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Micro-Analysis of Urbanization in the Keihanna Region

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I. Foreword : Purpose of this study

After the Second World War, especially in the case of Japan's remarkable economic growth, there has been an extensive urbanization taking place in the suburban area of metropolises all over the country. We can follow its growing process by looking at how DID has expanded since 1960. DID is an acronym for Densely Inhabited District, and it is checked and revised by a population census conducted every five years by the Statistics Bureau, Management and Coordination Agency of Japan, by whom it is defined as a substantially urbanized area. This broadly outlined report, however, does not allow us to grasp a clearer view of urbanization taking place in the suburban area of metropolises in this country.

To study the urbanization process in the Keihanna Region, therefore, we have chosen to use a topographic map, on the scale of one to 25,000, as a base map, and investigate the process in the micro-scale. We have compiled the figures and findings in our computer, which plays the role of data base for our further analyses. By finding out the process of urbanization, as well as the factors causing a certain type of urbanization, we shall be able to learn how a metropolis expands and the kind of problems it poses.

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II. Outline of our study area

The area we have chosen to study is the Keihanna Region, which is located among Kyoto, Osaka and Nara. Both Kyoto and Nara are known as ancient capitals of Japan, Nara being the first. Osaka, however, is a thriving metropolis in the western part of Japan. With many people living in the outskirts, each of them has a population of 1.5, 0.4 and 2.6 million respectively, according to the population census conducted in 1990. The Keihanna region is composed of low plain lands which started urbanizing comparatively early, and hilly areas which began its urbanization process only several years ago. As there is busy traffic among roads and railways in the three cities (Fig. 1), population tends to expand south-westwards as well as southwards in the suburbs of

