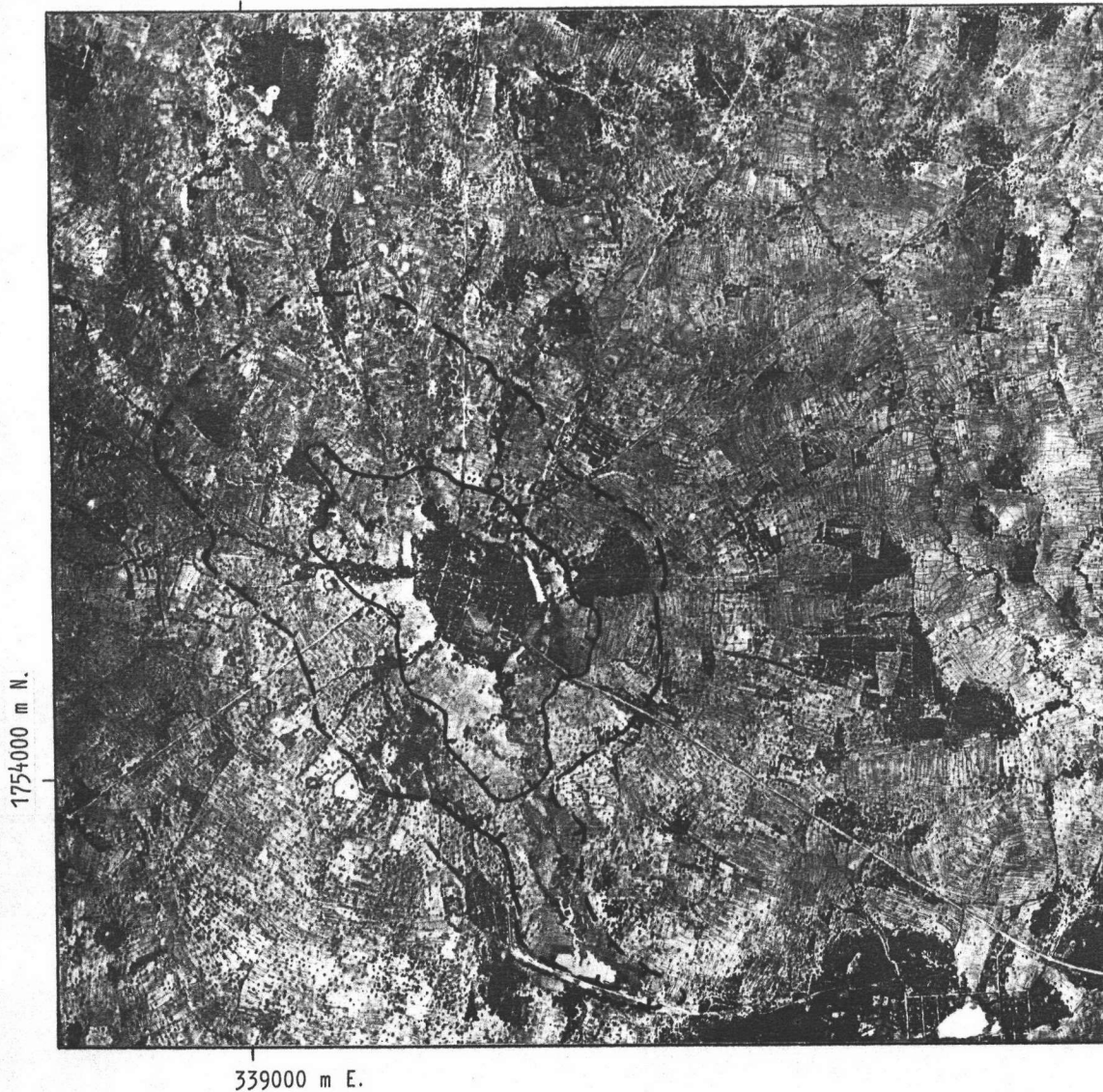



Photo No. 16191 Area 4 Sheet 11 Strip 34	Photo Scale	0  1 km
Map Reference: Sheet 5740 IV	Photo Date	9 / 2 / 54

Figure 3.3a Showing the ADL feature at Ban Muang Hong, Amphoe Chaturaphak Phiman, Changwat Roi-Et, the depression area can be delineated by the aid of stereoscopic viewing the barbed line pointe to the depression.

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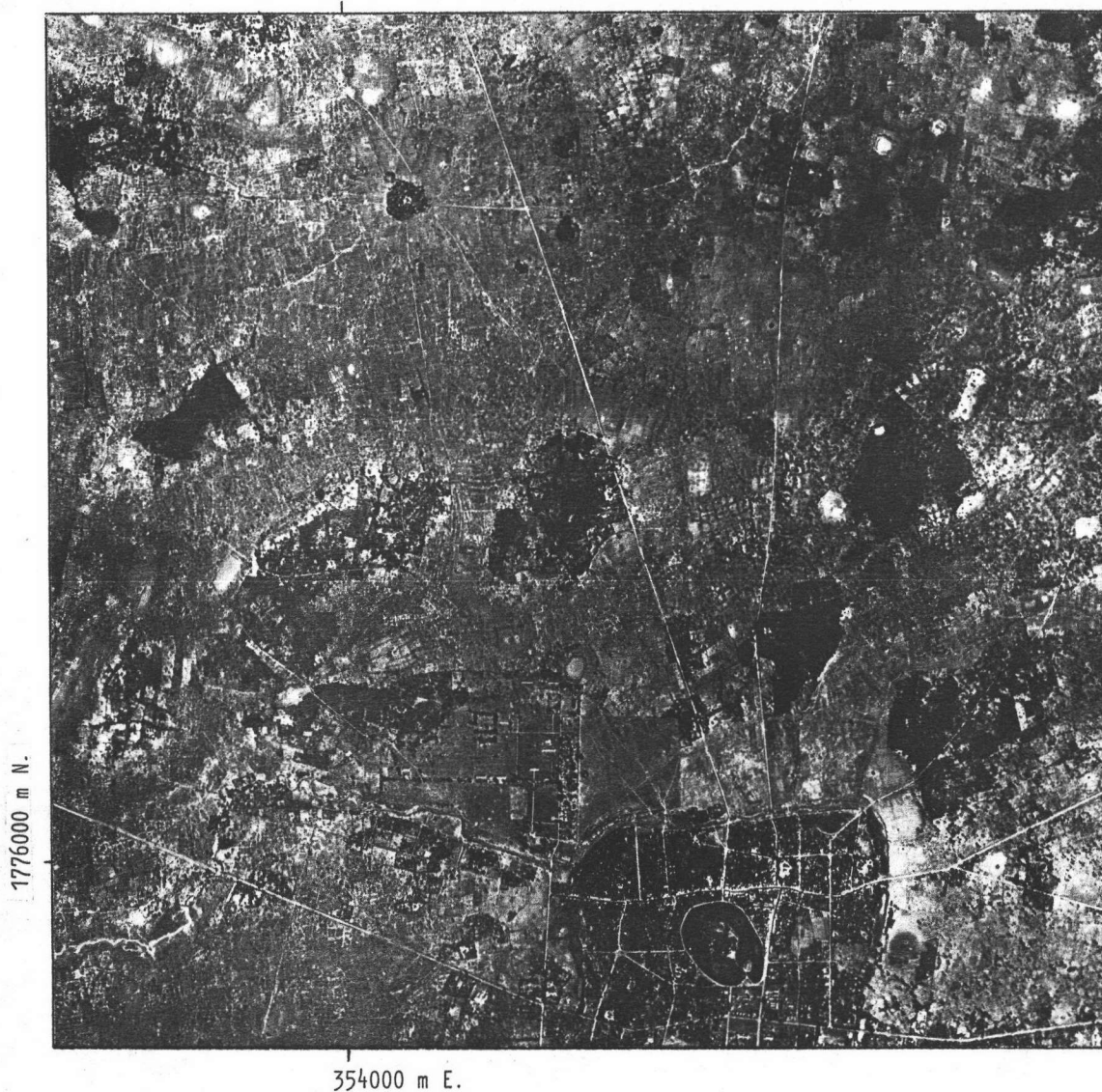


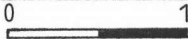
Photo No. 16411 Area 4 Sheet 7 Strip 36	Photo Scale	0  1 km
Map Reference: Sheet 5741 III	Photo Date	10 / 2 / 54

Figure 3.3b Demonstrates a similar feature of ADL but can not be identified as ADL by viewing 3-dimension.

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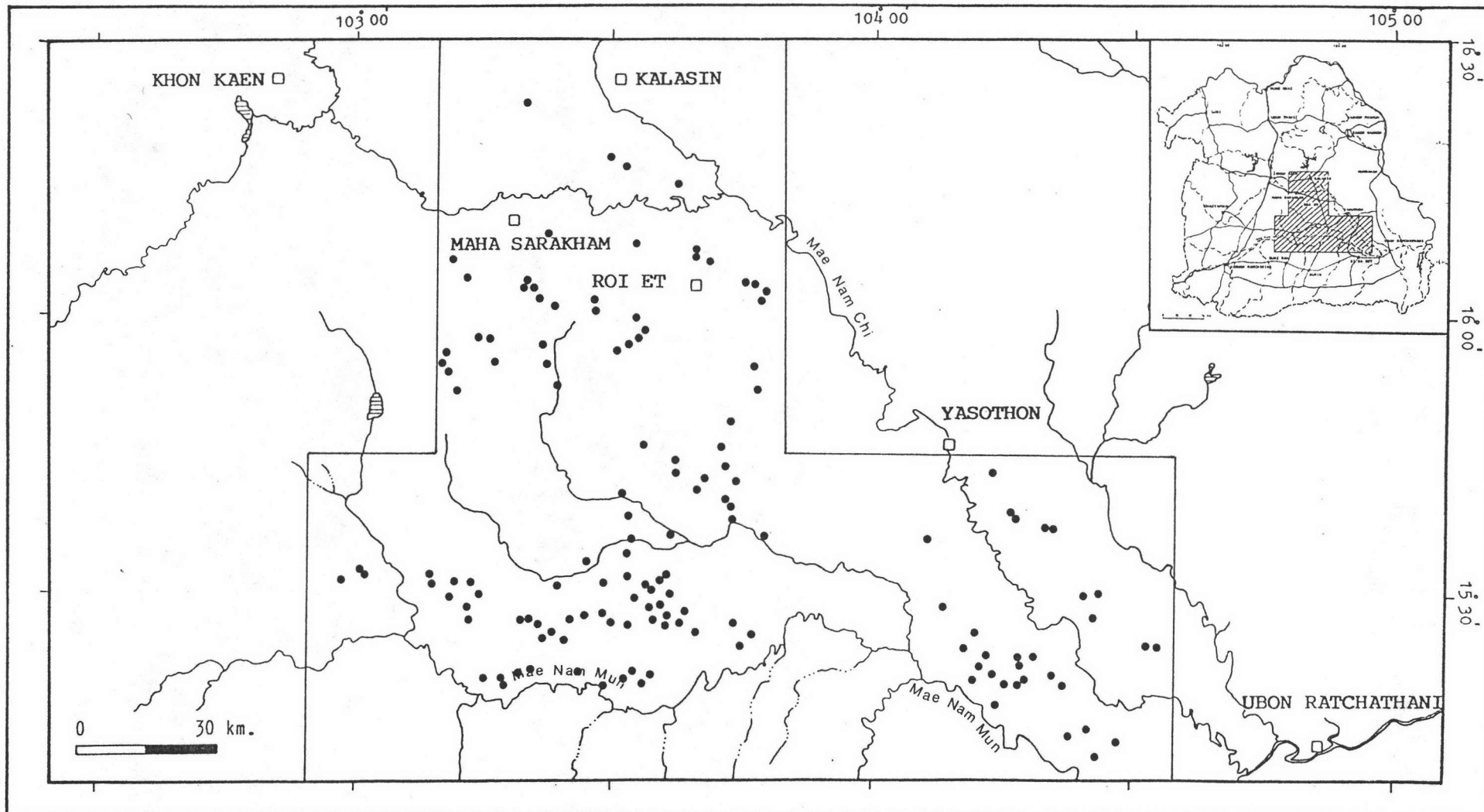


Figure 3.4 Map showing distribution of A.D.L. in the study area.

