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MAPS OF THE CHANGES IN THE WEEDS OF BODDINGTON BARN FIELD OVER TWENTY YEARS
(1961-1981)

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CONTENTS

INTRODUCTION	1
FIGURES 1 and 2	3
MAPS	4 - 37
ACKNOWLEDGEMENTS	38
REFERENCES	38

NOTE

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MAPS OF THE CHANGES IN THE WEEDS OF BODDINGTON BARN FIELD OVER TWENTY YEARS

(1961-1981)

R.J. Chancellor

Agricultural and Food Research Council Weed Research Organization, Begbroke
Hill, Yarnton, Oxford OX5 1PF

INTRODUCTION

This report consists of density and distribution maps of the most frequent of the 72 weed species recorded in Boddington Barn field in fourteen assessments between 1961 and 1981.

The field had been in permanent grass for an unknown number of years when the farm was purchased in 1960. The field was ploughed in that year and remained in an arable rotation of cereals and potatoes throughout the twenty year period of these assessments. Interspersed in this rotation at six year intervals were two year periods in which experiments concerned with weed control were positioned in the field. Areas surrounding these experiments were drilled with spring barley and treated as a farm crop.

Weed assessments were made in spring in a regular grid of 151 quadrat positions covering the whole field of 5.62 ha (Figs. 1 & 2). Using the straight western edge of the field as a base line, a series of transects 18.3 m apart were established at right angles to it with quadrat positions at 18.3 m intervals along each. Apart from 1961 when 0.37 m² quadrats were used, 0.09 m² quadrats were used in all assessments. Weed counts from the 1961 assessment have been divided by four and rounded up or down to the nearest whole number to make them comparable with the counts in other years. As many of the records were of single seedlings in the large sized

quadrats of 1961, which would have meant they were not included on the maps, half of the single seedling records of each species have been included on the distribution maps in order to show their area of distribution more fully. The totals do not then accord exactly with the totals published elsewhere (Chancellor, 1985).

The size of the dots on the maps indicates the density of seedlings at each quadrat position as follows:-

•	1-2	seedlings 30 cm ⁻²
•	3-6	" "
●	7-14	" "

The distribution maps include Poa annua, the only frequent grass in the field. It was not recorded in the first assessments (1961-5) because of uncertainty over identification.

The time of planting the crop proved to be influential in determining the occurrence of some species. In assessment years, crops were sown in spring in 1964, 1965, 1968, 1971, 1972 and 1981, the rest were sown in autumn. The season of planting is marked beside the maps as A = autumn sown and S = spring sown.

Further details of the field, its management and the weed assessments have been published elsewhere (Chancellor, 1985).

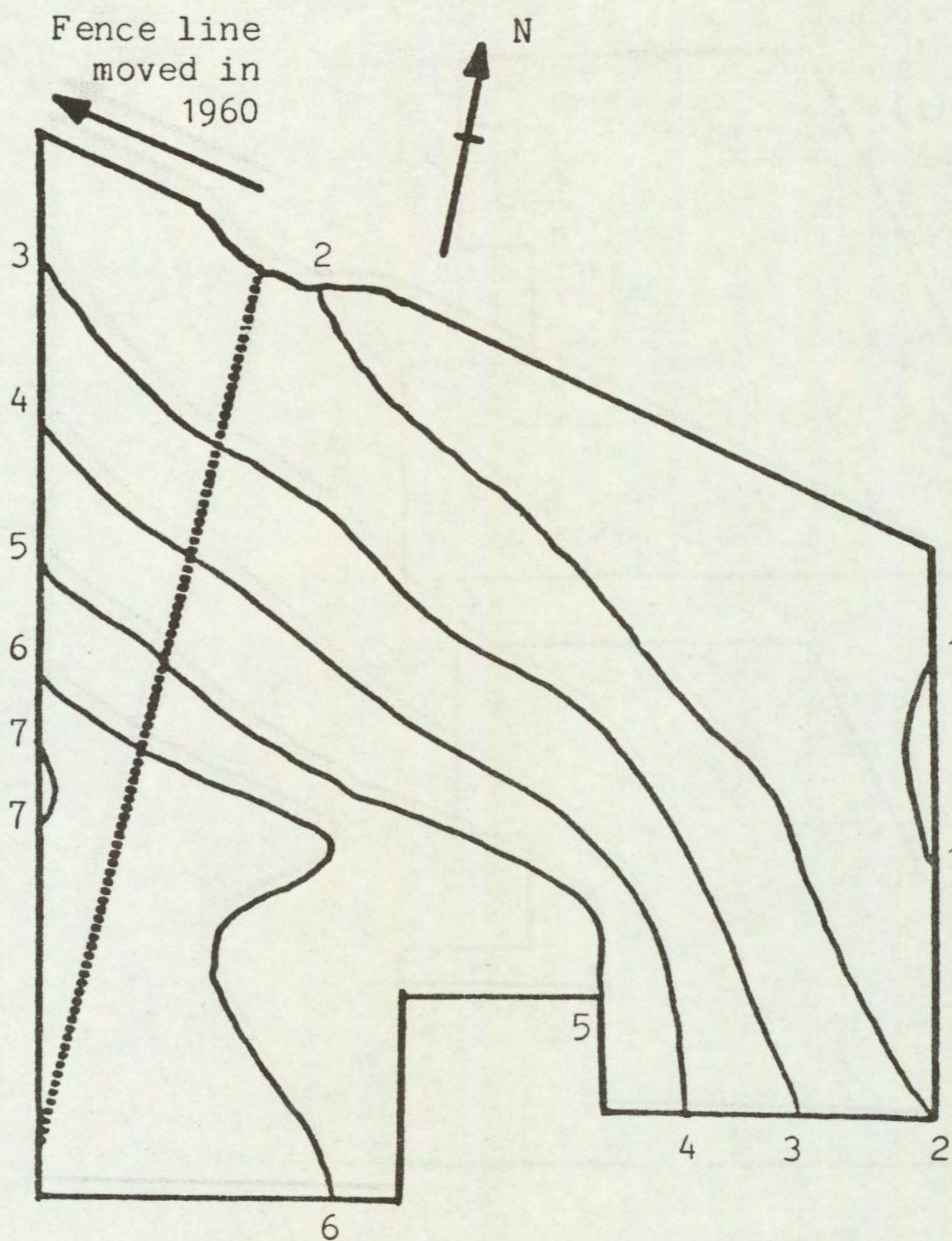


Fig. 1. Topography of the field. Contours in metres, 1 is the lowest.

