Baldacci, O. (1972): Puglia. Le regione d'Italia 14. Unione Tipografico Editrice Torinese, Torino.
Block, A. (1969): South Italian Agro-Towns. Studies in Society and History 39, 1: 121-135.
Christiansen, S. (1979): Classification of Agricultural Systems – an Ecological Approach. Geografisk Tidsskrift 78/79: 1-4.
Colamonico, C. (1960): Memoria illustrativa della Carta della Utilizzazione del Suolo d'Italia. Consiglio Nazionale delle Ricerche, Napoli.
Houston, J.M. (1963): A Social Geography of Europe. Duckworth, London.
King, R. (1973): Land Reform – The Italian Experiences. Butterworth. London.
King, R. (1978): The Sicilian Agro-Town. Erdkunde 32: 111-123.
Mørch, H. (1980): Apulien – ressourcer og kulturlandskab i en syditaliensk egn. Kulturgeografiske Skrifter 11.
Rasmussen, K. & Reenberg, A. (1980): Ecological Human Geography – Some Considerations of Concepts and Methods. Geografisk Tidsskrift 80: 81-88.
Rother,K. (1980): Bewasserungsgebiete und Bewasserungsprojekte in SO-Italien. Erdkunde 34: 287-293.
Richioni, V. (1957): Aspetti della trasformazione fondaria nella Murgia dei Trulli. Atti del Congresso Geografico Italiano 18: 330-345.
Spano, B. (1968): Insediamenti e dimore rurale in Puglia centromeridionale. Pubblicazioni del Istituto Geografico 14/15, Pisa.
Sprengel, U (1971): Die Wanderherdenwirtschaft im mittel- und südostitalienischen Raum. Marburger Geographische Schriften 51.
Vidal de la Blanche, P. (1921): Principes de la Géographie Humaine. Colin, Paris.
Wirth, E. (1962): Die Murgia dei Trulli. Die Erde 93: 249-278.

Location of rural settlements and geology – a case study of the Salento peninsula (S. Italia)

Henning Mørch

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The survey area is characterized by a level topography and a population largely concentrated in agglomerations. The spacing of the agglomerations is examined by nearest neighbour method and formally found to be random – not uniform. The localization is then analysed for connection with geology; the connection is confirmed statistically by a chi-squared test. The relation of settlement location to micro-topography, agicultural system, historical factors etc. is to be analyzed and also how the old pattern of localization is influencing the development of an emerging system of service centers.

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An agricultural population is likely to be fairly uniformly distributed; if agglomerated, the agglomerations may also be expected to be uniform. This so when conditions influencing settlementation are isotropic. The distribution, however, is influenced by the local kind of agricultural system and a spectrum of natural and socio-economic factors. When economic conditions change the agricultural system may change too, but the pattern of settlement survives and changes only slowly, as the population seldom redistributes immediately. Thus the old pattern of rural settlement is part of the preconditions when a new system of central places develops. A rising system of service centers will not develop strictly after central place theories, but has to change, or adapt itself to the former pattern of settlement. The object of this paper is the distribution of rural settlements in a concret case – the southern part of the Salento peninsula in SE Italia.

The Survey Area – delimitation

Salento is a part of the Italian region Puglia – a region, which may among others be characterized by two features of special relevance: topography and population distribution.

The topography of Puglia is fairly level (cf. Dickinson 1955, fig. 9). This implies that slope – often an important factor for the location of rural settlements – may here be of little consequence.

Area (ha)	Population Total	Centers	Other towns > 1100 inhab.	Dispersed
1453.5	391.685	352.942	23.358	4551
% of total	100	90.11	5.96	0.74

Note: "Dispersed" = the sum of population in "nucli" (very small hamlets etc. with 6-52 inhabitants) and in "case sparse" (dispersed houses).

Table 1.
The survey area - size of population and surface. Based on the 11th Censimento.

	Survey area	Sheet 214 & 223
Area km^2	1453.5	1958.5
A - Centers		
Number	69	81
Distance obs.	2.490	2.121
rand.	2.295	2.459
R = obs./rand.	1.108	0.863
z	1.350	2.3669
p(z)	0.162-0.193	0.016-0.021
B - All agglomerations > 1100 inhab.		
Number	83	101
Distance obs.	2.370	2.482
rand.	2.092	2.202
R	1.133	1.127
z	2.315	2.445
p(z)	0.016-0.021	0.016-0.021

Note: Distance obs. = mean observed, D. rand. = calculated for a random distribution.

Table 2.
Nearest neighbour analysis.