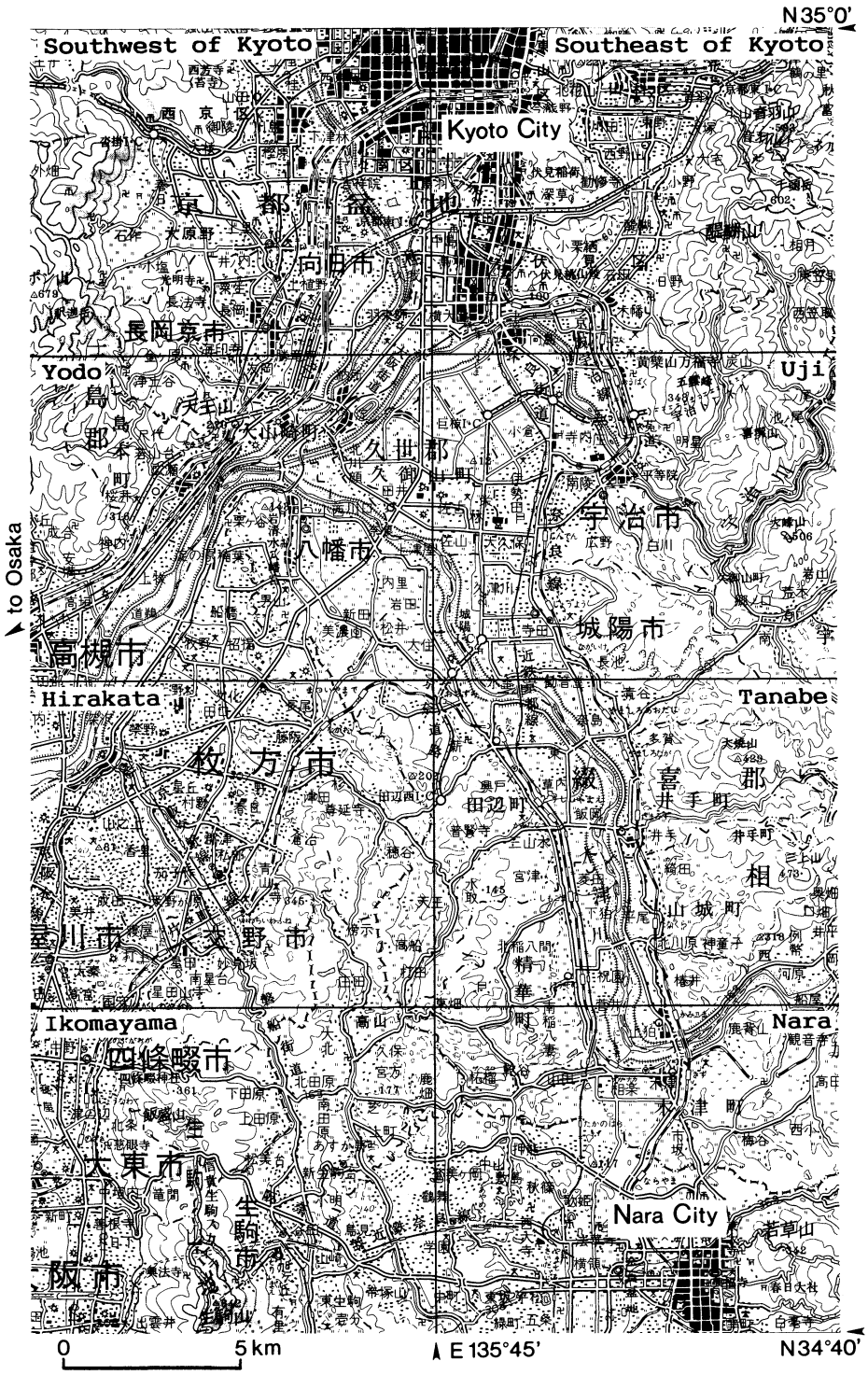


Fig. 1 Study area (a part of topographic map "Kyoto and Osaka" on the scale of one to 200,000)

Kyoto. We have provided eight charts on the scale of one to 25,000, which cover all the areas under our study. These maps include cities and towns around Kyoto, Osaka, and Nara. We shall hereafter refer to the above eight maps as:

Southeast of Kyoto	(NI-53-14-3-3)
Uji	(NI-53-14-3-4)
Tanabe	(NI-53-14-4-3)
Nara	(NI-53-14-4-4)
Southwest of Kyoto	(NI-53-14-7-1)
Yodo	(NI-53-14-7-2)
Hirakata	(NI-53-14-8-1)
Ikomayama	(NI-53-14-8-2)

Their locations are shown in Fig. 1.

III. Periods covered

The study of the urbanization process being one of our central points, we must set some several key periods to be contrasted and analysed in a particular time span. We based these periods as much as possible on original topographic maps compiled through precise measurements rather than on revised or retouched ones. For analysis, we have divided the past 65 years into the following 4 periods:

I: Around 1925 when there was almost no housing in suburban areas concerned.

II: The latter half of the 1960's, when population in suburban areas started to grow rapidly.

III: The latter half of the 1970's, when suburban areas became highly populated.

IV: The middle of the 1980's, when population in these areas reached the present level.

The noticeable time gap between period I and period II is due to the fact that no precise observation had been done in those days. To fill this gap, we are investigating the possibility of using aerial photographs taken by the American Army immediately after the Second World War and producing a map. However, this task will be very difficult.

IV. Study method and mathematical treatment system

There have been several up-dating topographic observations conducted in the study area. And we have chosen to use maps in as large scale as possible for our base map, that is, one in the scale of one to 25,000. In this connection, let us mention that there are three kinds of grid squares used in Japan for mathematical treatment of various geographical data. Most commonly used in this country is the third-grade grid square which divides topographic map on the scale of one to 25,000 into ten equal sections along latitude and longitude respectively.

For this study we prepared what we temporarily call a fourth-grade grid square which consists of horizontal and vertical bisections of the third-grade square units. We further divided the smallest square of this fourth-

grade grid squares into 100, that is, 10th division along length and width respectively, which we might call fifth-grade grid squares.

As far as this study is concerned, the unit error caused by differences in size of the topographic map should remain minimum, if at all. This in mind, we drew our fifth-grade grid square on a transparent acrylic sheet and placed it underneath the map. By casting light from beneath, we marked residentialized portions of areas with red. We repeated this procedure with the map of each period. Then, we counted the number of red portions and fed the figure into our computer as our basic data. The analysis we have conducted with this data base is as follows:

1) Number of colored parts in each unit shows how far the area is urbanized. By looking at surrounding units we can see the distribution of residential areas. We will find that the bigger the residential areas the more it looks like high mountains. (higher part of Fig. 2). It can also be projected as a choropleth map as in Fig. 3.