- | | | | |
|---|----------------|---|----------------|
|  | The study Area |  | Reservoir |
|  | River |  | A.D.L location |

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1:50,000. For some locations, of which the aerial photographs of the scale 1:15,000 are available, they are also be used. The aerial photographs are viewed under the stereoscope. Thus made possible for detail landforms to be viewed 3-dimensionally. According to the different natures of ring shape depression surrounding the mound, different nature of ADL can be observed as follows ;

a) Aerial photograph in Figure 3.5 demonstrates ADL between Ban Moei and Ban Dong Ling, Amphoe Kamalasai, Changwat Kalasin as a mound surrounded by a single level depression area (Figure 3.6).

b) Aerial photograph in Figure 3.7 demonstrates ADL at Ban Nam Om, Amphoe Kaset Wisai, Changwat Roi-Et as a mound surrounded by 2 level depression areas (Figure 3.8).

c) Aerial photograph in Figure 3.9 demonstrates ADL at Ban Saen Si, Amphoe Kaset Wisai, Changwat Roi-Et as the character of sink holes adjacent to the mound and all of them would be surrounded by depression area (Figure 3.10).

d) Aerial photograph in Figure 3.11 demonstrates ADL at Ban Non Tum, Amphoe Kaset Wisai, Changwat Roi Et as the sink hole on its mound and surrounded by depression areas (Figure 3.12).

e) Aerial photographs in Figure 3.13 demonstrates ADL at Ban Khi Lek, Amphoe Tha Tum, Changwat Surin as coalescing mounds surrounded by depression areas (Figure 3.14).

Figure 3.15 demonstrates different nature of ADL being classified into 5 types. For each type, the nature of landforms and

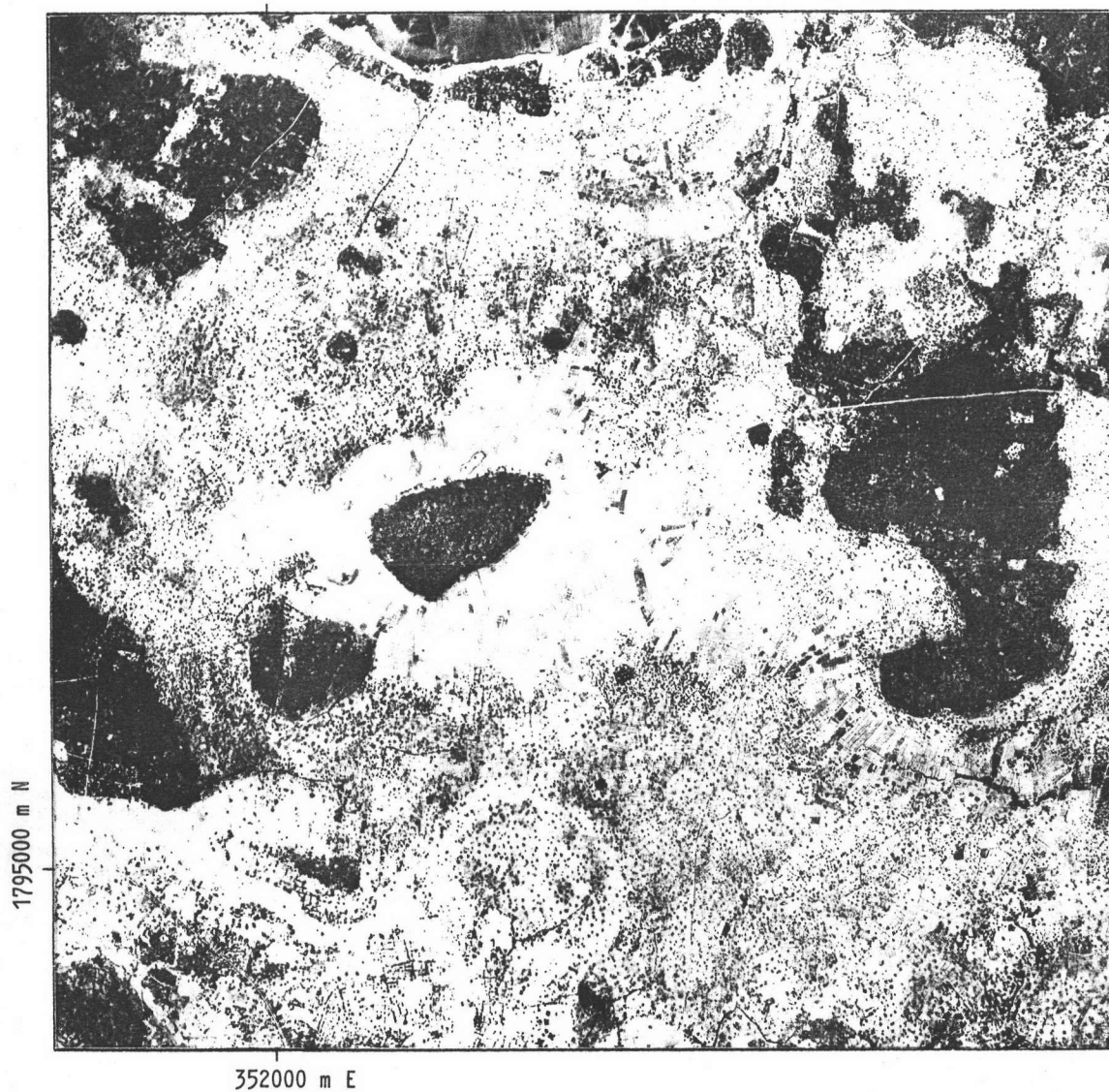



Photo No. 16406 Area 4 Sheet 7 Strip 36	Photo Scale  1 km.
Map Reference: Sheet 5741 III	Photo Date 10 / 2 / 54

Figure 3.5 Aerial Photograph showing A.D.L. between Ban Moei and Ban Dong Ling area, Amphoe Kamalasai Changwat Kalasin.

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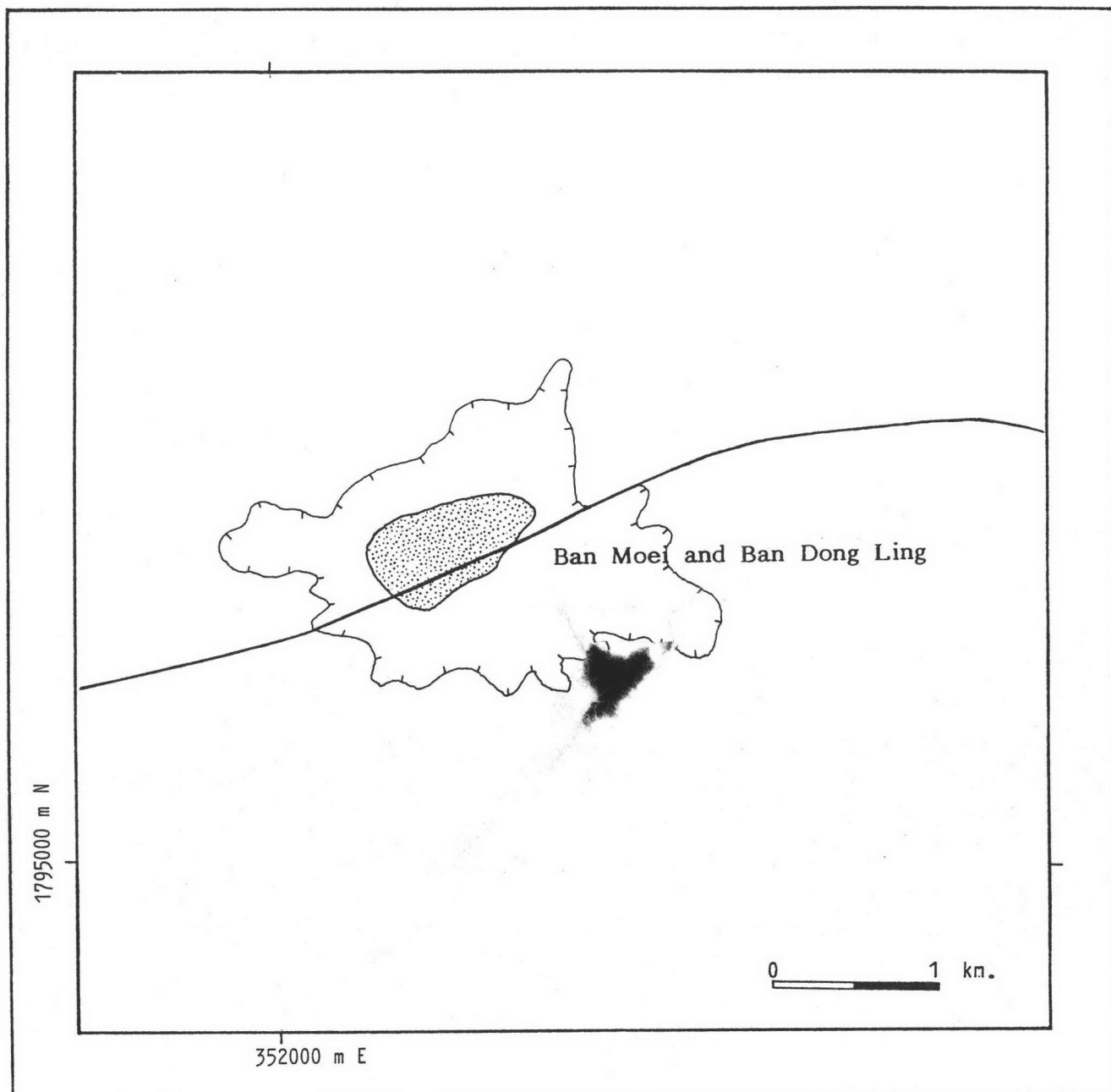







Figure 3.6 Map of Ban Moei and Ban Dong Ling showing depression area and mound, delineated from aerial photograph shown in Figure 3.5.