The population is concentrated in agglomerations – most of them considerable of size and counting tens of thousands inhabitants; generally, each commune has just one such agglomeration. Until recently these agglomerations – even the larger ones – had a rural function, and the main part of the population lived by agriculture; and still a big share is rural (Cautadella 1976 & Corsi 1983). In fact, the agglomerations functionally are villages or rural towns. Generally the agglomerations are large, but two zones differ in this point. The Capitanata, where small villages are located in the mountains and the large rural towns on the Tavoliere plain, i.e. a functional adaption to topography. The other area is the southern part of the Salento, – the study area, with a very level topography, and where the agglomerations cover a broad range of size. Apart from small zones – such as the Murgia dei Trulli and parts of the land reform districs, only a small share of the population is dispersed settled (Dianelli 1939 & Novembre 1976).

Concerning the province of Lecce in which the study area is situated, 90% of the population (the provincial capital Lecce excluded) are living in the centers of the communes, further 8% in other agglomerations, and the last 2% live dispersed (Mørch 1981). The agglomeration of the population implies that the localization is more simply measured by means of the spacing and localization of the rural towns.

The survey area as such was delimited to the Salento to the south of the provincial capital Lecce; north of Lecce the pattern of settlement has a different structure (e.g. Novembre 1979). As a marked topographic line or other objective criteria lack, the delimitation of the study area may appear arbitrary. First two settlements were excluded, viz. the only centers located at the coast: Gallipoli – situated at a promontory and functionally not a rural town, and Otranto with a natural harbour, but with agriculture as main trade. The location of both may be ascribed to factors outside agriculture and thus not comparable to that of the rural towns of the area. In this way the agglomerations under consideration could be found solely on the two 1:100.000 sheets »214 Gallipoli« and »223 Capo S. Maria di Leuca«. Next, it was decided that only communes having their entire area within the two sheets should be included. Finally, communes with centers outside the two sheets or, centers having their nearest neighbouring center in communes excluded by the first criterion were excluded too. Through this procedure the survey area was delimitated northwards by a row of communes included in the area – cf figure 1:

Zone	Area %	Centers Observed (O)	Expected (E)	$(O-E)^2/E$
Western	21.4	15	14.8	0.003
Central	28.3	10	19.5	4.628
Eastern	50.3	44	34.7	2.601
Total	100	69	69	$\chi^2 = 7.232$

Note: $p(\chi^2) = 0.02-0.05$

Table 3.
Distribution of the centers within the survey area.

Fig. 1. The communes of the survey area – the southern part of the Salento peninsula. The hatched area is excluded from part of the survey.

Fig. 1. Kommunerne i undersøgelsesområdet i den sydlige del af Salento halvøen. Det skraverede område er udeladt af det egentlige undersøgelsesområde, men medtaget i nogle beregninger.

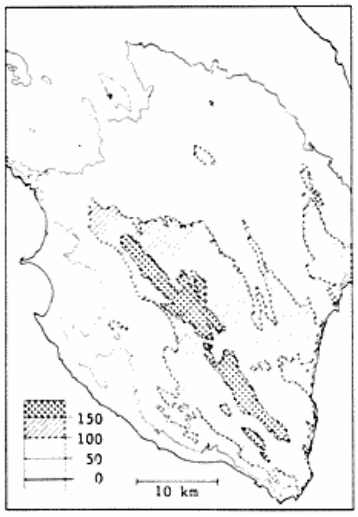


Fig. 2. The general topography of the survey area.

Fig. 2. Højdeforhold.

Sannicola, Galatone, Galatina, S. Pietro in Lama, Lequile, S. Cesario di Lecce, S. Donato di L., Caparica di L., Castri di L., Calimera, Carpignano Salentino, Cannole, Palamariggi, Guggianello, Poggiardo, Ortelle, & Diso.

Delimited in this way the survey area has a mosaic of small as well as fairly large rural towns; however, it may be regarded as a unit distinct from the rest of the Salento, which is dominated by solely large rural towns.

It might be argued that the Salento delle Serre should be used as survey area as well. This region – literarily Salento of the Ridges, with reference to the topography – is delimitated to the north by a line approximately Galatone-Zollino-Otranto (cf. Novembre 1979 fig. 10). The line, however, appears not to have any special influence on the pattern of settlements.

For the matter of completeness the different calculations were carried out not only for the survey area as such, but also for the total land surface of the two sheets »214« & »223«.