2) The increase in number of colored parts between two successive periods will show how the residential area expanded chronologically in a particular unit. Connecting all the units together on a plane provides us with a bird's eye view as to how urbanization took place in the Keihanna Region. This is shown in the lower part of Fig. 2, which can also be transformed into a choropleth map, as in Fig. 4.

V. Conclusion

Referring to Fig. 2, 3 and 4, let us therefore conclude our study in a concise

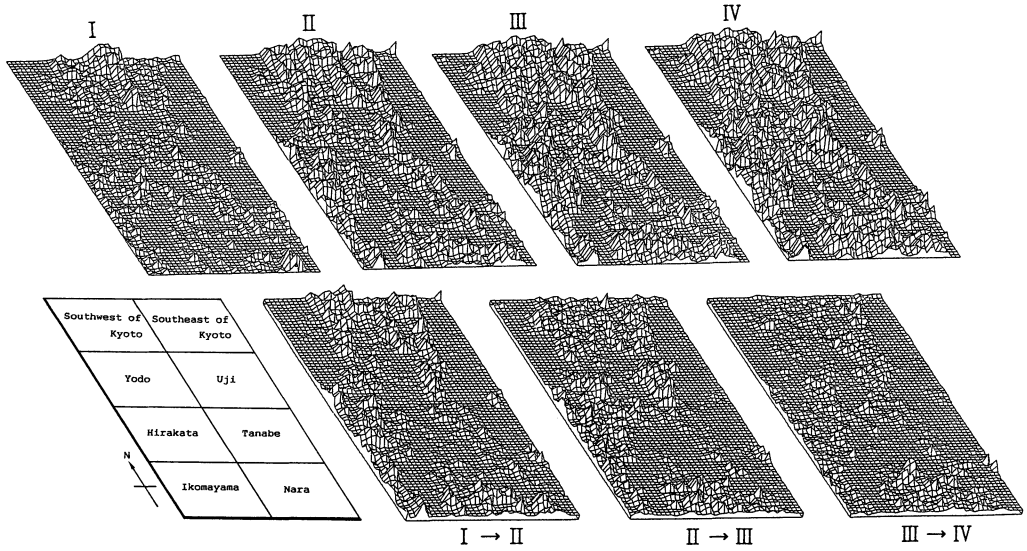


Fig. 2 Block diagram showing ratio and increase of residential area in the Keihanna Region

form:

1) The fact that residential areas are generally recognized along railway lines shows that in spite of today's highly developed road traffic network with no small driving population, the flow of commuters still depends largely on railway in this country. There are several factors which determined the rate at which an area become urbanized.The closer the area from a station, the earlier was the period of its development as a residential area. While areas along the Keihan and Hankyu Lines had started developing as commuterlands relatively early, those along the Kintetsu and JR Lines developed far later. And, needless to say, urbanization had started earlier in the areas along main lines than those along branch lines in either case.

2) When areas within a walking distance of one kilometer from the nearest railway station becomes saturated, the surrounding areas usually start developing as commuterlands, where bus, bicycle and motorcycle are the means of access to the station.If chronological development of commuterland around a railway station is to be shown as concentric circles, process of urbanization along a certain railway line would be like seeing those concentric circles growing bigger and bigger until in the end they start reaching and overlapping each other. This process, however, did not take place simultaniously everywhere; by the time the concentric circles along the Kintetsu and JR Lines started growing individually, those along the Keihan and Hankyu Lines were already overlapping each other. If this time lag caused a negative outcome with the effective use of hilly lands in the Keihanna Region, it also may be said that the construction of the Kansai Culture and Academic Research City was made possible due to this delay. The time lag in urbanization can be found between the trunk lines and branch lines of any railway concerned.

3) In the areas where urbanization started early, there has been but a modest increase of residential area during the III and IV periods. This is due to the soaring land prices, which led to a general stop in growth of urbanization by discouraging erection of new houses or condominiums in these areas, even if space permits such growth. This probably worked as a drive to urbanize other areas with relatively low land prices, such as those between Kyoto and Nara, or area of considerable distance from railway stations located between Kyoto and Osaka.