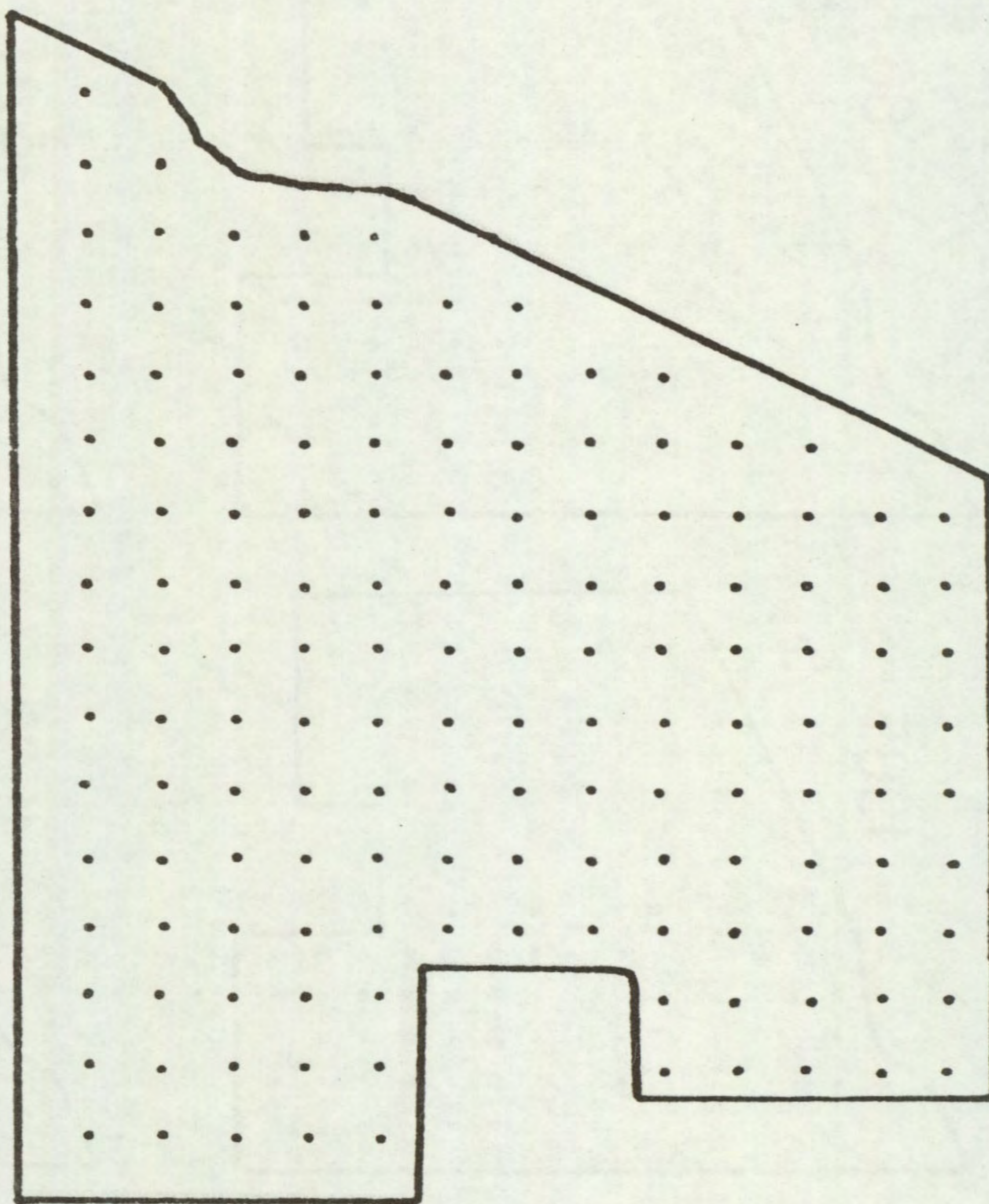
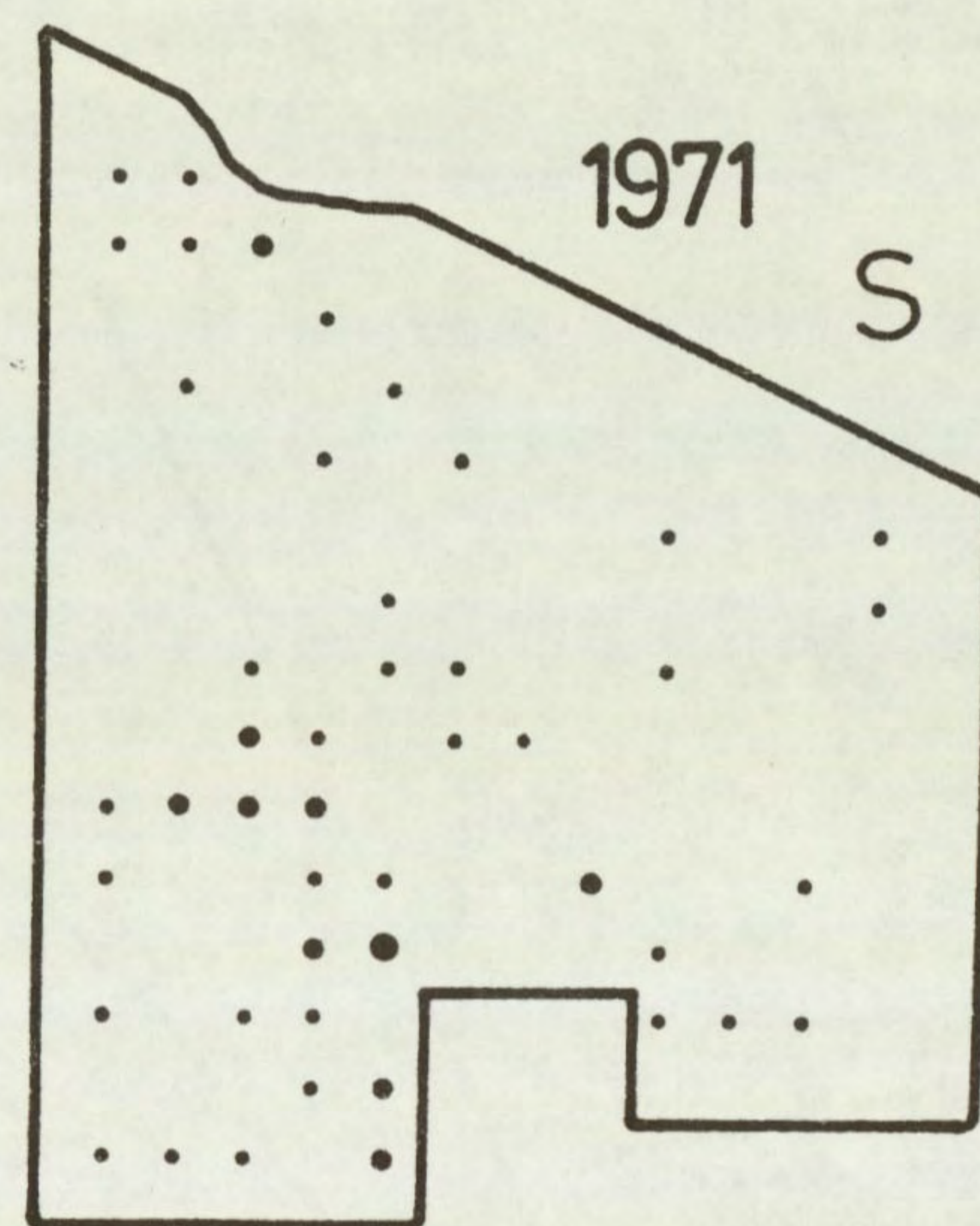
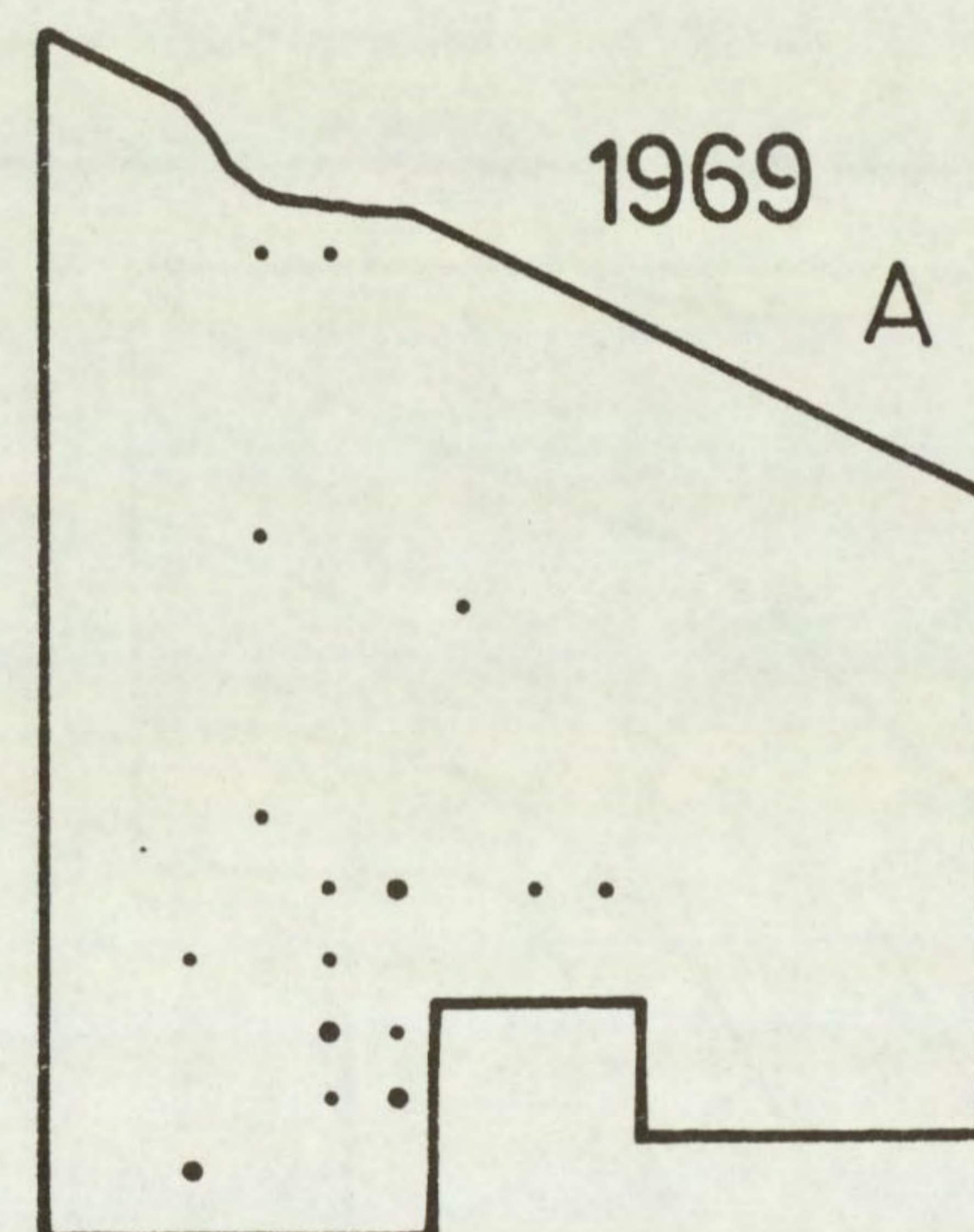