The Survey Area – some characteristics

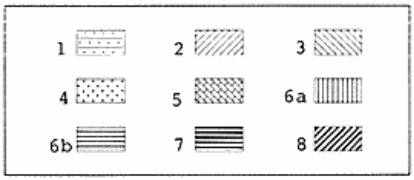
The survey area is low-lying and fairly plain – figure 2. The highest point is only 195 m above sea level. Though the southern part of the area is called »Salento of the Ridges« – this element of topography, however, is only to a small extent conspicious on the map 1:100.000, on which figure 2 is based. Apart from steep coastal cliffs the main part of the area is sloping less than 5% and only small and narrow zones 5-10%. Thus, sloping also in this area seems to be of little significance for settlement location. The size of population and the surface appear from table 1. The population is by and large completely concentrated in villages and rural towns. Around half of the towns has agriculture as dominating trade, but an increasing number are getting other trades as the most important (Novembre 1979). Non the less the towns studied are agricultural of origin, which is regarded as an important precondition for their localization. It was decided to delimit the survey to the centers of the communes and other villages of comparable size – i.e. agglomerations with more than 1100 inhabitants. In 1971 the centers had from 1108 inhabitants (Secli) up to 22.127 (Galatina), the median size was around 4500 and 50% had 2500 to 6500 inhabitants. The fourteen other agglomerations included had 1116 to 2544 inhabitants.

THE SPACING OF RURAL TOWNS – nearest neighbour analysis

The surface of the survey area is quite level, and the communes may thus be expected roughly to be of equal size and their centers uniformly distributed – with regard to size of the agglomerations and kind of agricultural system. The distribution of agglomerations in the survey area appears from figure 3. A look gives the impression that the setttlements are not uniformly distributed. In a central zone settlements appear to be more spaced than in the two flanking zones (especially that to the east). – Circles representing the average area per center were set around each center. This procedure accentuates the central zone, which then was delimitated by use of communal borders as shown in figure 3. The mean area of the communes in the central zone was more than double that of the two other zones – 41,2 km² against 17,7.

Fig. 3. Nearest neighbours. The dots (●) are the administrative centers (centri) of the communes, the rings (o) are other rural towns comparable in size to that of the centers (i.e. with more than 1100 inhabitants). The two dashed lines delimit a central zone with less dense settlements.

Fig. 3. Landsbyer og rurale byer. Prikkerne (●) er kommunernes administrative centre og ringene (o) er andre rurale byer af tilsvarende størrelse – d.v.s med mindst 1100 indbyggere. De to stiplede linier afgrænser en central zone, hvor byerne ligger mindre tæt.



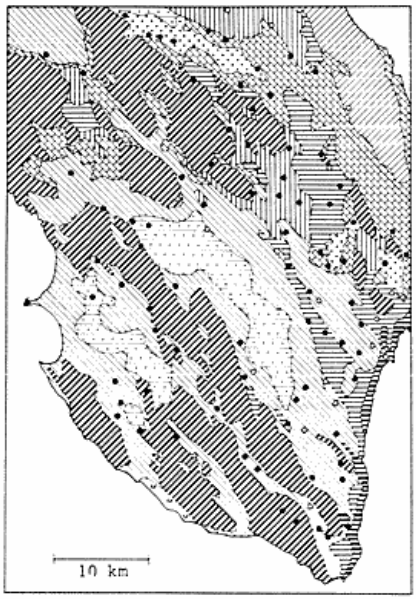


Fig. 4 and table 4. The geology. For the explanation of the signatures incl. the »M« zone at the SW coast – see table.

Fig. 4 og tabel 4. Geologi – signaturforklaring ses i tabellen.

No. ref. figure 4	Era	Description example	% of surface zone A/B
M	Holocene	recent beach sediments	0.4/ 0.3
1	Pleistocene	sand & conglomerates "Gallipoli Formation"	9.9/ 8.0
2		terrigenous, skeletal limestone "Salento Calcarenites"	- / 4.6
3	Pleistocene-Pliocene	terrigenous, skeleton limestone "Salento Calcarenites"	32.3/30.3
4	Pliocene	sands & conglomerates "Uggiano Sands"	1.6/ 2.6
5		terrigenous, skeletal limestone calcarenitic member of 4	7.1/11.4
6 a + b	Miocene (Mid & Low)	skeletal limestone & calcarenites	
		a) "Pietra Leccese"	4.9/ 6.8
		b) "Andrano Calcarenites"	8.2/ 7.7
7	Paleogene	limestone & calcarenites "Castro Limestone"	1.3/ 1.2
8	Cretaceous (upper)	skeletal limestone, locally dolomitic "Melissano Limestone", "Galatina Dolomites"	34.4/27.1

Notes: 2, 3, & 5 of "panchina" & "tufa" type.
A = survey area. B = total land surface of sheet 214 & 223.

The distribution of the agglomerations was examined by the nearest neighbour method – well-known and should not need to be reviewed in detail (a short, careful description e.g. in Hammond & McCullag 1974). The nearest neighbour index, R, ranges from 0 for a complete clustering to 2,15 for a uniform spacing, and the value of 1 indicates a random distribution. Calculations were made for the centers of the communes and for all agglomerations with more than 1100 inhabitants – for the survey area as well as for the toal land surface of the two sheets 214 & 223.