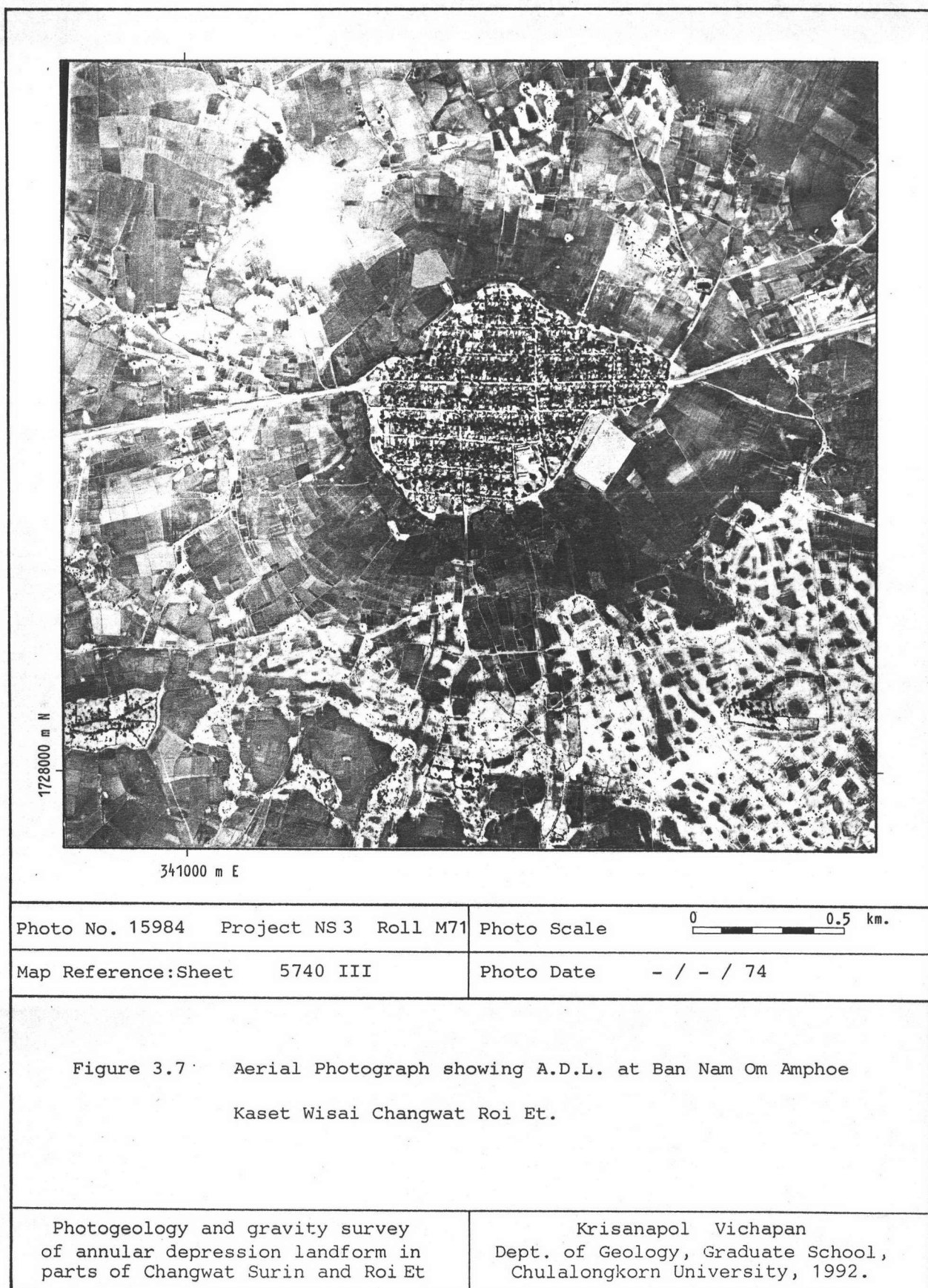
Explanation

-  Road
-  River
-  Pond

-  Depression Area
-  Mound

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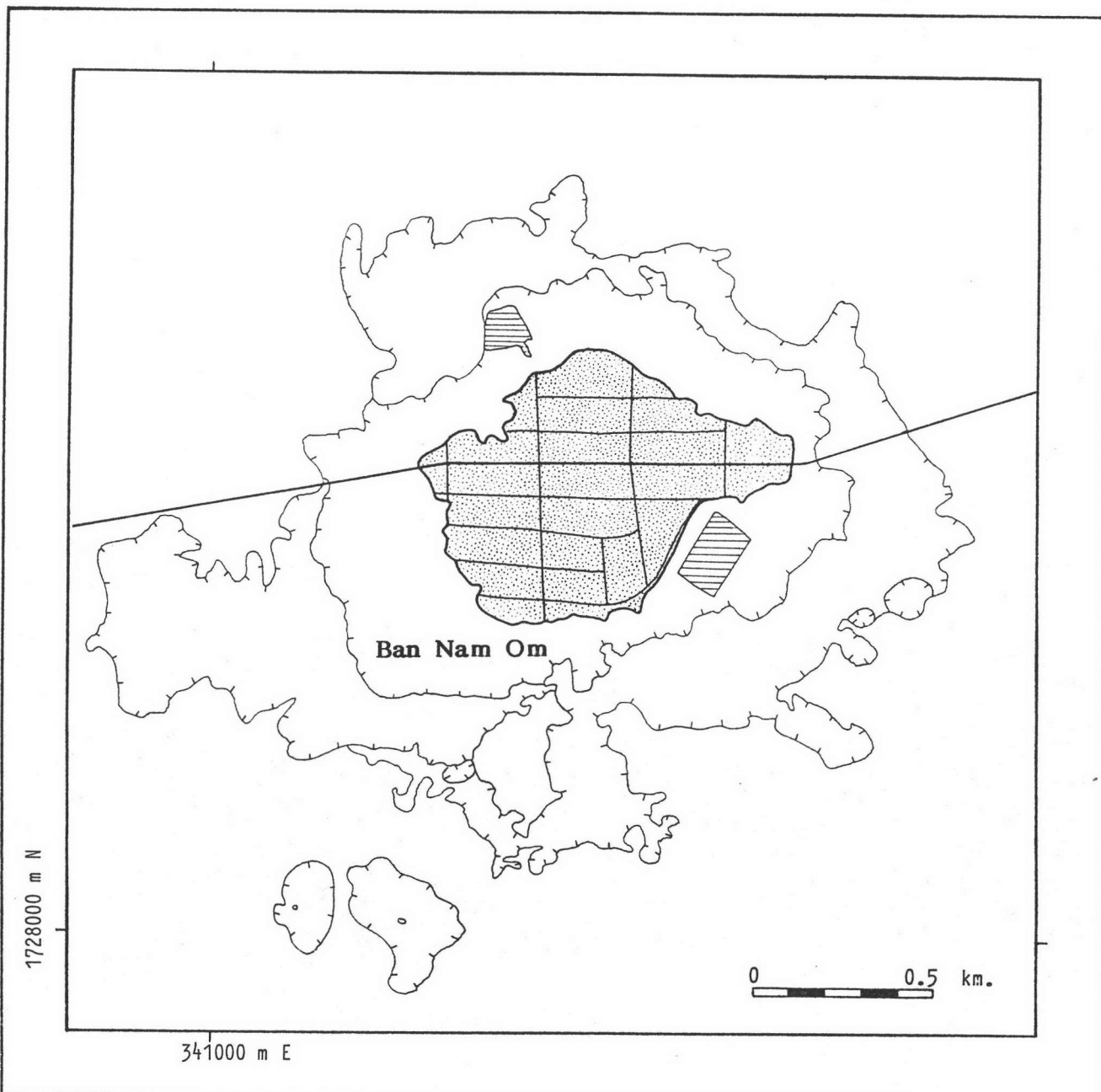







Figure 3.8 Map of Ban Nam Om showing depression area and mound, delineated from aerial photograph shown in Figure 3.7.