VI. Further study to be followed

Following four points should be noted for further study.

1) It may be a good idea to set the study area larger and refine picture treatment system accordingly.

2) Setting another study period between the first and the second ones will certainly add another insight to the study.

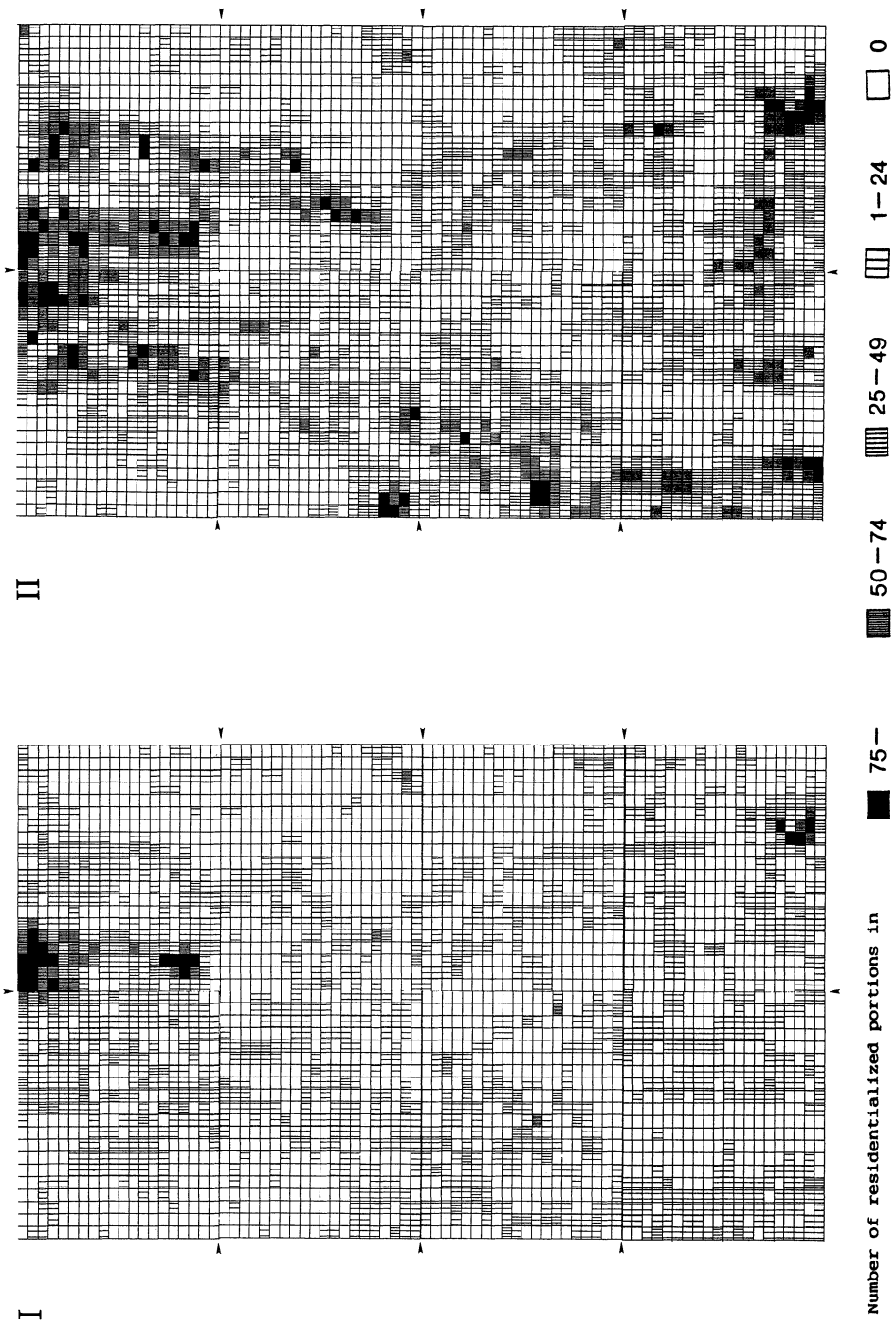


Fig. 3(a) Choropleth map showing ratio of residential area in the Keihanna Region (I and II period)

※ Index map is shown in the initial of Fig. 4.