The null hypothesis should be: the agglomerations are uniformly distributed. The calculations appear from table 2. The values of R are all far from 2,15 and close to 1 – i.e. the distributions are close to be random and not uniform. The probability of the R-values were controlled through the z-scores (King 1969). In three cases the probability of R was found in the interval 0.016-0.0021, which is a reasonable level of significance for the rejection of the null hypothesis and for an acceptance of the opposite – that the distribution of the agglomerations is random. For the centers within the survey area the probability of the R-value is in the interval 0.16-0.19 and thus weak. And this might be an evidence of the suggested heterogeneity of the survey area – with the distribution more spaced in the central zone than in the two flanking ones. To elucidate this it was tested through the χ^2 (chi squared) method whether the centers were distributed equally by chance in the three zones (table 3). For the share of the centers in the three zones for having occurred by chance the probability was in the interval 0.02-0.05; and thus the distribution in the three zones appears to be significant – NOT to have occurred by chance.

Formation (ref. table 4)	Survey area no. of agglomerations Observed (O)	Expected (E)	$\frac{(O-E)^2}{E}$	Sheet 214 & 223 no. of agglomerations Observed (O)	Expected (E)	$\frac{(O-E)^2}{E}$
M, 1, 2, & 5	5	7.7	0.947	8	14.4	2.844
3 & 4	22	14.9	3.383	34	19.4	10.988
6 a & b	7	5.8	0.248	11	8.6	0.670
7 & 8	6	15.7	5.993	6	16.7	7.741
Total	44	44.1	$\chi^2 = 10.571$	59	59.1	$\chi^2 = 22.243$

Note: $p(\chi^2)$ the survey area 0.01-0.02, and sheet 214 & 223 below 0.001

Table 5. Centers and geological formations.

Summing up, the examination of the distribution of the agglomerations showed that the agglomerations are randomly – and not equally distributed. The randomness, however, needs not necessarily to be a result of a random process, the pattern might have been influenced by other factors; as the villages and rural towns are agricultural of origin, some of the governing factors could be environmental.

LOCATION OF RURAL TOWNS

Relation to geology

A basic environmental factor is the geology – being decisive for the hydrology and as parent material for the soils. Like the nieghbouring landscapes of the Murge, the Salento consists of different types of calcarenites and limestone. This appears in the complete lack of surface streams due to hyper-drainage and subterranean run-off caused by the karstification of the calcareous material. Figure 4 and table 4 show the distribution of the geological formations and give a very short description; it is not the objective here to give a geological discription as such. The base material was the two 1:100.000 sheets »214« & »223« of the Italian geological map.

A glance at the agglomerations in relation to the geological formations suggests two features:

A) The agglomerations seem to be more frequent on some of the formations than on others.
B) Most of the agglomerations appear to be close to the contact zone of two geological outcrops. These two features were examined through the χ^2 test.

A. Location and type of formation

Quite a lot of the agglomerations have a location, which makes it difficult objectively to determine whether location solely is on one geological outcrop. Therefore the test is only presented here for centers with an evident geological location. To get more than 5 observations in each group, as required by the χ^2 test, it has been necessary to unite some of the geological categories as shown in table 5. Objectively, it could be expected that the centers are distributed proportional to the share of areas with different geological formation, and in accordance with this the null hypothesis should be formulated.

The test shows that the distribution of the agglomerations are NOT proportional to those areas with different geological formations – at an acceptable level of significance (table 5). Thus the opposite assumption must be accepted: the unequal distribution has not occurred by chance and thus some formations have special attraction for the location of rural towns – espec. formation 3 (with 4) – and others repel settling – espec. formation 8 (with 7). The calculations for all agglomerations with an evident location gave similar results. Finally, the calculations were executed for all agglomerations including those having an »unclean« location; this gave similar results too, but the procedure is not »after the book«.

B. Distance from contact between two geological outcrops

The agglomerations appeared generally to be located close to the contact zone between geological outcrops or formations (figure 4). A zone was measured ½ km to each side of the limits on the geological maps – the distance was arbitrarily chosen. Figure 5 shows the situation of the agglomerations in relation to these distance zones. The null hypothesis should be: the number of agglomerations within a distance of ½ km from the contact between two geological outcrops is proportional to the area within the zone. Also this could be tested through the χ^2 method.

The test shows that the number of agglomerations along the contact lines at an acceptable level of significance was NOT proportional to the area within the zone – there are more rural towns than expected (table 6). Thus the opposite assumption must be accepted: that the contact lines evidence special attraction for the location of settlements.