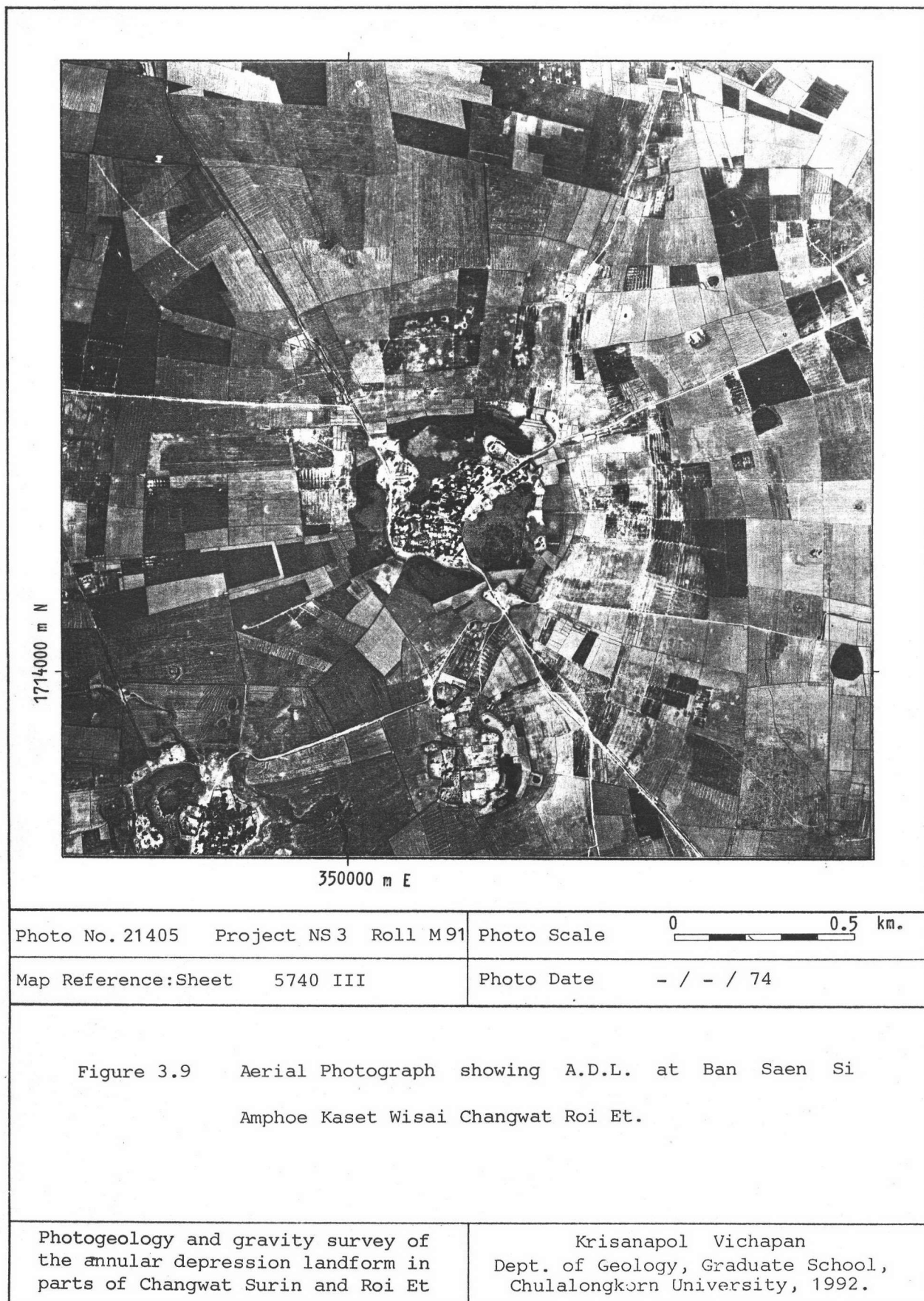
Explanation

-  Road
-  River
-  Pond

-  Depression Area
-  Mound

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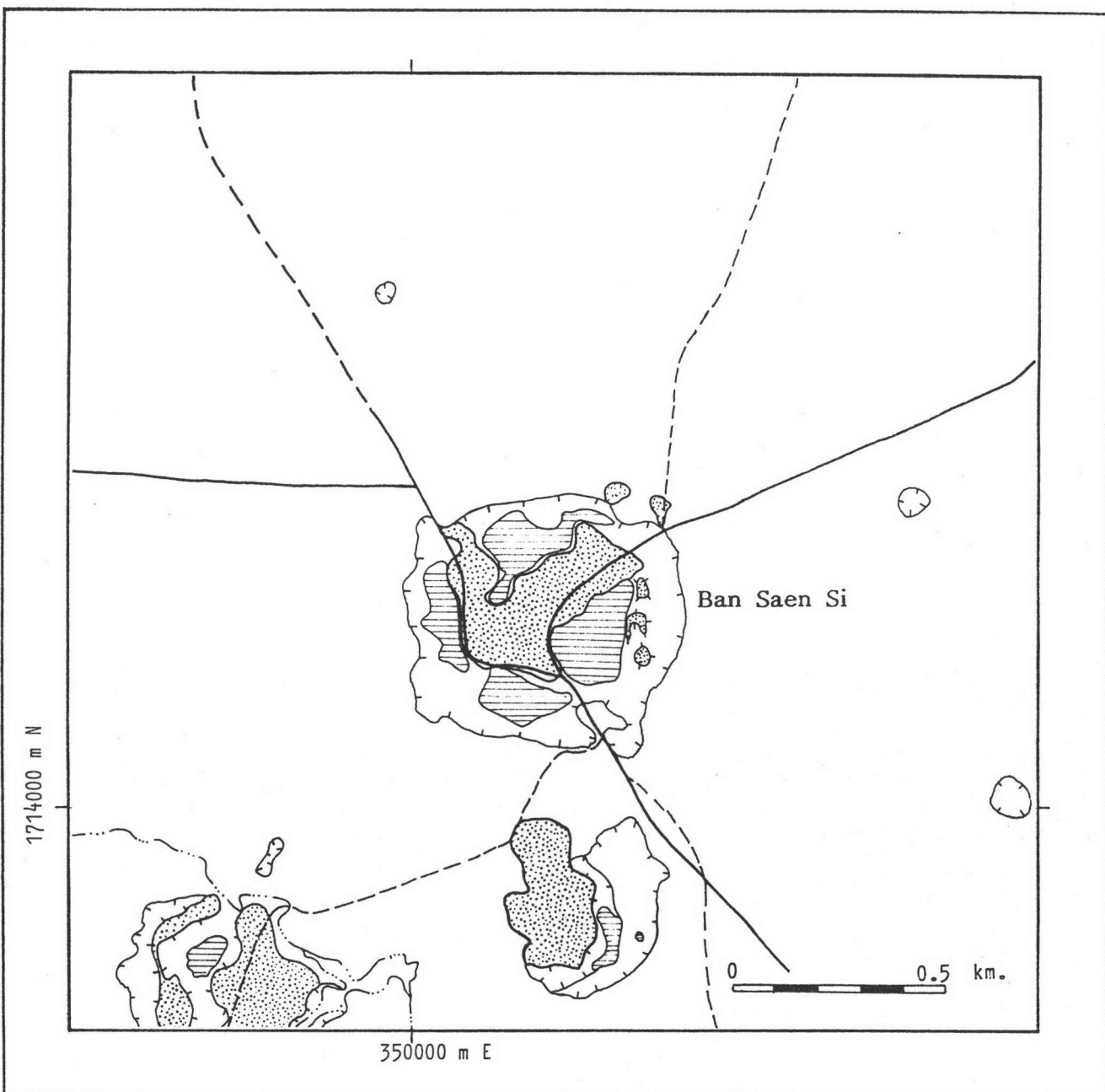


Figure 3.10 Map of Ban Saen Si showing depression area and mound, delineated from aerial photograph shown in Figure 3.9.

Explanation

- | | |
|---|---|
|  Road |  Depression Area |
|  River |  Mound |
|  Pond | |

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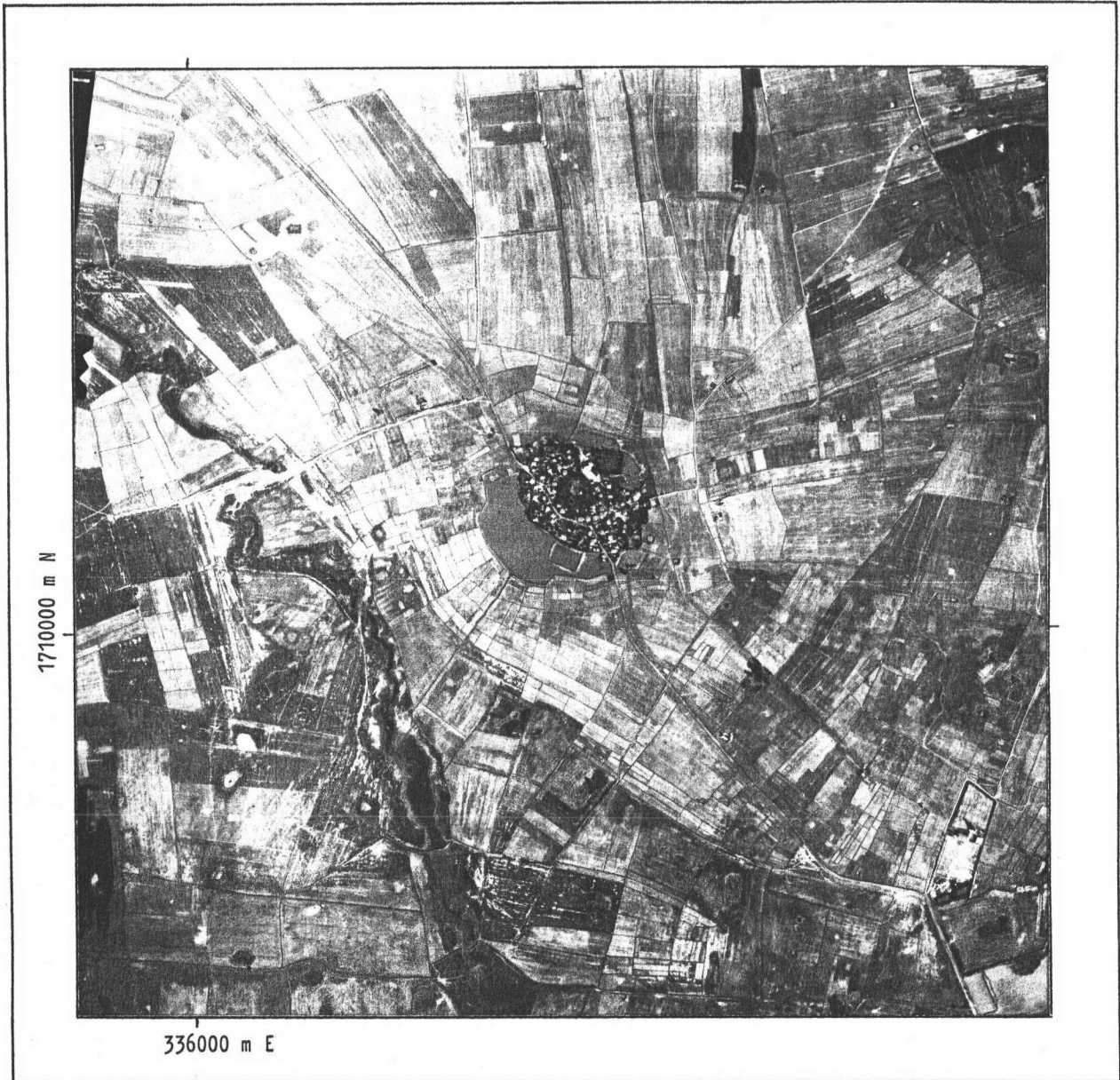


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Figure 3.11 Aerial Photograph showing A.D.L. at Ban Non Tum
Amphoe Kaset Wisai Changwat Roi Et.

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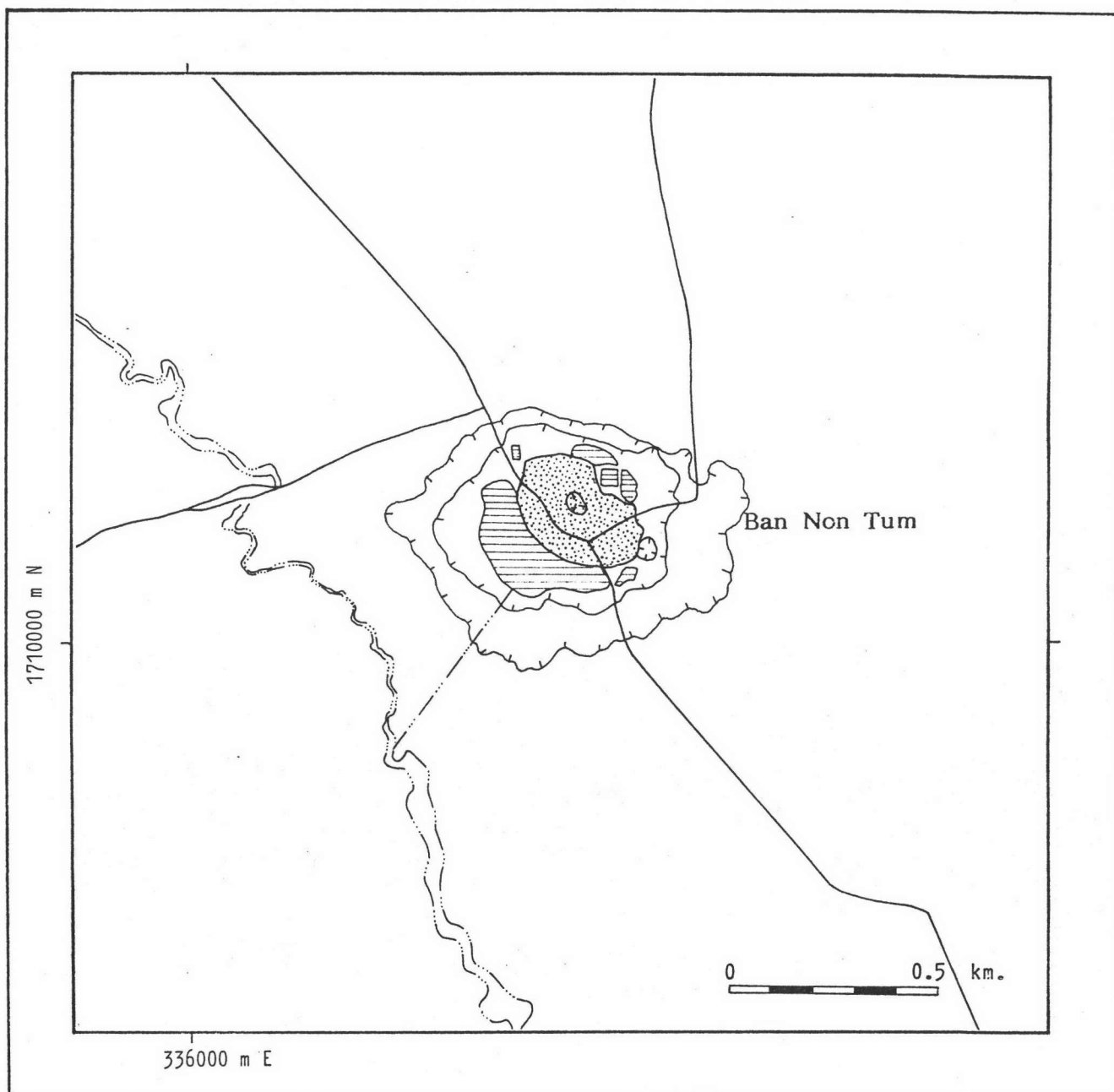







Figure 3.12 Map of Ban Non Tum showing depression area and mound, delineated from aerial photograph shown in Figure 3.11.