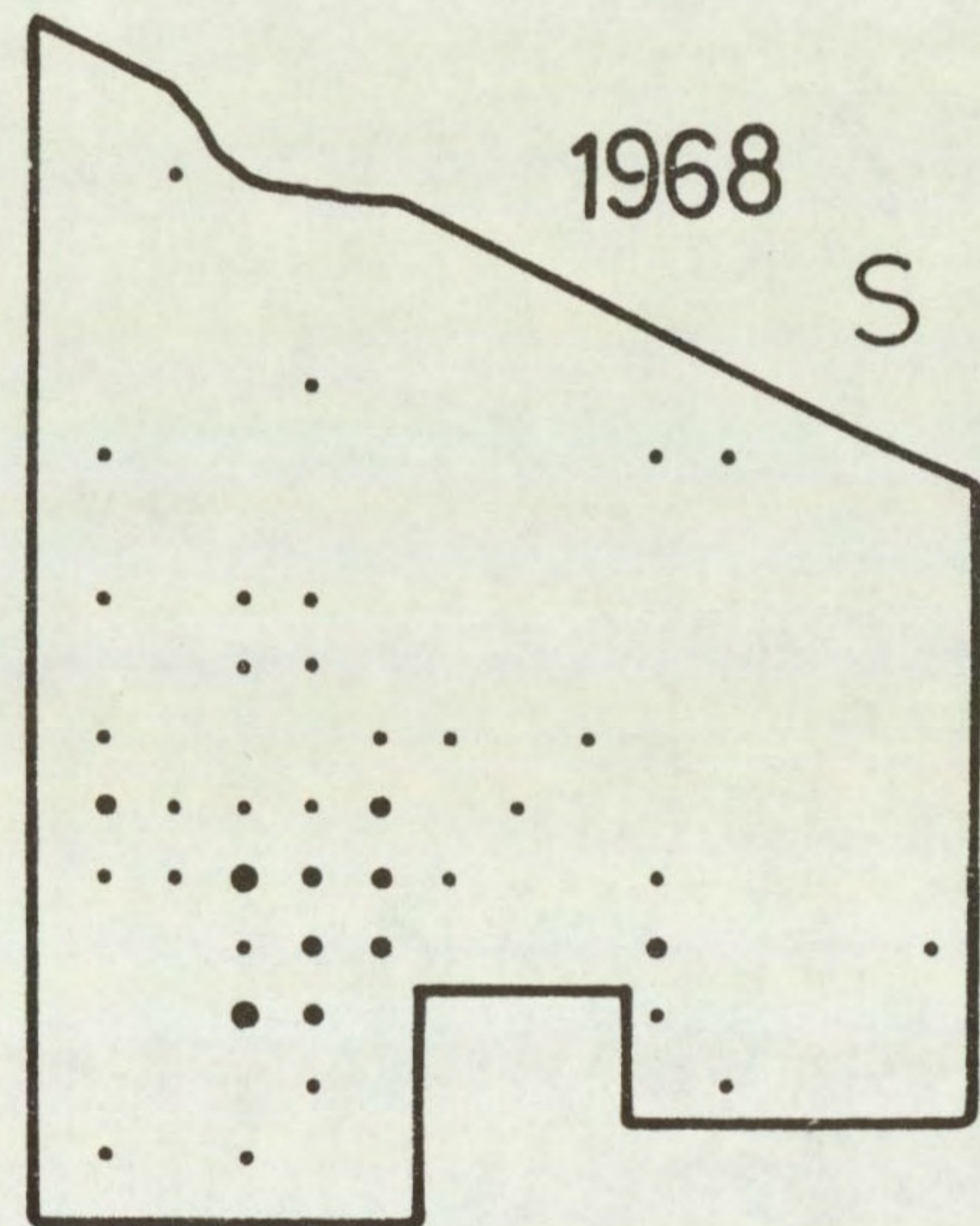
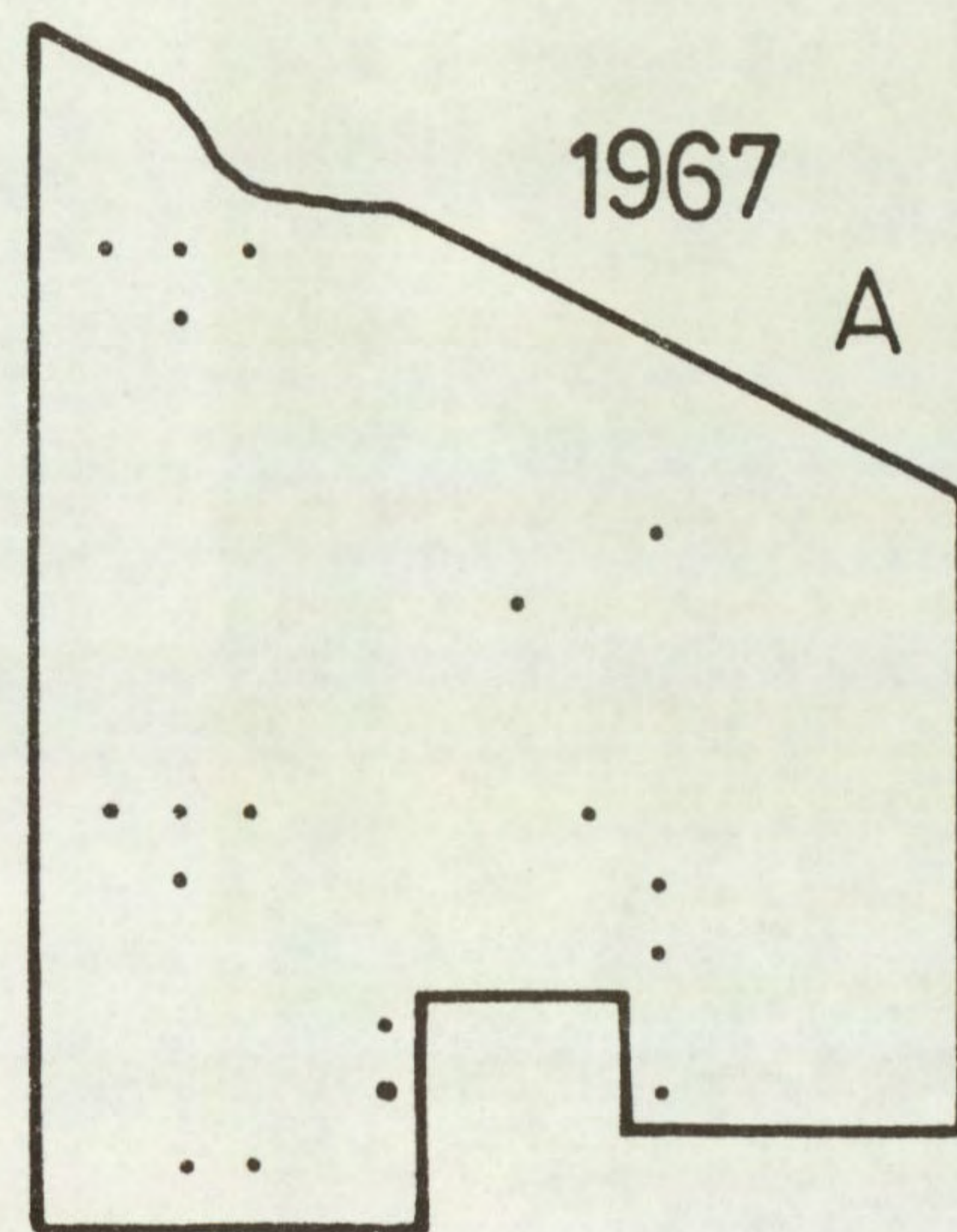