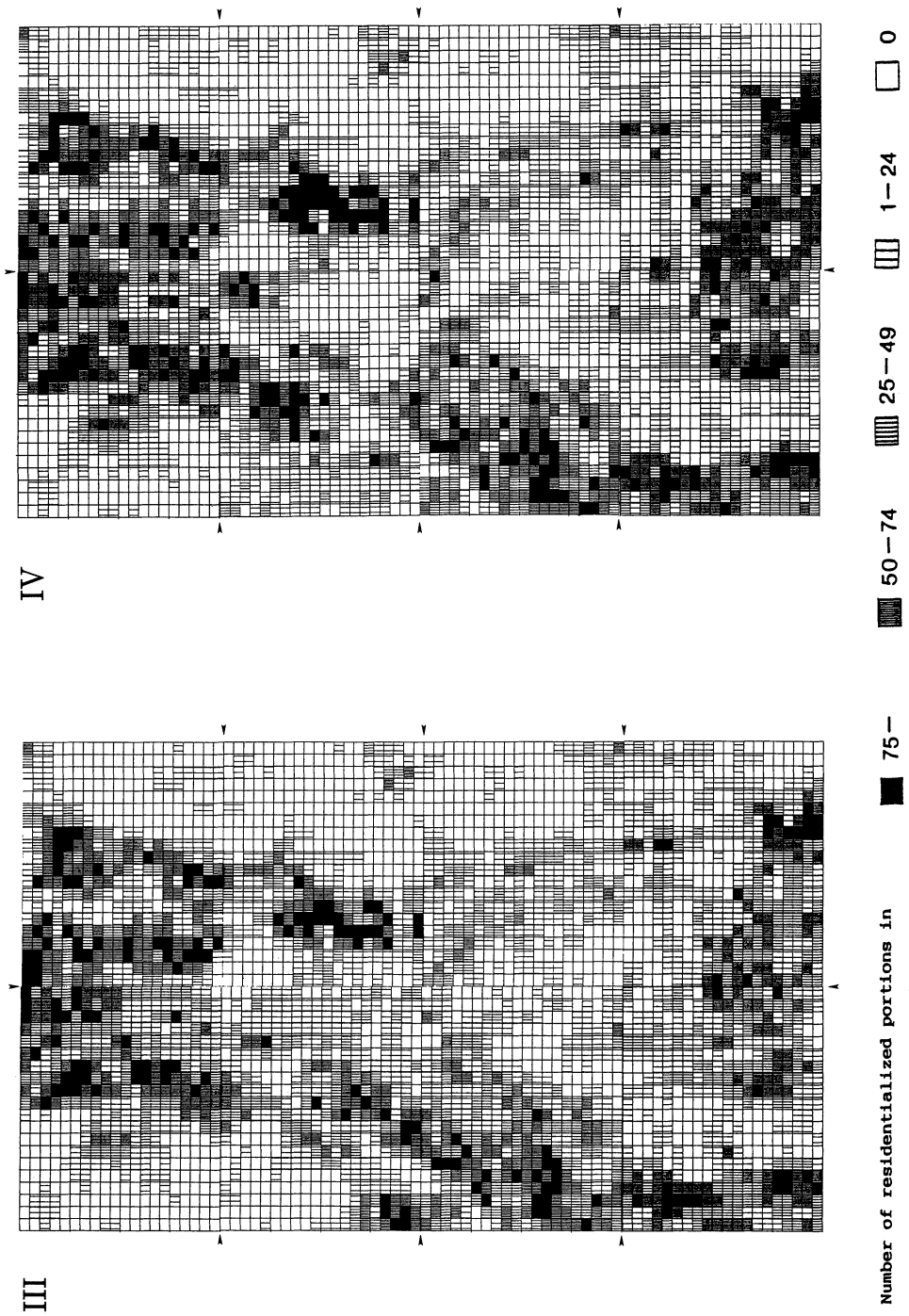
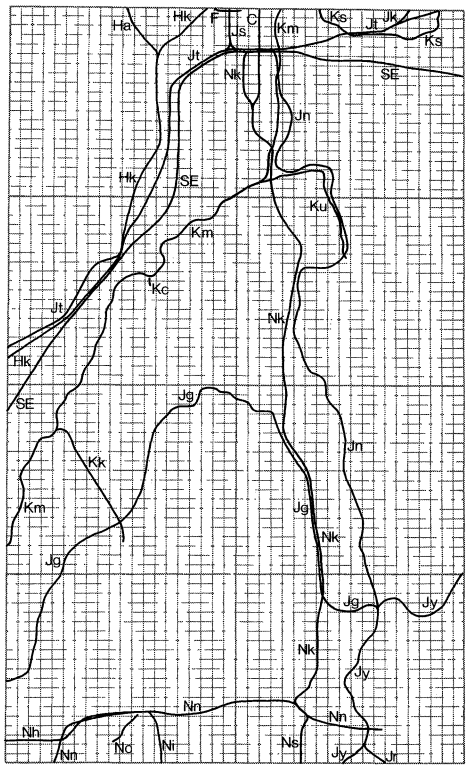