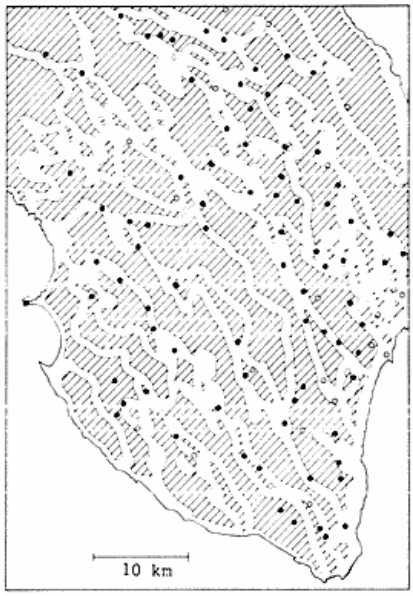


Fig. 5. Distance from the contact zone between geological outcrops. The hatched zones are more than 0,5 km from such limits.

Fig. 5. Afstand fra kontakt mellem de geologiske formationer. De skraverede zoner er mindst 0,5 km fra kontaktlinierne.

The test was also carried out for a zone with a range of 1 km to each side of the lines of contacts. Now the assumption that the number of agglomerations was proportional to the area along the lines could statistically not be rejected. This observation could be regarded as a further support to the above assumption: the contact zones have special attraction for the location of settlements – within a very narrow range.

DISCUSSION and CONCLUSION

The very level terrain of the southern part of the Salento peninsula might have created a uniform spacing of the agglomerations, as their territories should be expected to be equal-sized – with reservations as regards type of agricultural system and number of inhabitants. The nearest neighbour analysis showed that this was not the case, and thus a visual impression could be supported objectively. The distribution may not originate from a random process, but be a result of some governing factor. In a zone of the survey area the territories of the agglomerations – the communes, appeared to be larger than in other parts, and thus their centers more dispersed. Statistically this observation could be supported – and also that this inhomogeneity has not occurred by chance. As the agglomerations have a rural function or at least an agricultural origin, some of the factors which have governed the location might have been environmental.

The geology of a region is the base for a range of factors with relevance to agriculture and settlement locations. The statistical analysis of the location of the agglomerations in relation to the geological formations, in this case of Salento, supported two sets of relationship.

A – The agglomerations are not distributed proportional to each geological formation's specific area; certain formations show attraction and some repel settlement location. The statistical procedure, the χ^2 method, made it necessary to unite those formations constituting minor areas or include them in larger areas. Therefore the statistical analysis of the locational impact of the formations just supports two main observations. Aa – The formation »3« that shows attraction of settlement, is for a large part

	Survey area				Total of sheet 214 & 223			
		no. of agglomerations				no. of agglomerations		
Distance km	Area %	Observed (O)	Expected (E)	$\frac{(O-E)^2}{E}$	Area %	Observed (O)	Expected (E)	$\frac{(O-E)^2}{E}$
A - Centers								
0 - 0.5	47.7	41	32.9	1.756	45.8	49	37.1	3.503
> 0.5	52.3	28	36.1	1.600	54.2	32	43.9	2.960
Total	100	69	69	$\chi^2 = 3.356$*	100	81	81	$\chi^2 = 6.463$***
B - all agglomerations > 1100 inhabitants								
0 - 0.5	47.7	50	39.6	2.475	45.8	62	46.3	4.990
> 0.5	52.3	33	43.4	2.258	54.2	39	54.7	4.224
Total	100	83	83	$\chi^2 = 4.733$**	100	101	101	$\chi^2 = 9.214$****

Notes: The Yeats correction has been applied. The probability of the chi-squared $p(\chi^2)$: *) 0.1-0.05, **0.05-0.02, ***) 0.02-0.01, ****) 0.01-0.001.

Table 6. Agglomerations and distance from contact line between geological outcrops.

the Salento Calcarenites. It is a calcareous sandstone of the »tufa« type, fairly permeable and the aquafers are relatively easy to reach. The soils that have developed on this formation are relatively porous, deep, fertile, and easily workable. Ab – The formation »8« that repels settlementation consists of compact limestones. The groundwater conditions here are difficult – the soils more skeletal, shallow and troublesome to handle.

Thus the location appears to depend on the possibilities for agriculture and the supply with water.

B – The zones of contact between geological outcrops show a strong attraction for the location of agglomerations, which can be ascribed the good possibilities of getting groundwater – especially valuable in an area with these difficult hydrogeological conditions.

The findings are well in accordance with the thorough studies of all Puglia by Colamonico (1916). The opportunity is taken here to stress the value of much older geography. This should certainly not be neglected, often it serves as fine base to recent works – but quantitatively the »... relationships can be supported on two main grounds. First, it (the quantitative method) is more rigorous. Second, and more important, it is a considerable aid in the avoidance of self-deception (Burton 1963)«.