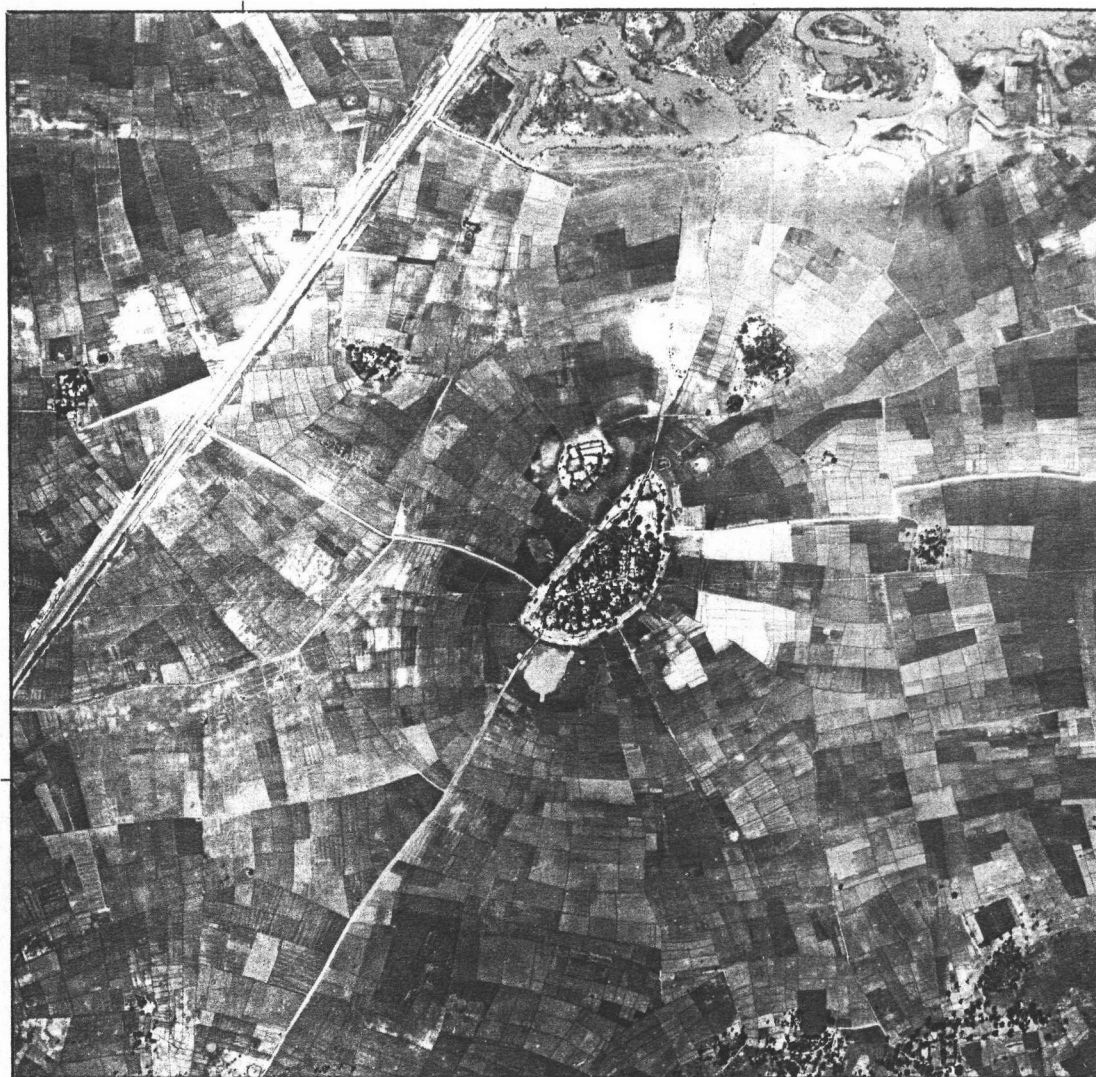
Explanation

-  Road
-  River
-  Pond

-  Depression Area
-  Mound

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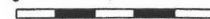


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Figure 3.13 Aerial Photograph showing A.D.L. at Ban Khi Lek
Amphoe Tha Tum Changwat Surin.

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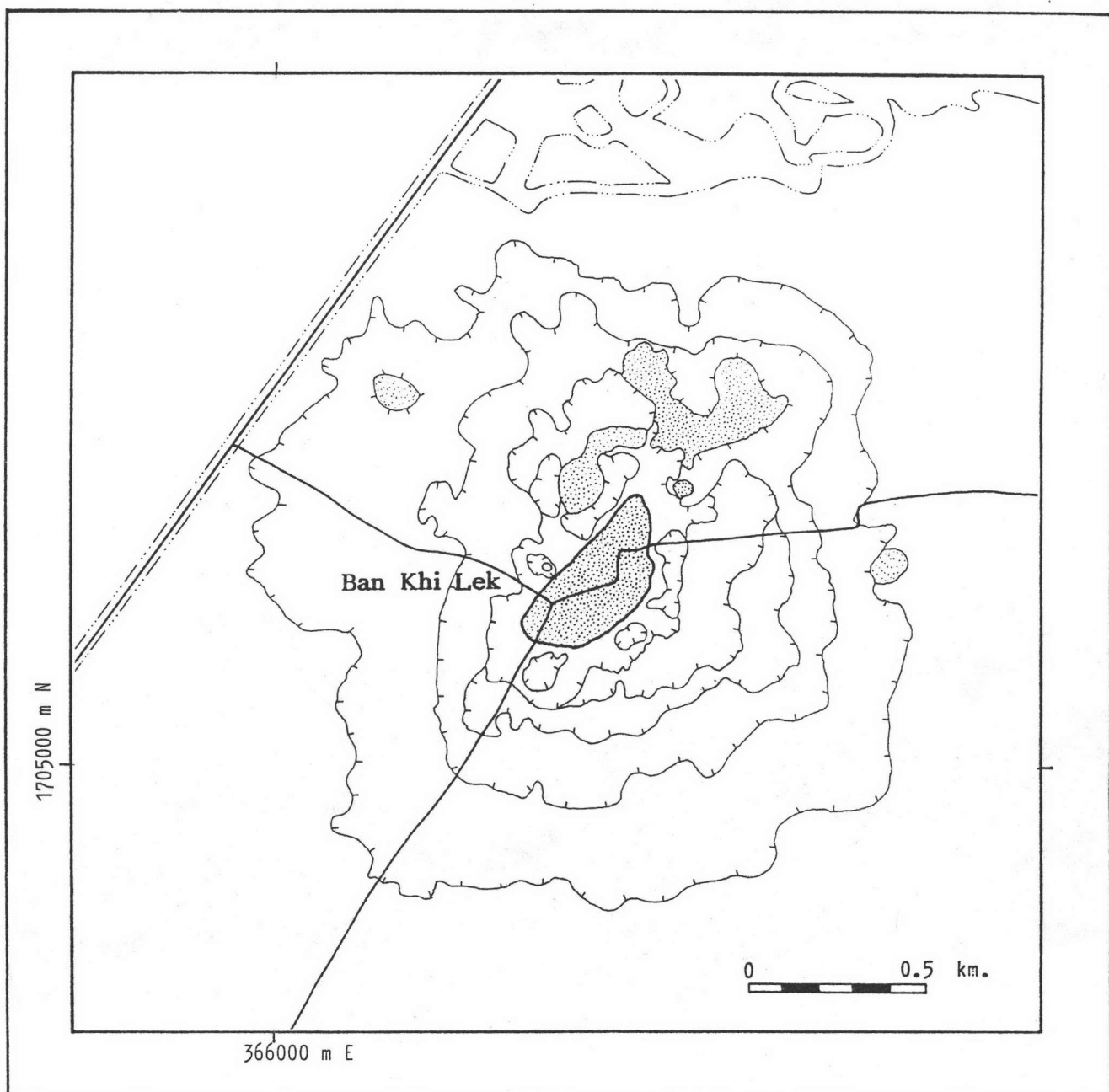


Figure 3.14 Map of Ban Khi Lek showing depression area and mound, delineated from aerial photograph shown in Figure 3.13.

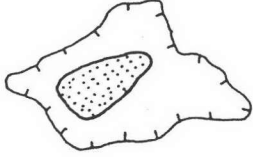
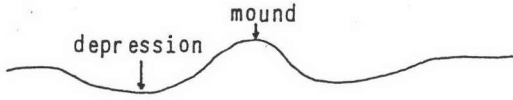
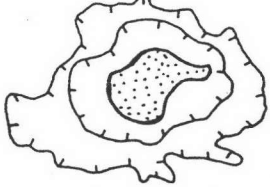
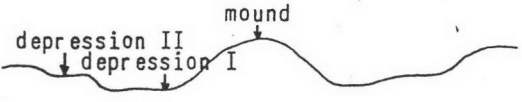
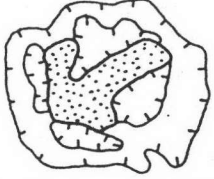

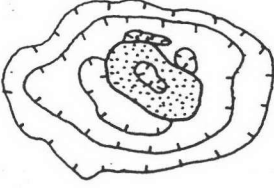
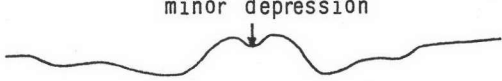
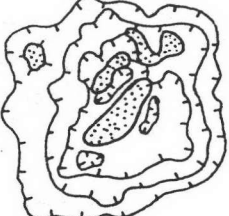

Explanation

	Road		Depression Area
	River		Mound
	Pond		

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Figure 3.15 Showing classification of A D L.

Form of A D L	Schematic Profiles
 <p data-bbox="428 741 522 774">Type-1</p>	 <p data-bbox="796 696 1273 763">Annular depression of a single level surrounding a mound</p>
 <p data-bbox="428 1035 529 1068">Type-2</p>	 <p data-bbox="796 1021 1298 1088">Annular depression of different levels surrounding a mound</p>
 <p data-bbox="435 1344 537 1378">Type-3</p>	 <p data-bbox="802 1300 1298 1367">Annular depression with several minor depressions adjacent to a mound</p>
 <p data-bbox="435 1641 537 1674">Type-4</p>	 <p data-bbox="807 1597 1345 1663">Annular depression with minor depression developed on top of a mound</p>
 <p data-bbox="435 1942 537 1975">Type-5</p>	 <p data-bbox="807 1906 1251 1973">Annular depression with coalescing mounds</p>

schematic profiles are illustrated. The nature of ADL for each type can be summarized as followed;

Type 1, Annular depression of a single level surrounding a mound.

Type 2, Annular depression of different levels surrounding a mound.

Type 3, Annular depression with several minor depressions adjacent to a mound.

Type 4, Annular depression with minor depressions developed on top of a mound.

Type 5, Annular depression with coalescing mounds.

The locations of each type of ADL are demonstrated on the map shown in Figure 3.16.

3.2 Image Interpretation of Geological Features.

In order to understand the relationships of the distribution of ADL to geology, The map showing relevant geological features relating to salt structure and salt solution are needed to be prepared. The geologic structures in the area underlain by the Maha Sarakham Formation together with the regional landform of the Quaternary deposits superimpose on the Maha Sarakham Formation should be delineated. The map showing information as aforementioned is not available and has to be prepared for this study.

In preparation of the regional geologic feature maps of the study area, the geologic map of Changwat Roi-Et of the scale 1:250,000 (Varavudh Sutheetorn and Pairat Jarnyakra, 1986), the aerialphoto mosaic scale 1:250,000 and satellite images are used.

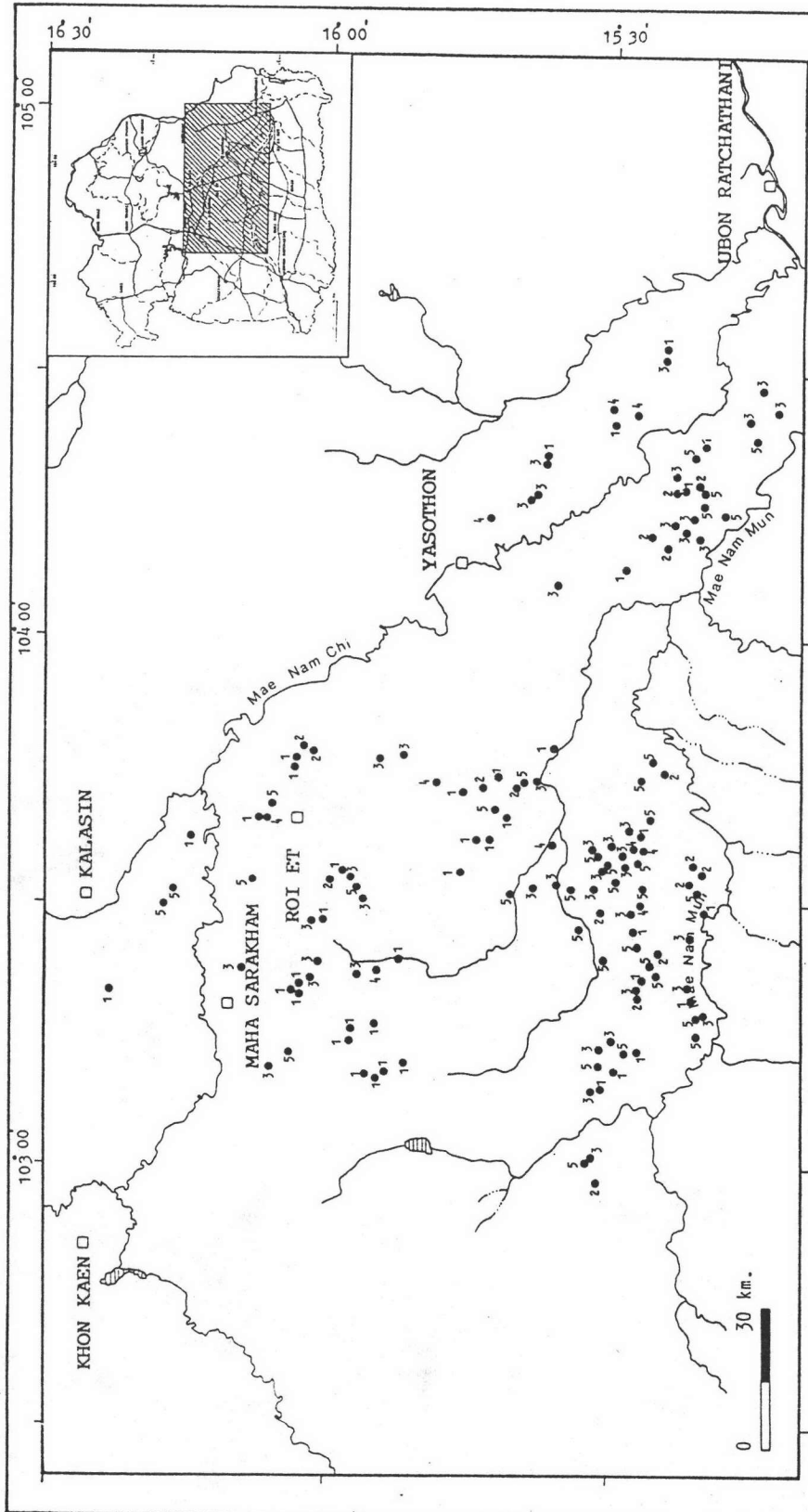




Figure 3.16 Distribution of each type of ADL location.