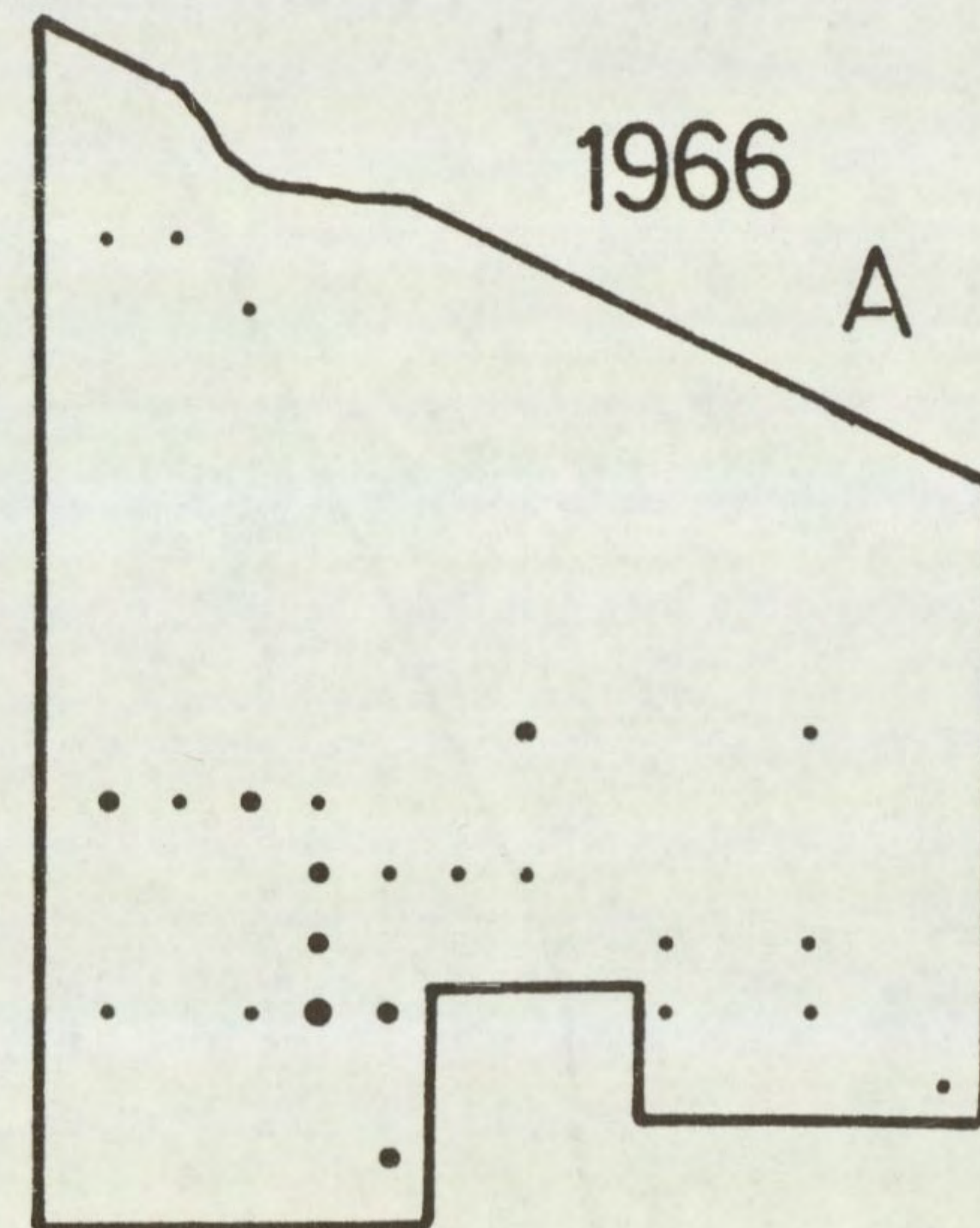
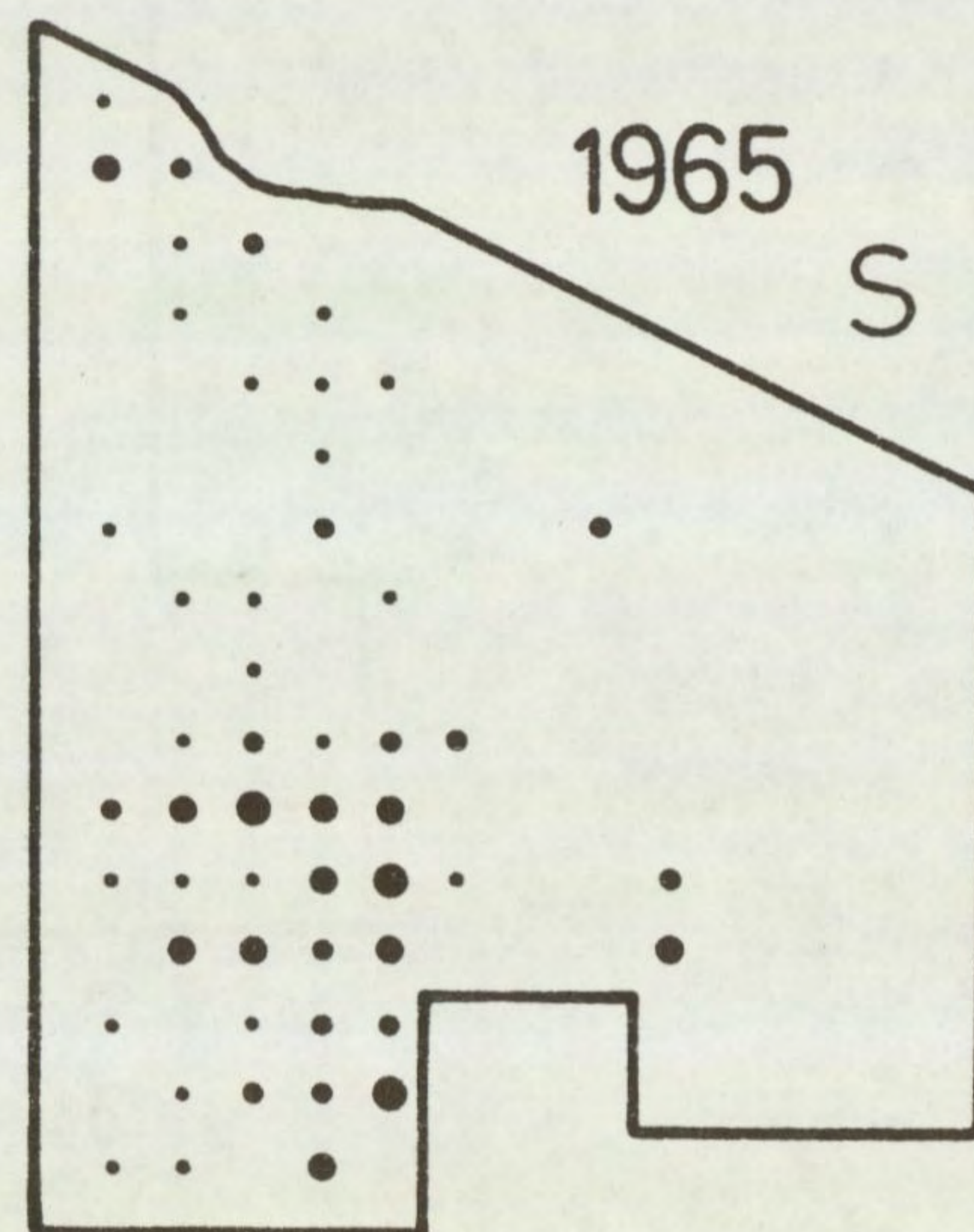
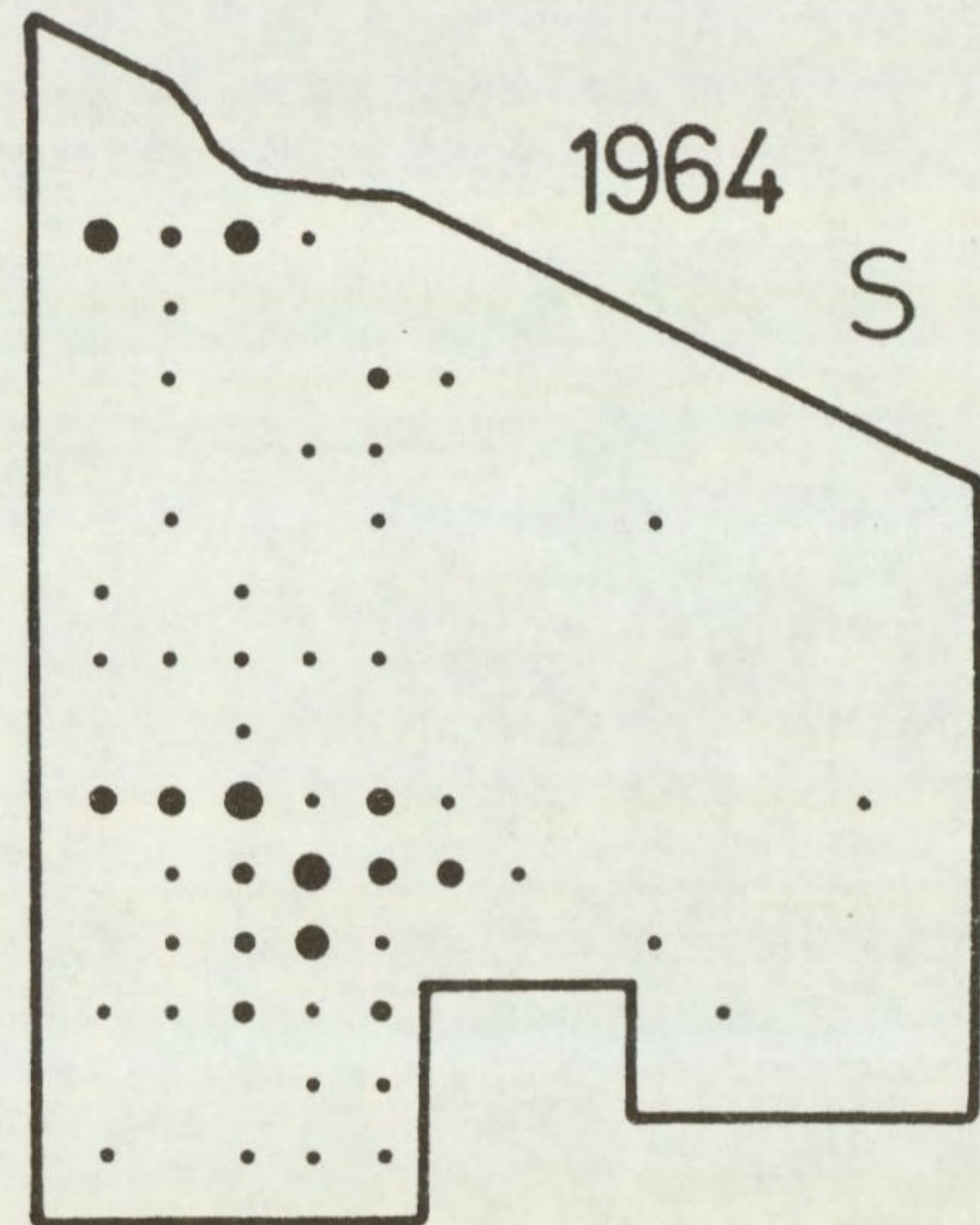