The locations should be studied more directly in relation to micro-topography, hydrology and soil conditions. As not only environmental factors shape an agricultural system with which the settlement system has arisen, other factors should be involved too. Many of the agglomerations in the Salento are old of origin, but others were founded quite recently in a feudal society, and a systematical study of historical sources might reveal locational factors.

In the past generation or so, the study of rural settlement in relation to environmental factors has been dismissed as being too deterministic and descriptive, and the attention has turned to more theoretical, economic models of settlement (i.e. Gilg 1985 p. 47). However, as a functional part of settlement theory, environmental factors should not be omitted. Settlement patterns reveal considerable inertia, and economic models might be incomplete when they disregard preceding settlement patterns as a part of the precondition when a settlement pattern changes and a new one arises – even if the older pattern might be governed by environmental factors. It might be interesting – also in the Salento – to see how the system of central places arising within the existing system of rural settlements will adapt itself and change the preceding pattern.

Resume

Lokaliseringen af rurale byer og geologi – en undersøgelse af Salento halvøen i S. Italia.

Undersøgelsesområdet er karakteristisk ved at have en meget jævn topografi og ved, at befolkningen næsten udelukkende bor i landsbyer eller rurale byer med 1100-22.000 indbyggere. Byernes territorier, kommuner, kunne forventes – under hensyntagen til indbyggertal og landbrugssystem – at være af ensartet størrelse og derfor kunne byerne forventes at ligge nogenlunde jævnt fordelt. Fordelingen er undersøgt ved »nærmeste nabo metoden« og er bestemt til at være tilfældig – ikke jævn. En tilfældig fordeling er ikke nødvendigvis et resultat af en »tilfældig proces«, men kan være et resultat af fordelingen af de faktorer, der har indflydelse på lokaliseringen. Da der er tale om bebyggelser med oprindelse i landbrug, kan sådanne faktorer bl.a. være ressourcemæssige som f.x. geologiske forhold. Geologien er afgørende for hydrologiske forhold og for jordbundsudviklingen. Undersøgelsesområdet består overvejende af forskellige kalksten, hvilket bl.a. viser sig ved, at der ingen vandløb er, da forkarstningen af områdets bjergarter har skabt en hyper-dræning; de hydrologiske forhold er altså særdeles vanskelige. Bebyggelsernes lokalisering blev undersøgt for relationer til de geologiske forhold ved X^2 metoden. Visse geologiske formationer viser særlig tiltrækning på lokaliseringen, andre afviser. En sandet kalkstensformation, der er relativ permeabel, og hvor jordbunden er relativt frugtbar og håndterlig, viser sig at være en sådan faktor, der tiltrækker landsbyer. En hård, kompakt kalksten, hvor jordbunden er stenet og vanskelig håndterlig, afviser lokalisering. Desuden var landsbyerne i særlig grad koncentreret i smalle zoner langs kontaktlinierne mellem de geologiske formationer. Det kan således statistisk bekræftes, at lokaliseringen i betydeligt omfang er styret af muligheder for dyrkning og for at finde vand. Andre faktorer må dog også have haft indflydelse på lokaliseringen, der burde undersøges mere direkte i relation til hydrologi, mikrotopografi, landbrugssystemer etc. Mange af bebyggelserne er af gammel oprindelse, men adskillige er grundlagt i forholdsvis recent tid under et feudalt samfundssystem; en undersøgelse af historiske kilder kunne muligvis afsløre lokaliseringsfaktorer. Det foreslås undersøgt, hvordan et ældre system af landsbyer med sine lokaliseringsfaktorer indvirker på centerstrukturen, når et nyt system af servicebyer opstår. Et system af servicecentre opstår ikke blot som styret af økonomiske modeller. Der er betydelig inerti i bebyggelsesmønstre, og de ny bysystemer må bl.a. tilpasse sig og ændre gamle systemer.

Literature and sources:

Baldacci, O. (1972): Puglia. Unione Tipografico Editrice Torinese, 2. ed., Torino.

Burton, I. (1963): The quantitative revolution and theoretical geography. The Canadian Geographer VII, 4: 151-162.

Cautadella, M. et al. (1976): Some factors used in a definition of the urban system in southern Italy. – p. 125-131 in Pecora, A. & Pracchi, R. eds.: Italian Contributions to the 23rd International Geographical Congress. Consiglio Nazionale delle Ricerche, Roma.

Colamonico, C. (1916): La distribuzione della popolazione nella Puglia centrale e meridionale secondo la natura geologica. Bollettino della Reale Societa Geografica V: 201-234, 274-305, 403-429.

Corsi, G. (1983): La struttura funzionale delle citta Italiane. L'Universo 63, 2: 225-270.