 River, stream
 Type and location of ADL

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The infrared images of the Landsat 3, MSS-band 7, dated October 6, 1979 are selected for interpretation. The images manifest a geological feature of the study area and can be delineated easier than using other images. This is because the images were recorded during the time when the moisture is still accumulated in the low topography thus give high contrast to the higher topography (Thiva Supajanya, 1981). The mosaic is compiled using images of Thailand ID 2-5 and Thailand ID3-5 of the original scale 1:500,000 to cover the study area. The photocopy of the mosaic is demonstrated on Figure 3.17.

Geological features relevant to this study such as circular features, anticlinal features, lineaments, the boundary of Maha Sarakham Formation, and also geomorphological boundaries are delineated. They are interpreted by using the original panchromatic prints of the scale 1:500,000. The information is transferred onto the mosaic, the map of the same scale is prepared and then be reduced to an appropriate scale for further study.

Figure 3.18 shows regional geologic map of the study area interpreted from this study. The map is interpreted from satellite images with references to geological map of the Maha Sarakham Formation are drawn to separate the formation from the older rocks. Geomorphological boundaries are drawn to separate the units of the Quaternary deposits, gravel petrified wood beds, alluvium plain of the recent flood plains, alluvium deposits of the higher terraces where the underlying rocks of Maha Sarakham Formation can be expected and the sand splay deposits (Thiva Supajanya and Somyot Hokjaroen, 1983; Somyot Hokjaroen and Parry, 1989) are also included.



Figure 3.17 Mosaic of Landsat-3 imageries (MSS Band 7) of the study area, scene:Thailand ID 3-5, date:Oct 7,1979 and ID 2-5, Oct 6,1979, Path 137,Row 049. Drainage system,structure and regional geology are studied the area by means of visual interpretation techniques. Results are illustrated in Figure 3.16,3.17,3.18,3.19,3.20.

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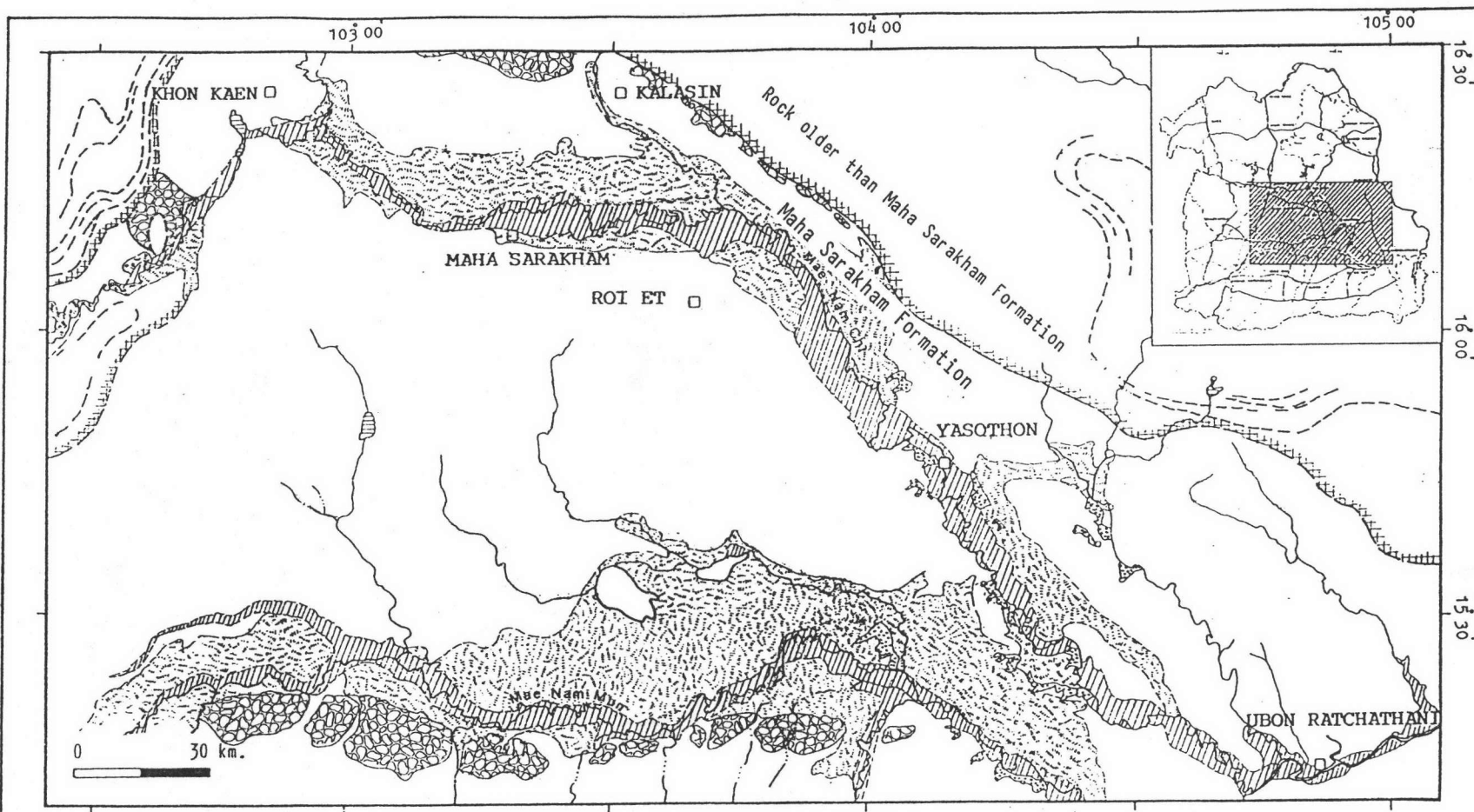


Figure 3.18 Showing regional geologic map of the study area interpreted from satellite image with references to geological map.



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Maps showing each nature of geological features are separately prepared for demonstrating the spatial relationship of ADL locations to each nature of geological features. Figure 3.19 shows the regional structures of major geological boundaries. Figure 3.20 shows the lineaments and Figure 3.21 shows the circular and anticlinal features.

3.3 Spatial Relationship of ADL to Geological Features.

The ADL locations identified within the study area as shown in Figure 3.16 indicating that they are widely distributed throughout the area. However, some particular types can be observed concentrated in some areas. The spatial relationships of ADL to the geological feature can be observed as the followings.

3.3.1 Spatial Relationship of ADL Relating to Regional Geology.

The distribution of ADL is clearly related to the rock of Maha Sarakham Formation, particularly within the area where layers of rock salt has been proposed by drilling. The area south of Mae Nam Mun can not be observed. The ADL locations are not found within the area mapped as Quaternary deposits, particularly the recent flood plain, wind splay deposits, and gravel petrified wood deposits. This observation not include the area of alluvial deposits to be mapped as terraces. There are numbers of ADL can be observed within the region. It can be explained that the underlying rock of Maha Sarakham Formation is probably not deeply situated. Otherwise, the ADL might be formed, due to the continuing evolution of salt dome, after the terrace landform was developed. The distribution of ADL location relating to the regional geology of the study area is demonstrated in

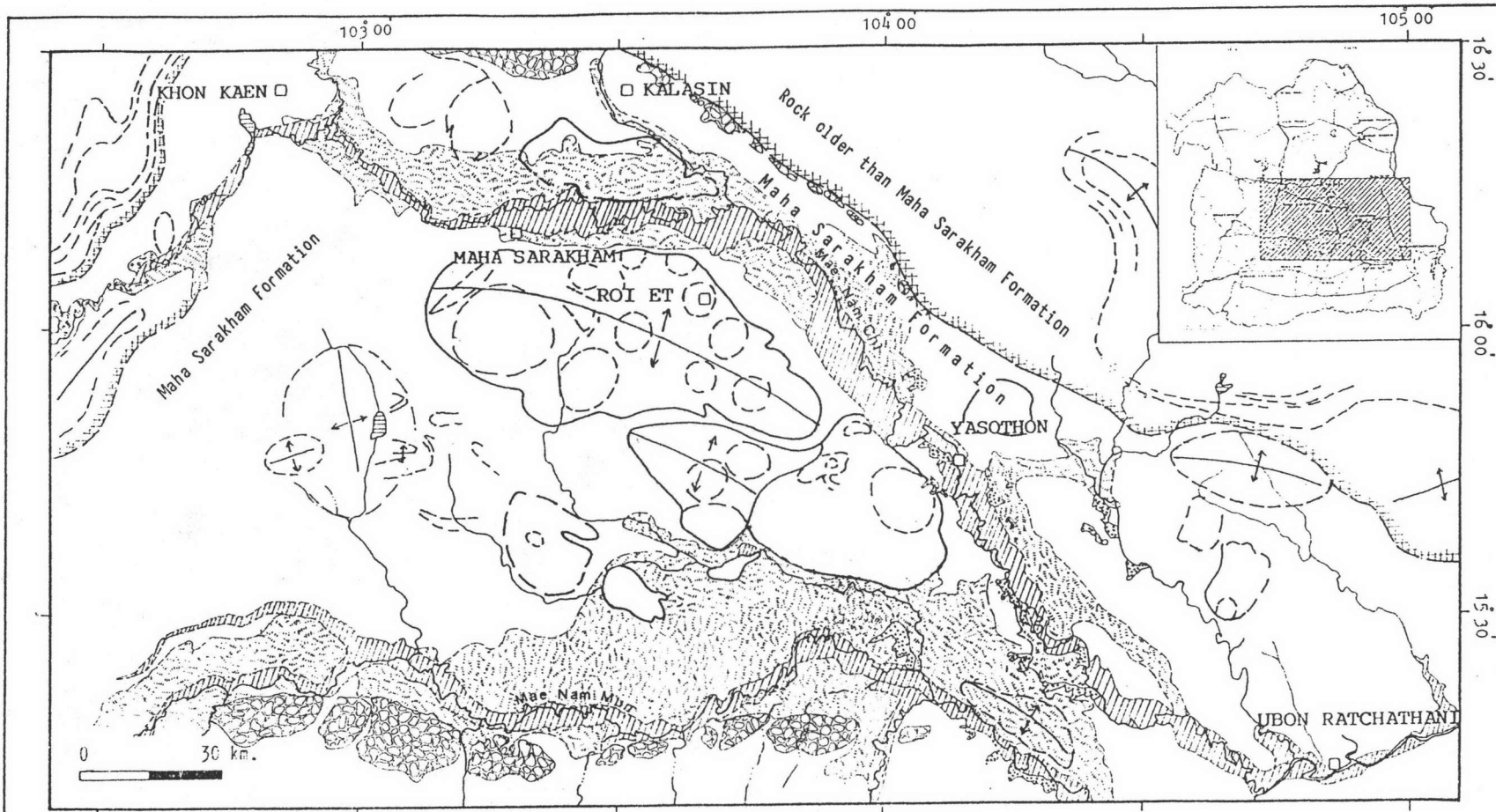


Figure 3.19 Illustrates the regional structure of major geological boundaries.