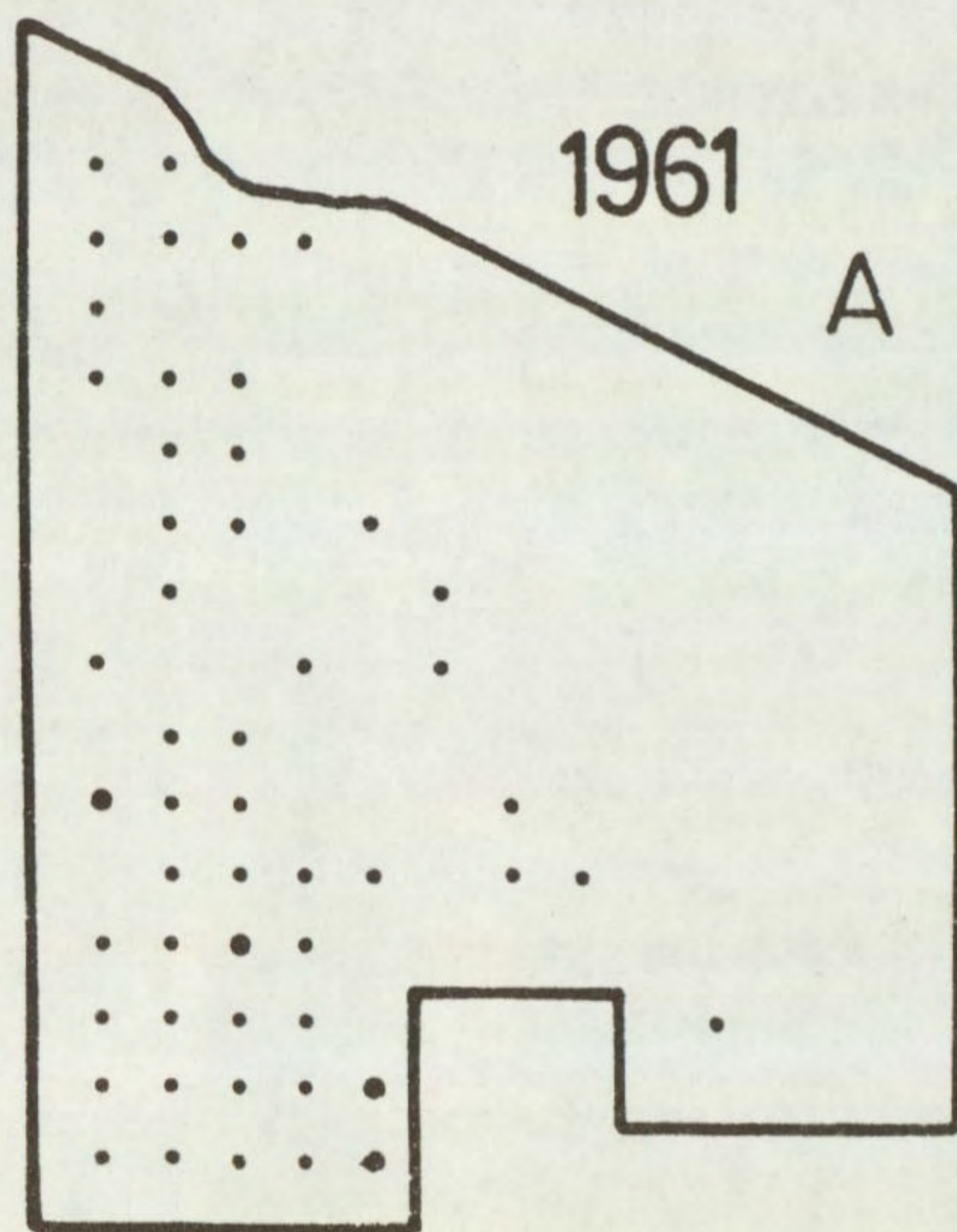
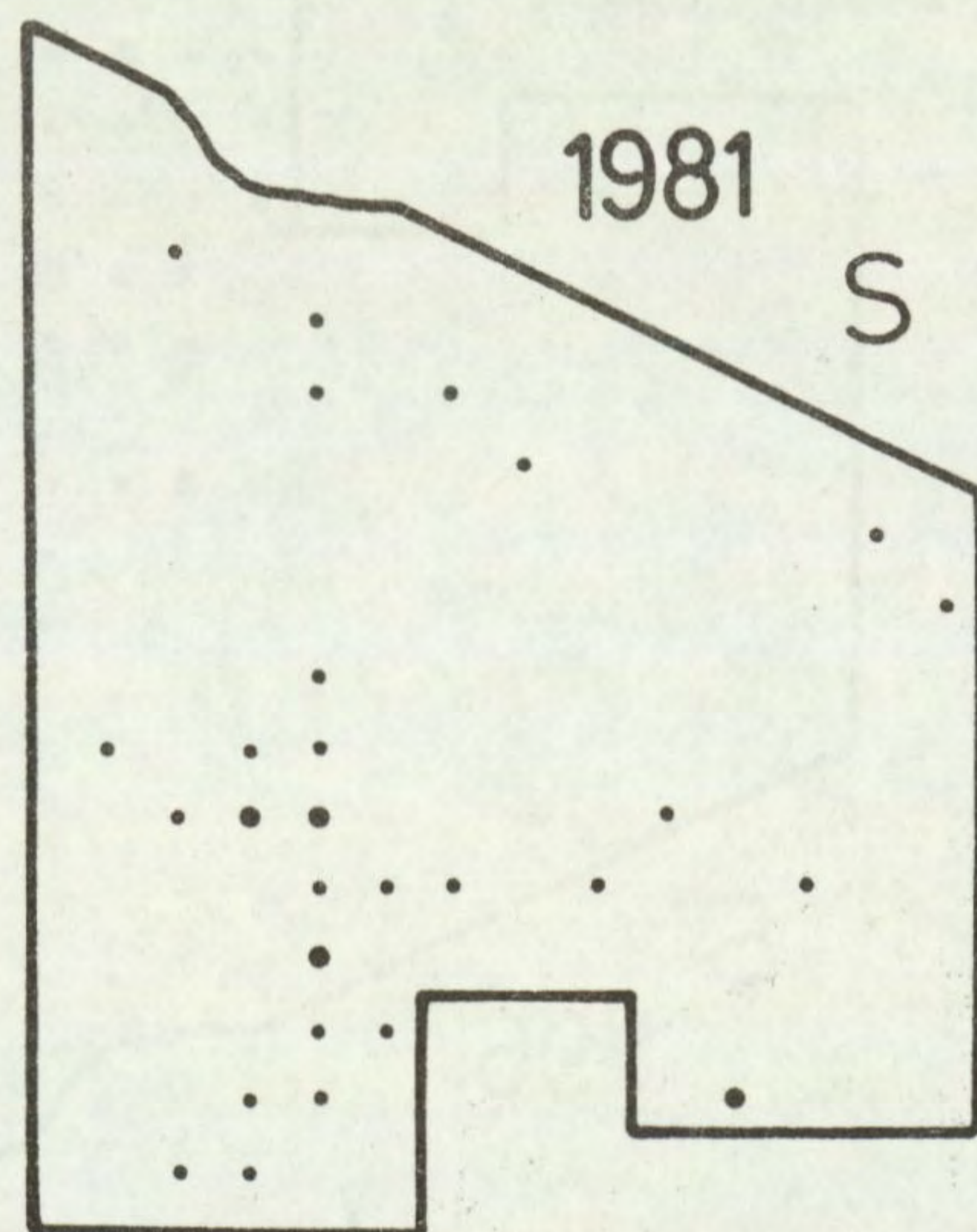