Dianelli, G. ed. (1939): Atlante fisico-economico d'Italia. Consociazione Turistica Italiana, Milano.

the Salento Calcarenites. It is a calcareous sandstone of the »tufa« type, fairly permeable and the aquafers are relatively easy to reach. The soils that have developed on this formation are relatively porous, deep, fertile, and easily workable. Ab – The formation »8« that repels settlementation consists of compact limestones. The groundwater conditions here are difficult – the soils more skeletal, shallow and troublesome to handle.

Thus the location appears to depend on the possibilities for agriculture and the supply with water.

B – The zones of contact between geological outcrops show a strong attraction for the location of agglomerations, which can be ascribed the good possibilities of getting groundwater – especially valuable in an area with these difficult hydrogeological conditions.

The findings are well in accordance with the thorough studies of all Puglia by Colamonico (1916). The opportunity is taken here to stress the value of much older geography. This should certainly not be neglected, often it serves as fine base to recent works – but quantitatively the »... relationships can be supported on two main grounds. First, it (the quantitative method) is more rigorous. Second, and more important, it is a considerable aid in the avoidance of self-deception (Burton 1963)«.

The locations should be studied more directly in relation to micro-topography, hydrology and soil conditions. As not only environmental factors shape an agricultural system with which the settlement system has arisen, other factors should be involved too. Many of the agglomerations in the Salento are old of origin, but others were founded quite recently in a feudal society, and a systematical study of historical sources might reveal locational factors.

In the past generation or so, the study of rural settlement in relation to environmental factors has been dismissed as being too deterministic and descriptive, and the attention has turned to more theoretical, economic models of settlement (i.e. Gilg 1985 p. 47). However, as a functional part of settlement theory, environmental factors should not be omitted. Settlement patterns reveal considerable inertia, and economic models might be incomplete when they disregard preceding settlement patterns as a part of the precondition when a settlement pattern changes and a new one arises – even if the older pattern might be governed by environmental factors. It might be interesting – also in the Salento – to see how the system of central places arising within the existing system of rural settlements will adapt itself and change the preceding pattern.

Resume

Lokaliseringen af rurale byer og geologi – en undersøgelse af Salento halvøen i S. Italia.

Undersøgelsesområdet er karakteristisk ved at have en meget jævn topografi og ved, at befolkningen næsten udelukkende bor i landsbyer eller rurale byer med 1100-22.000 indbyggere. Byernes territorier, kommuner, kunne forventes – under hensyntagen til indbyggertal og landbrugssystem – at være af ensartet størrelse og derfor kunne byerne forventes at ligge nogenlunde jævnt fordelt. Fordelingen er undersøgt ved »nærmeste nabo metoden« og er bestemt til at være tilfældig – ikke jævn. En tilfældig fordeling er ikke nødvendigvis et resultat af en »tilfældig proces«, men kan være et resultat af fordelingen af de faktorer, der har indflydelse på lokaliseringen. Da der er tale om bebyggelser med oprindelse i landbrug, kan sådanne faktorer bl.a. være ressourcemæssige som f.x. geologiske forhold. Geologien er afgørende for hydrologiske forhold og for jordbundsudviklingen. Undersøgelsesområdet består overvejende af forskellige kalksten, hvilket bl.a. viser sig ved, at der ingen vandløb er, da forkarstningen af områdets bjergarter har skabt en hyper-dræning; de hydrologiske forhold er altså særdeles vanskelige. Bebyggelsernes lokalisering blev undersøgt for relationer til de geologiske forhold ved X^2 metoden. Visse geologiske formationer viser særlig tiltrækning på lokaliseringen, andre afviser. En sandet kalkstensformation, der er relativ permeabel, og hvor jordbunden er relativt frugtbar og håndterlig, viser sig at være en sådan faktor, der tiltrækker landsbyer. En hård, kompakt kalksten, hvor jordbunden er stenet og vanskelig håndterlig, afviser lokalisering. Desuden var landsbyerne i særlig grad koncentreret i smalle zoner langs kontaktlinierne mellem de geologiske formationer. Det kan således statistisk bekræftes, at lokaliseringen i betydeligt omfang er styret af muligheder for dyrkning og for at finde vand. Andre faktorer må dog også have haft indflydelse på lokaliseringen, der burde undersøges mere direkte i relation til hydrologi, mikrotopografi, landbrugssystemer etc. Mange af bebyggelserne er af gammel oprindelse, men adskillige er grundlagt i forholdsvis recent tid under et feudalt samfundssystem; en undersøgelse af historiske kilder kunne muligvis afsløre lokaliseringsfaktorer. Det foreslås undersøgt, hvordan et ældre system af landsbyer med sine lokaliseringsfaktorer indvirker på centerstrukturen, når et nyt system af servicebyer opstår. Et system af servicecentre opstår ikke blot som styret af økonomiske modeller. Der er betydelig inerti i bebyggelsesmønstre, og de ny bysystemer må bl.a. tilpasse sig og ændre gamle systemer.