Fig. 3(b) Choropleth map showing ratio of residential area in the Keihanna Region (III and IV period)



Index map

SE; JR Shinkansen Line Jt; JR Tokaido Line (Kyoto Line & Biwako Line)
Jk; JR Kosei Line Js; JR San-in Line (Sagano Line) Jn; JR Nara Line
Jg; JR Katamachi Line (Gakkentoshi Line) Jy; JR Kansai Line (Yamatoji Line)
Jr; JR Sakurai Line Hk; Hankyu Kyoto Line Ha; Hankyu Arashiyama Line
Km; Keihan Main Line Ku; Keihan Uji Line Kk; Keihan Katano Line
Ks; Keihan Keishin Line Kc; Keihan Otokoyama Cable Line Nk; Kintetu Kyoto Line
Nn; Kintetsu Nara Line Nh; Kintetsu Higashi-Osaka Line Ns; Kintetsu Kashiwara Line
Ni; Kintetsu Ikoma Line Nc; Kintetsu Ikoma Cable Line
C; Kyoto Municipal Subway Line F; Keifuku Arashiyama Line

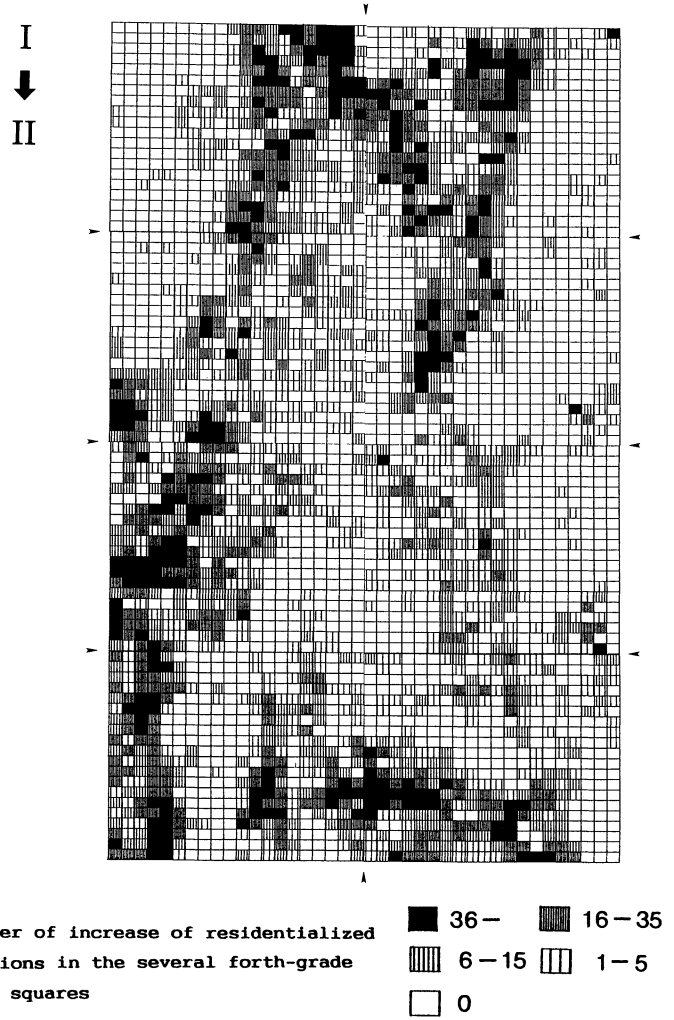


Fig. 4(a) Choropleth map showing increase of residential area in the keihanna Region (from I to II period)