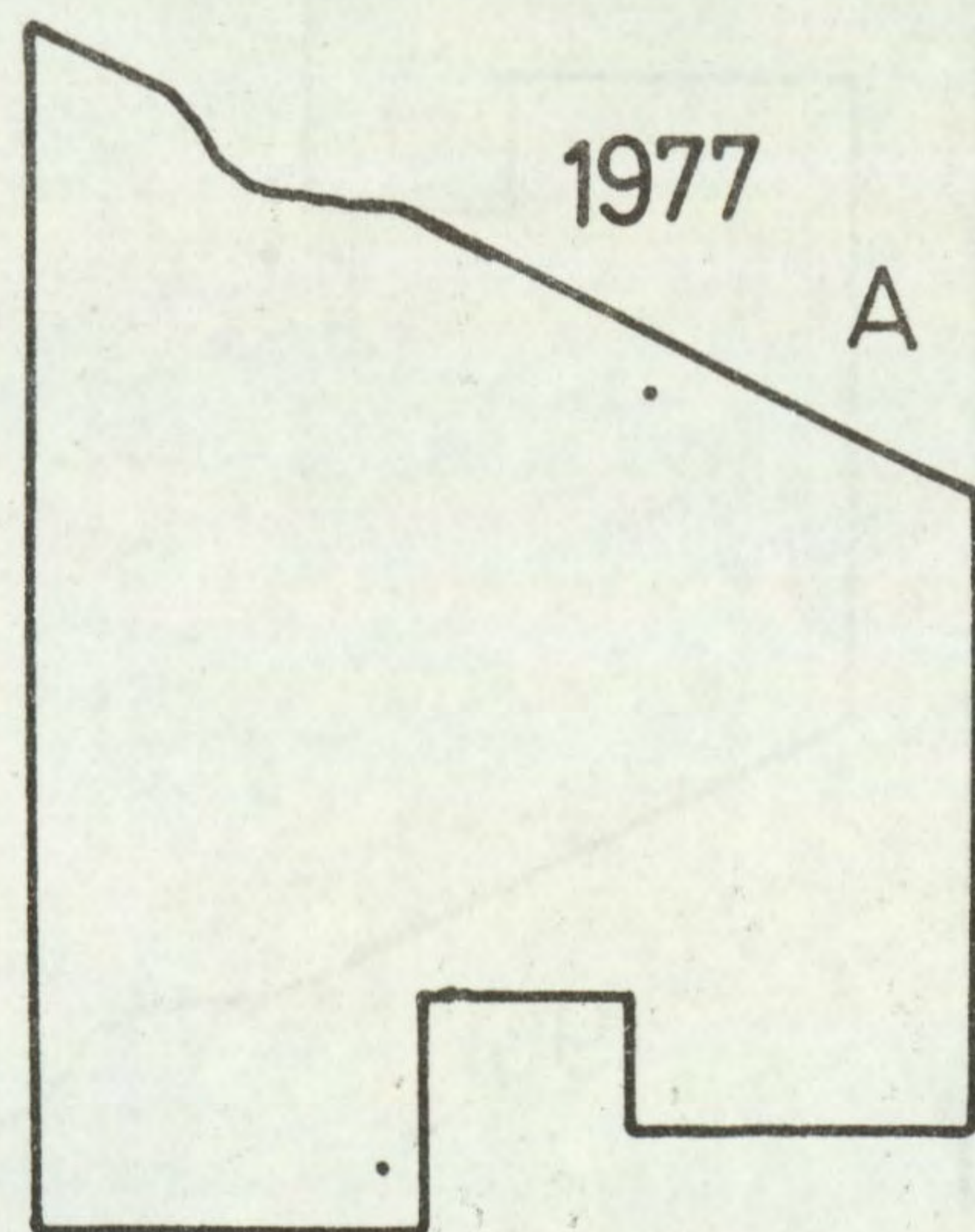
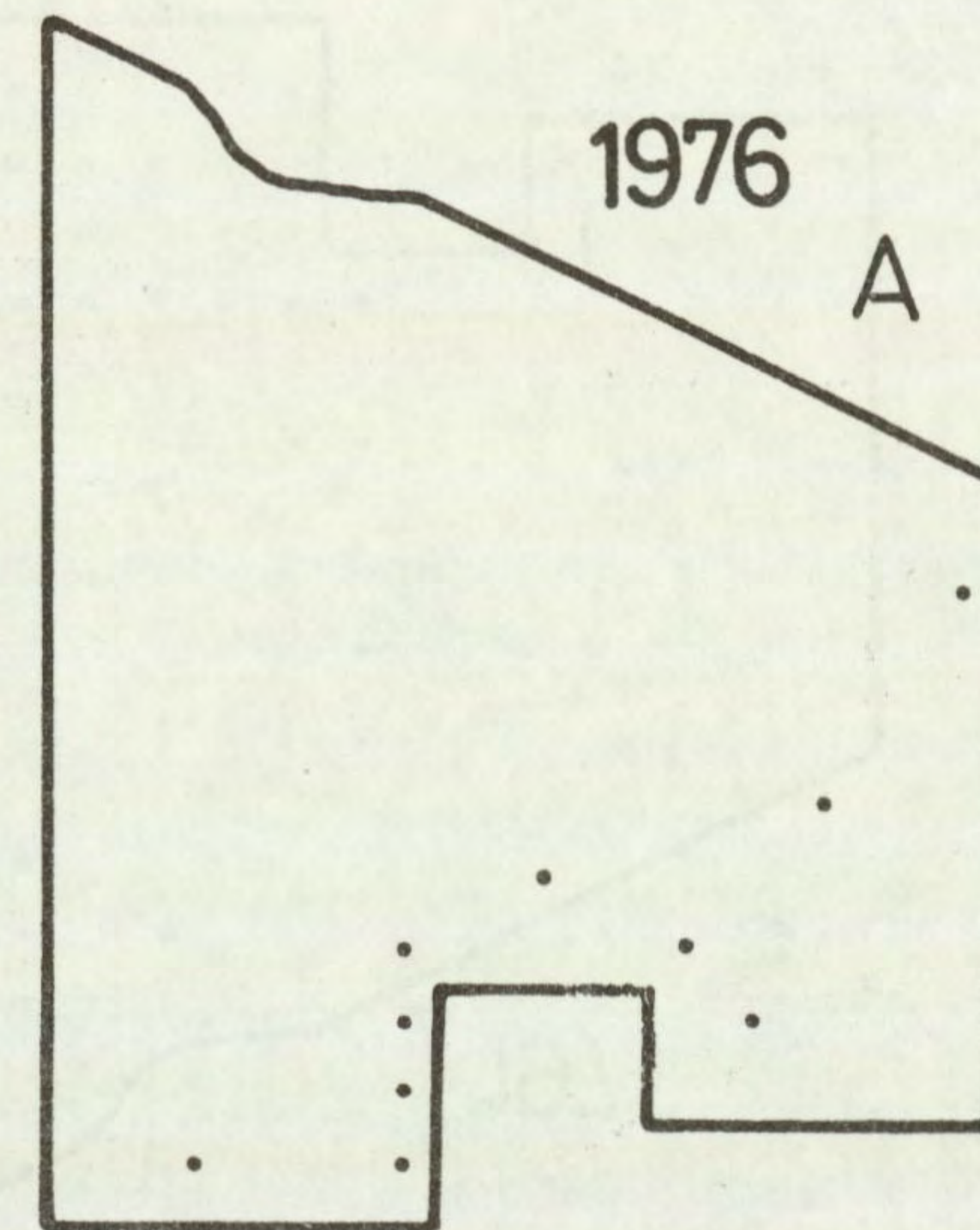
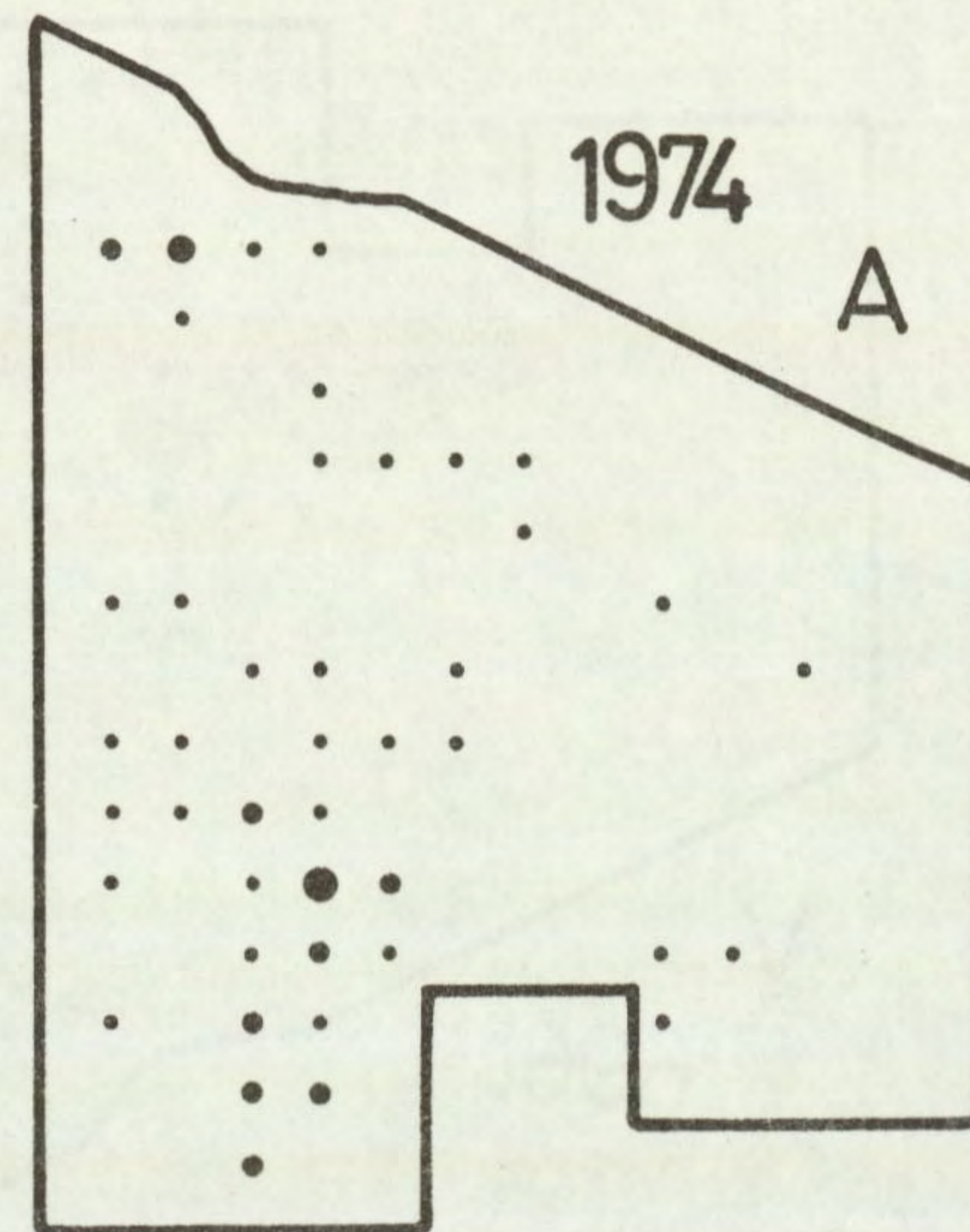