Literature and sources:

Baldacci, O. (1972): Puglia. Unione Tipografico Editrice Torinese, 2. ed., Torino.

Burton, I. (1963): The quantitative revolution and theoretical geography. The Canadian Geographer VII, 4: 151-162.

Cautadella, M. et al. (1976): Some factors used in a definition of the urban system in southern Italy. – p. 125-131 in Pecora, A. & Pracchi, R. eds.: Italian Contributions to the 23rd International Geographical Congress. Consiglio Nazionale delle Ricerche, Roma.

Colamonico, C. (1916): La distribuzione della popolazione nella Puglia centrale e meridionale secondo la natura geologica. Bollettino della Reale Societa Geografica V: 201-234, 274-305, 403-429.

Corsi, G. (1983): La struttura funzionale delle citta Italiane. L'Universo 63, 2: 225-270.

Dianelli, G. ed. (1939): Atlante fisico-economico d'Italia. Consociazione Turistica Italiana, Milano.

Dickinson, R.E. (1955): The Population Problem of Southern Italy. Syracuse Univesity Press; Syracuse.
Gilg, A. (1985): An Introduction to Rural Geography. Arnold, London.
Hammond, R. & McCullagh, P.S. (1974): Quantitative Techniques in Geography. Clarendon, Oxford.
Istituto Centrale di Statistica (1955): IX Censimento generale della popolazione 1951. Dati sommari per commune. Fascicolo 74 – provincia di Lecce. Roma.
Istituto Centrale di Statistica (1974): 11 Censimento generale della popolazione 1971. Volume III, 16 – Popolazione della frazione geografische e delle localita abitate dei commune. Roma.
King, L.J. (1969): Statistical Analysis in Geography. Prentice-Hall, Englewood Cliffs.
Largaiolli, T. et al. (1969): Note illustrative della Carta Geologica d'Italia 1:100.000 – foglio 214 Gallipoli. Servizio Geologico.
Mancini, F. ed. (1966): Carta dei suoli d'Italia. Comitato per la Carta dei Suoli, Firenze.
Martinis, B. (1970): Note illustrative della Carta Geologica d'Italia 1:100.000 – foglio S. Maria di Leuca. Servizio Geologico.
Mørch, H. (1981): Apulien – ressourcer og kulturlandskab i en syditaliensk egn. Kulturgeografiske Skrifter 11, København.
Novembre, D. (1976-79): Puglia – popolazione e territorio. 1st & 2nd ed., Minella, Lecce.
Principi, P. (1961): I terreni Italiani – caratteristische geopedologiche delle regioni. Ramo Editoriale degli Agricoltori, Roma.
Servizio Geologico (1968a): Carta geologica d'Italia 1:100.000, foglio 214 Gallipoli.
Servizio Geologico (1968b): foglio 223 Capo S. Maria di Lauca.
Servizio Geologico (1978): Carta geologica d'Italia 1:500.000 – foglio 3.

Conditions for agricultural development in Central Kalimantan, Indonesia

Leif Petersen

Fig. 1. Map of Indonesia. *Fig. 1. Kort over Indonesien.*

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The Indonesian province of Central Kalimantan is planned to receive a substantial number of settlers from Java. The settlers will be occupied in agriculture. In some areas the suitability of the land for agriculture is limited due to steep slopes, shallow soils, sandy soil texture or poor soil drainage. In the central parts of the province these limitations are less serious, but the soils are acid and low in most plant nutrients.

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The population of Indonesia is extremely unevenly distributed among different regions (Table 1). In the heavily populated regions, i.e. Java and the islands nearby, there is a serious overpopulation. This leads to a number of problems such a high rate of unemployment and pressure on agricultural land. The high demand for agricultural land has forced people to cultivate land which is marginally suitable for agriculture, e.g. steep upland areas. Cultivation of such areas usually results in poor yields and often causes severe soil erosion. This is described f.ex. by Repetto (1986) for regions in West Java.

On the other hand, the thinly populated regions, in particular Irian Jaya (the Western part of New Guinea) and Kalimantan (Borneo), are characterized by a low stage of development with a weak infrastructure and few service facilities.

In ordrer to relieve the problems due to population pressure in the central region around Java and to promote development in the thinly populated islands and provinces, the Indonesian Government encourages and sponsors the moving of people from densely to thinly populated regions through the so-called transmigration program. From 1969 through 1983 a total of about 2.3 million people have moved from Java and nearby islands to Su-