- | | | | |
|---|--------------------|---|----------------------------|
|  | Bedding trace |  | Alluvial flood plain |
|  | Anticlinal feature |  | Alluvium, terrace |
|  | Circular feature |  | Aeolian sand splay |
| | |  | Gravel petrified wood beds |

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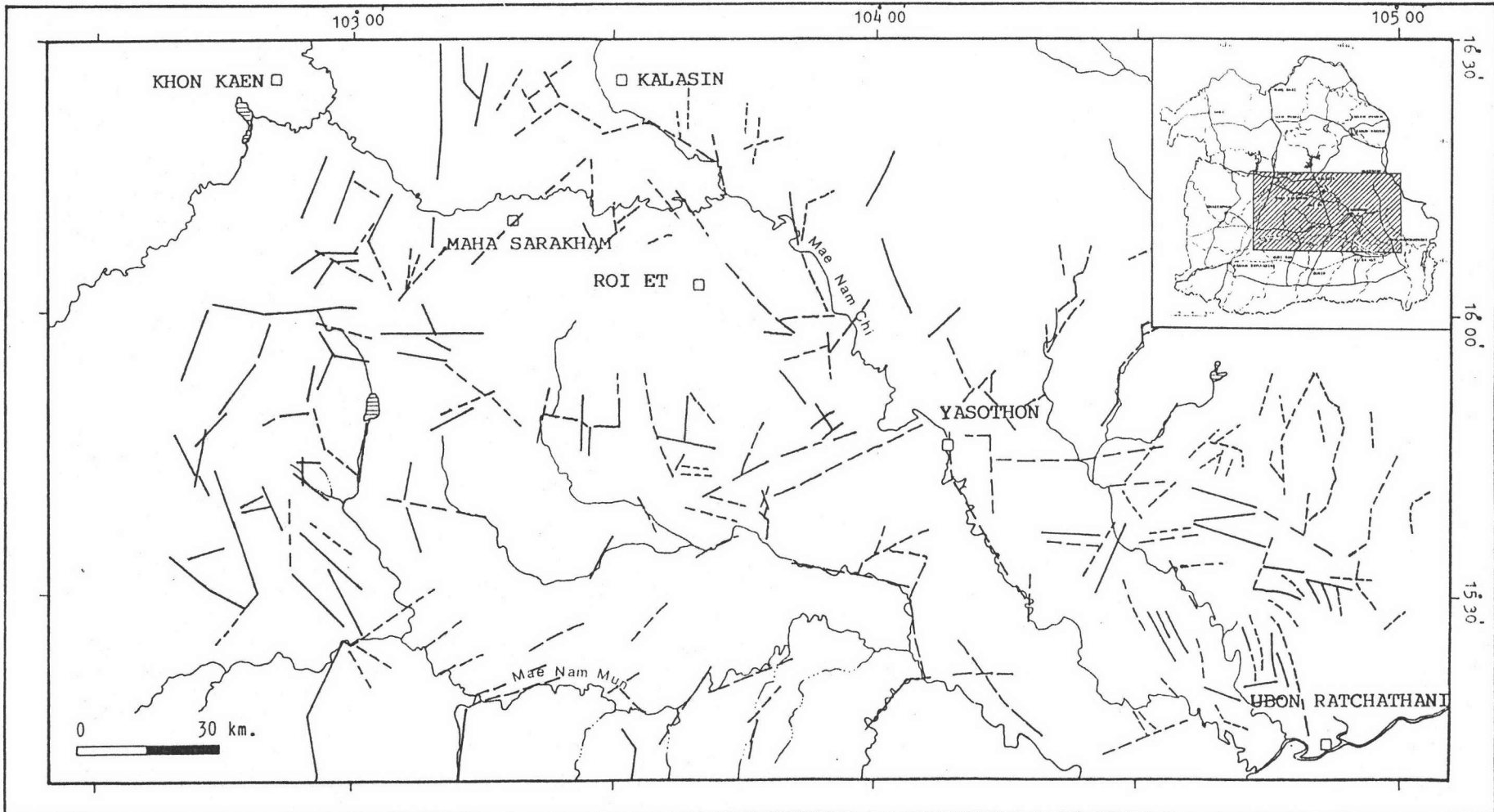


Figure 3.20 Map showing photolineament, directly interpreted from mosaic of Landsat-3 imageries of the original scale 1:50,000 shown in Figure 3.15.

-  River
-  Reservoir
-  Photolineament

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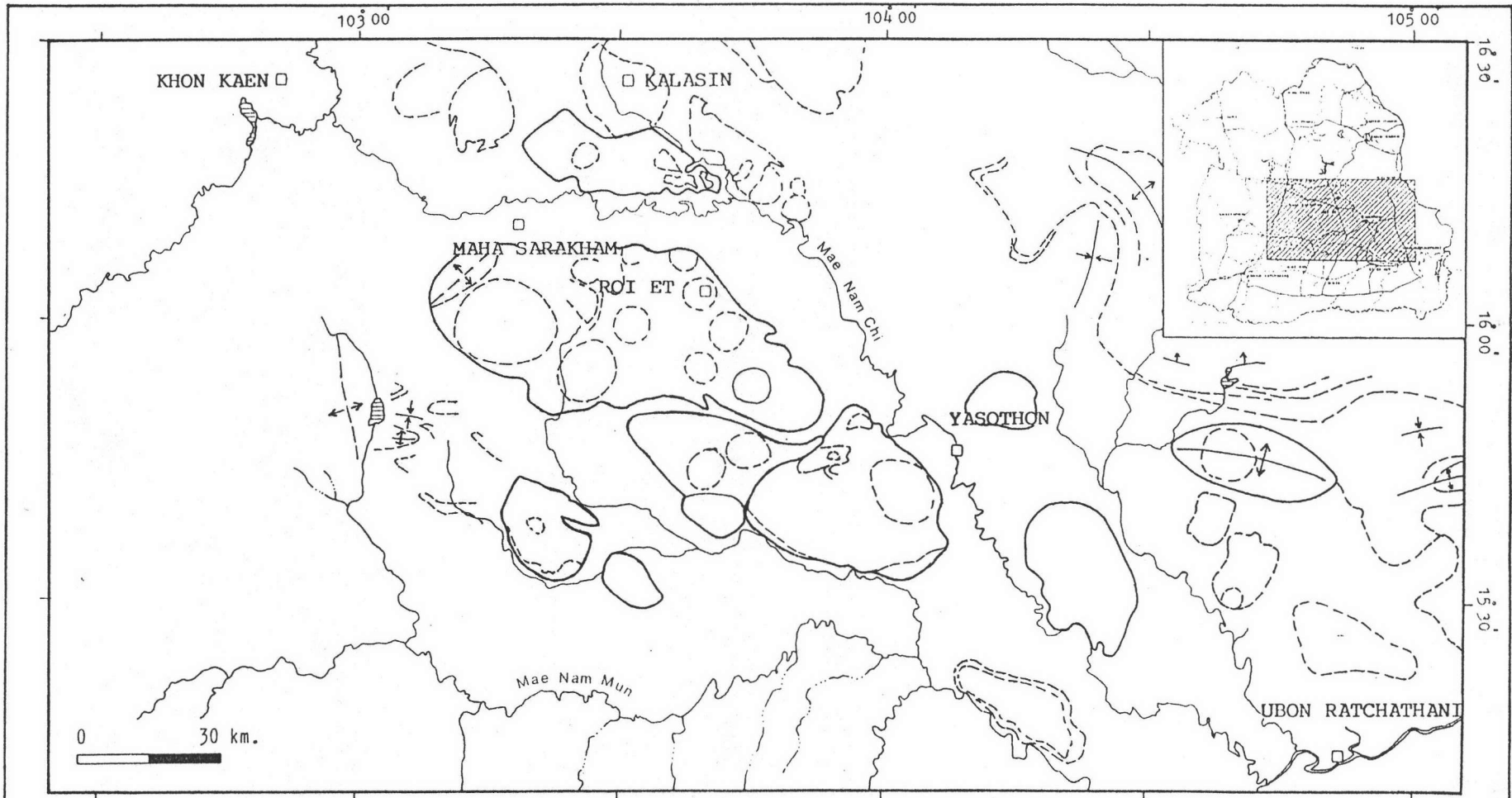


Figure 3.21 Map showing circular feature and folding, structures interpreted from mosaic of Landsat-3 imageries of the original scale 1:500,000 show in Figure 3.15.

- | | | | |
|---|------------------|--|------------------------|
|  | River |  | Anticlinal folding |
|  | Reservoir |  | Synclinal folding |
|  | Bedding trace |  | Anticlinorium boundary |
|  | Circular feature | | |

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Figure 3.22.

3.3.2 Spatial Relationship of ADL Relating to Lineaments.

Figure 3.23 demonstrates the distribution of ADL relating to lineaments. Several ADL locations are situated on the lineaments mapped from image interpretation. Some ADL locations are observed to be located on the lineaments, some locations are on the continuation of the lineaments, and some of them are aligned on the straight line without lineaments to be observed. There are several locations of ADL can be seen aligned along the Mae Nam Mun. Although these observations can not lead to the definitely proved of their relationships, it suggests that the detailed study should be carried out for this kind of study.

3.3.3 Spatial Relationship of ADL Relating to Circular and Anticlinal Features.

The observations of ADL locations in relation to circular and anticlinal features are demonstrated in Figure 3.24. Their relationships are not distinctly observed in this study, although the ADL locations are concentrated on some places. However, it is observed that some of the ADL locations are grouped on the interpreted anticlinal features and its neighbor areas. The example can be seen at the area (A) closed to the Mae Nam Mun southeast of the study area. The anticlinal feature is interpreted to this region. The area (B) and area (C) which are interpreted to be circular features, the ADL locations are situated on the rim surrounding the circular features. It is noticeable for the ADL type surrounding the circular features at area (C). All of them belong to type-1, annular