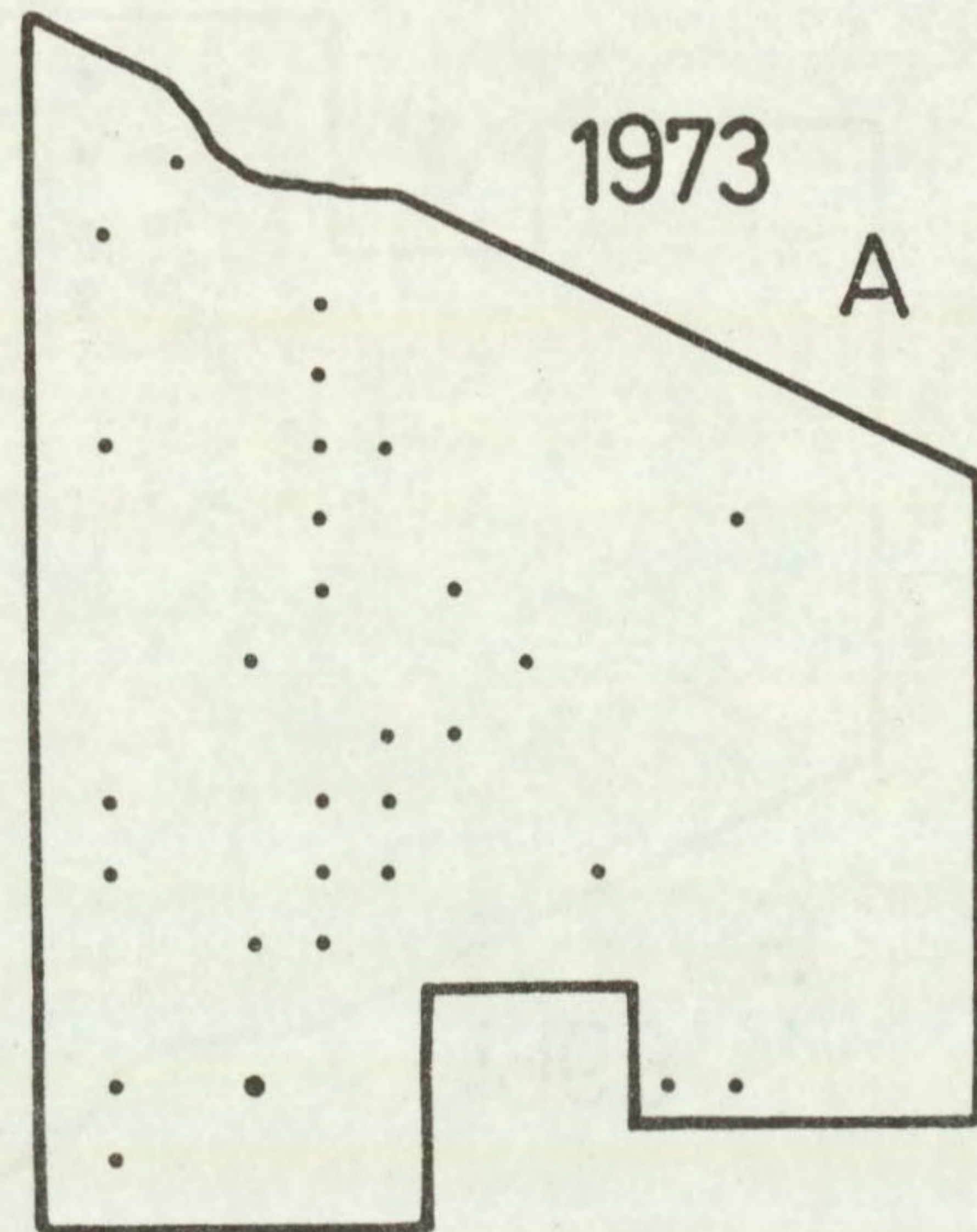
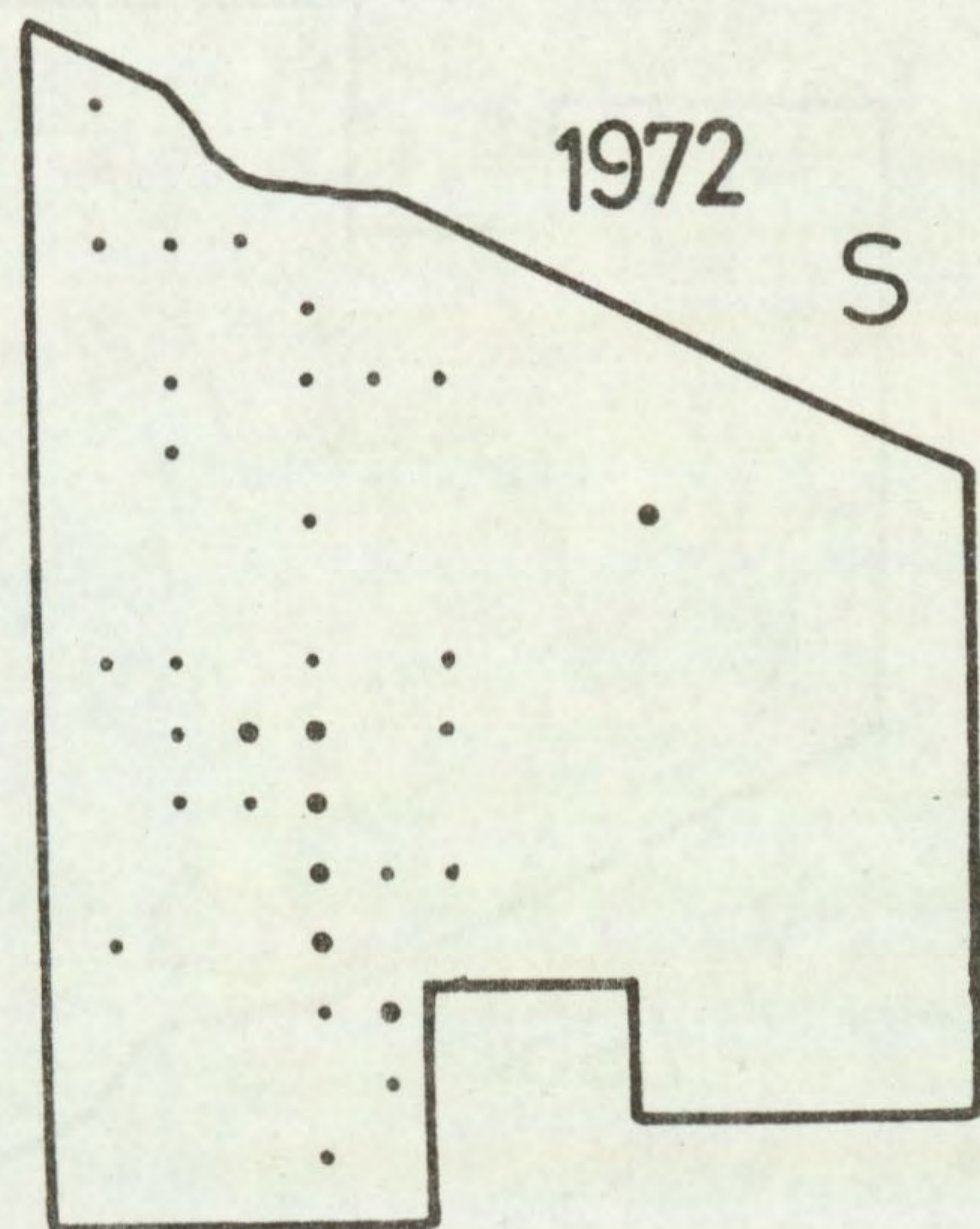