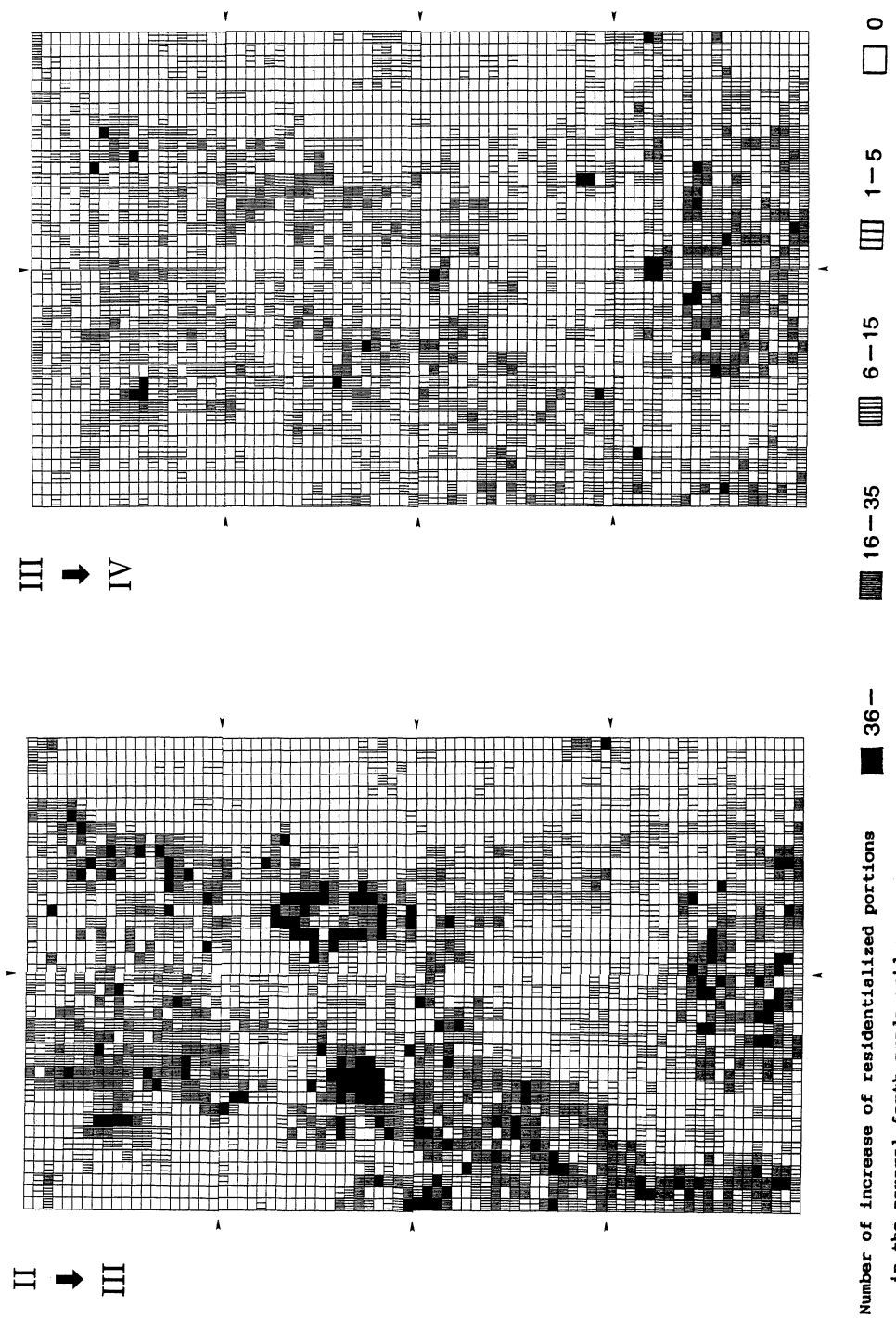


Fig. 4(b) Choropleth map showing increase of residential area in the Keihanna Region (from II to III period, from III to IV period)

3) Compiling further information upon our data base would result in a better and more detailed analysis.