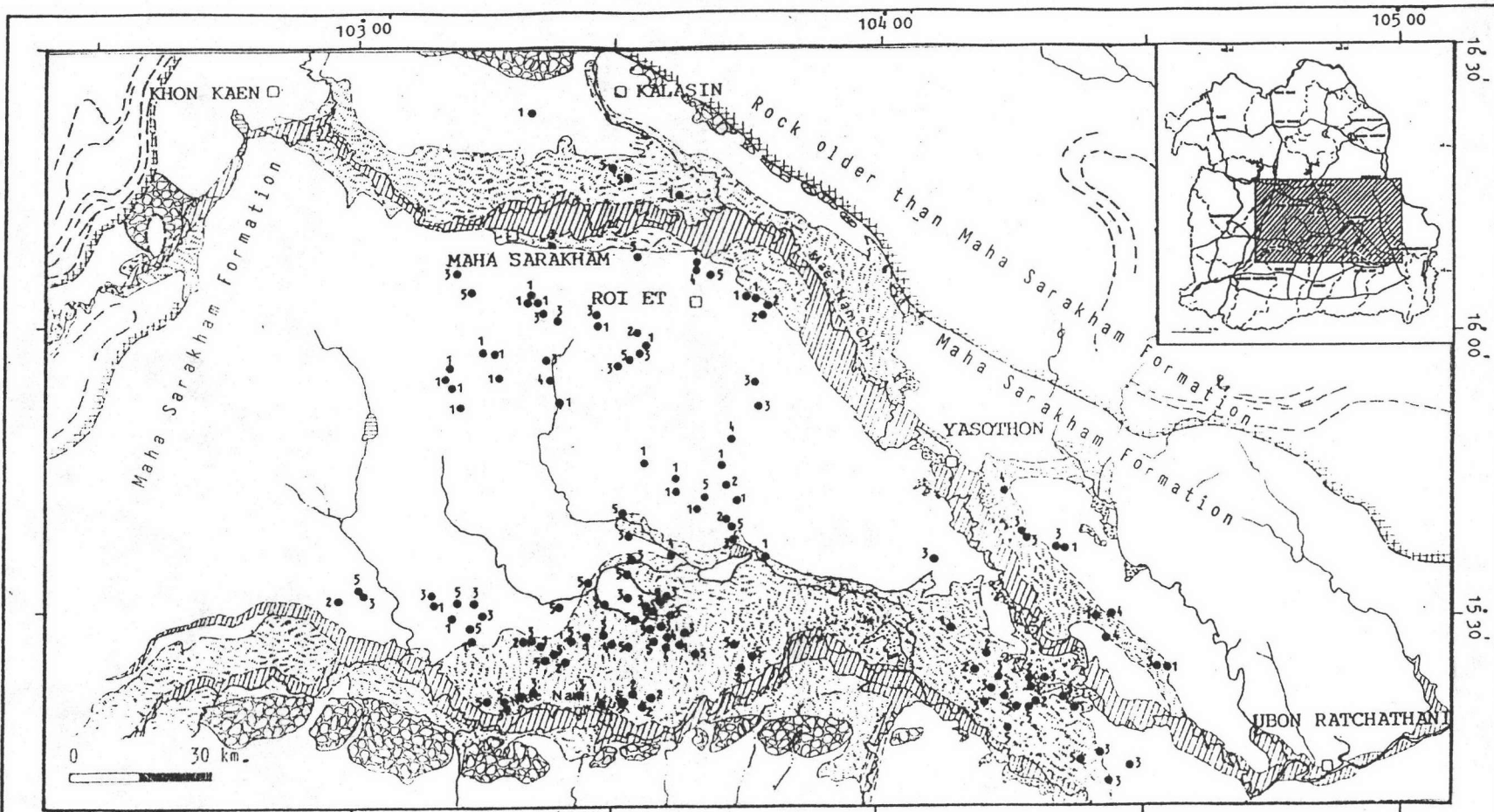


Figure 3.22 Map showing distribution of ADL location relating to the regional geology of the study area.

- | | | | |
|--|---------------|--|----------------------------|
| | River, stream | | Alluvial flood plain |
| | Rock boundary | | Alluvium, terrace |
| | Bedding trace | | Aeolian sand splay |
| | | | Gravel petrified wood beds |

Photogeology and gravity survey of the annular depression landform in parts of Changwat Surin and Roi Et

Krisanapol Vichapan
 Dept. of Geology, Graduate School,
 Chulalongkorn University, 1992.

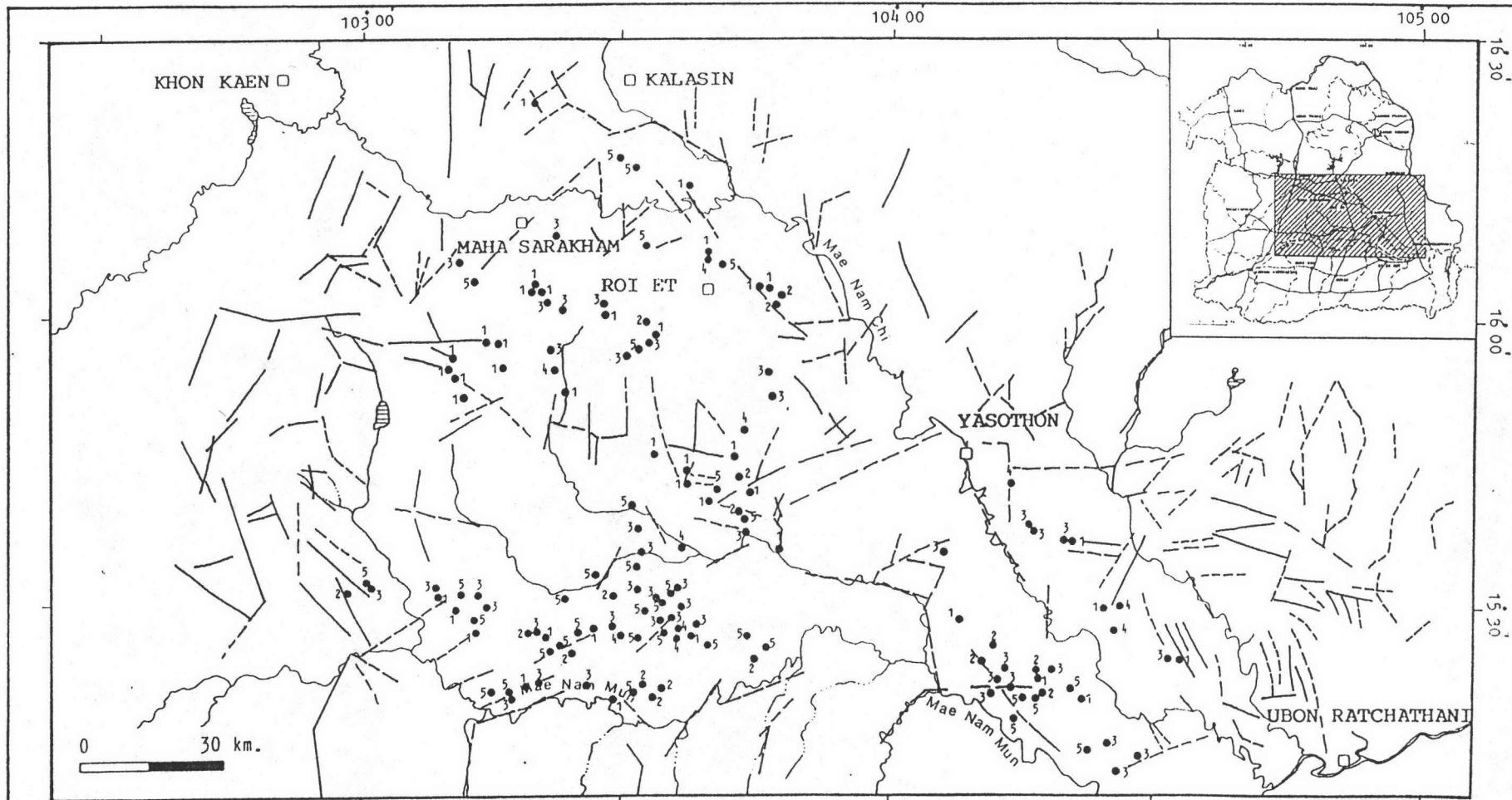


Figure 3.23 Map showing classified A.D.L distribution and photolineament.

Photogeology and gravity survey of annular depression landform in parts of Changwat Surin and Roi Et

- River
 - Reservoir
- A.D.L. location
 - Photolineament

Krisanapol Vichapan
 Dept. of Geology, Graduate School,
 Chulalongkorn University, 1992.

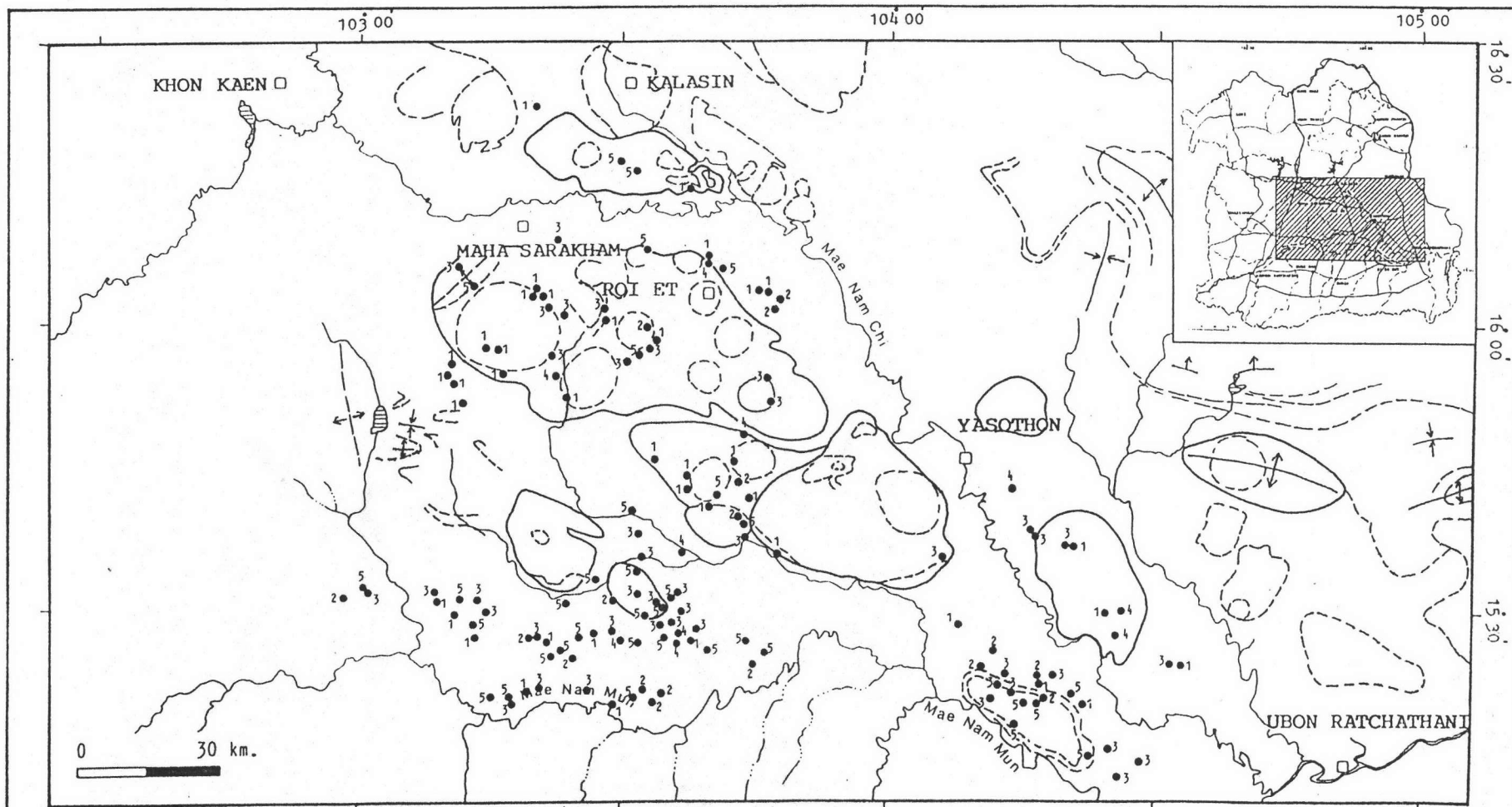






Figure 3.24 Map showing classified A D L distribution, circular feature and folding.

- | | | | |
|---|----------------|--|------------------------|
|  | River |  | Circular feature |
|  | Reservoir |  | Anticlinorium boundary |
| • | A D L location | | |

Photogeology and gravity survey of annular depression landform in parts of Changwat Surin and Roi Et

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 Chulalongkorn University, 1992.

depression of a single depression level surrounding a mound. The ADL locations are highly concentrated at the area (A) where anticlinal features were delineated. Several of them are found in the area extended along the axis of the anticlinal features into the area of alluvium deposits. This is probably that the area is an extension of the anticlinal structure underlying the thin layer of alluvium deposits. The observations made for this study cannot lead to any definite conclusion. It is likely that the ADL's locations show their closer relationships to a circular feature rather than the other geological features.