4) Reassessment, with further data, of factors that cause urbanization may help better explain how and why urbanization occurs at particular time and location.

Acknowledgement

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References

Kagawa, T. *et al.*: Micro-analysis of Urbanization in Southern Suburbs of Kyoto, *Environmental Change and GIS*, vol. 1, 1991, pp. 260～267.

Yamada, M. *et al.*: The Urbnization in Keihanshin Metropolitan Area since The Meiji Era (part 1), *GIS for Environmental Change Research Project*, vol. 1, 1990, pp. 175～182. (in Japanese).

Yamada, M. *et al.*: The Urbnization in Keihanshin Metropolitan Area since The Meiji Era (part 2), *GIS for Environmental Change Research Project*, vol. 1, 1992, pp. 153～160. (in Japanese).

京阪奈地域における住宅地化のミクロ分析

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本研究の目的は、京阪奈地域における住宅地化の進展状況をデータベース化することである。分析対象とした時期は、1925年前後、1960年代後半、1970年代後半、1980年代半ば、以上の4ステージであり、研究対象地域は、2万5千分の1地形図「京都東南部」、「宇治」、「田辺」、「奈良」、「京都西南部」、「淀」、「枚方」、「生駒山」の範囲（第1図）である。

我々は、ミクロ分析に耐えられるように、基準地域メッシュを縦横2等分したもの（仮称・4次メッシュ）を、さらに天地左右で10等分した単位（仮称・5次メッシュ）を設定した。この5次メッシュの大きさは、50m 前後の四辺で構成される不等辺四辺形である。そして、5次メッシュを作業単位として、各ステージの地形図上で住宅地化されている部分を着色し、それが4次メッシュ毎にいかなる比率を示すのかをカウントし、データシートを作成した。次に、このデータシートを用いて、①住宅地の分布状況と、②住宅地の増加状況とを、視覚的に表現した。第2図のブロックダイヤグラムでは、上半分に上記の①が、下半分に②が示されている。高い山のように見えるところは、①に関しては住宅地が多く分布する箇所で、②に関しては住宅地の増加が著しい箇所といえる。さらに、これらのうち、①は第3図、②は第4図のような階級区分図でも表現できる。

こうして得られた第2～4図をもとにすると、以下のような結果を導き出すことができる。

1）全般的に住宅地は、鉄道に沿って認められる。このことは、モータリゼーションが進んだとはいえ、日本の通勤・通学流動が鉄道に依拠していることの証左である。しかし、住宅地化が生じた時期は、最寄駅からの距離、鉄道沿線別などによって異なっている。例えば、最寄駅からの距離が近いほど住宅地化の生じた時期は早い。また沿線別では、京阪・阪急沿線が比較的早く、一方で近鉄・JR 沿線が相対的に遅い。さらに、鉄道の本線・支線別では、当然ながら本線沿いの方で早期に住宅地化が生じている。

2）最寄駅から1km 前後の徒歩圏内での住宅地化が飽和状態になると、バスないしは自転車・バイク利用圏に住宅地化が進展する。その過程は、複数の同心円が接合していくような具合に進展していく。ただ、このことに関しても、沿線別に時期的な差異があり、京阪間と阪奈間において複数の同心円の接合が始まった時期に、京奈間では個々の同心円が成長しつつある状況が確認される。この時期的な差があったために、京阪奈丘陵地域における土地利用の高度化が遅れ、逆にこれが幸いして関西文化学術研究都市の開発が可能になったと解釈できる。住宅地化に関する同様の地域的差異は、鉄道の本線沿いと支線沿いとの間でも見出せる。

3）住宅地化が早期に生じた地域では、Ⅲ～Ⅳの時期において住宅地の増加が沈静化している。この時期は、地価の高騰が社会問題化し始めた時期に相当しているから、たとえ住宅建設が可能なスペースがあっても、価格面との折り合いでそこに住宅が立地し得ず、相対的に地価が低い地域（例えば京阪間の駅から遠い地域や京奈間など）で住宅地化が進展したと考えられる。

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