Fig. 2. The 151 quadrat positions at 18.3 m spacings.

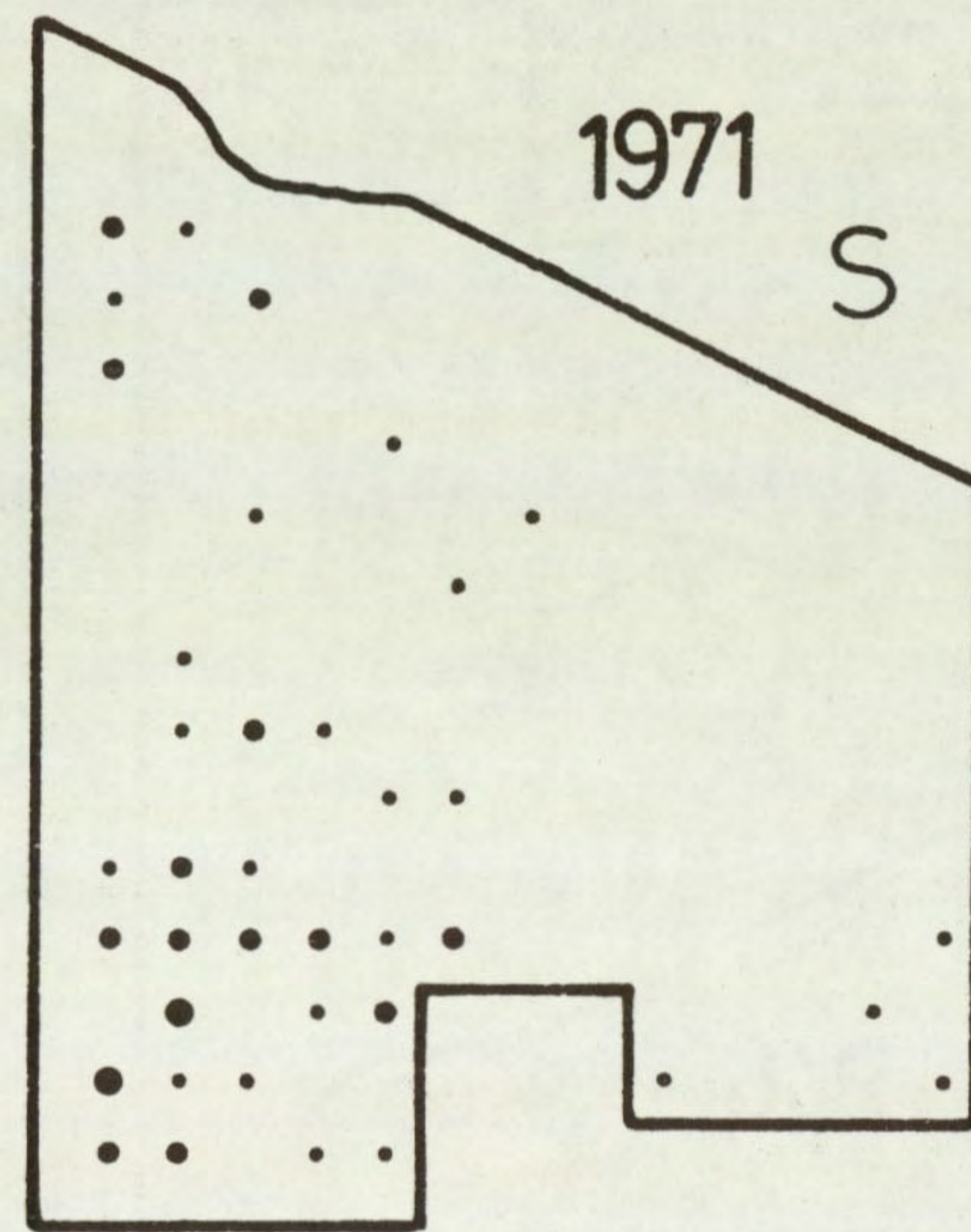
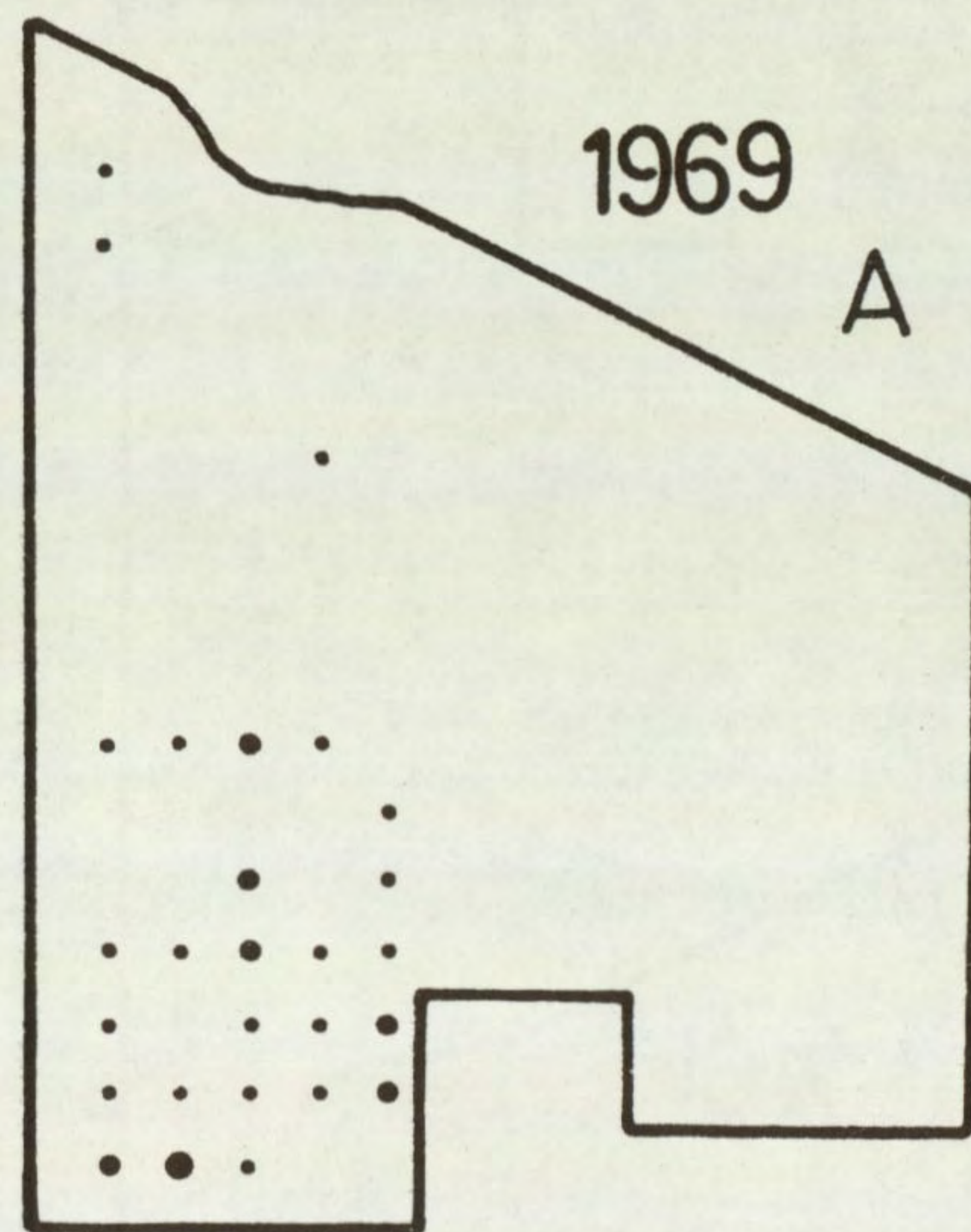
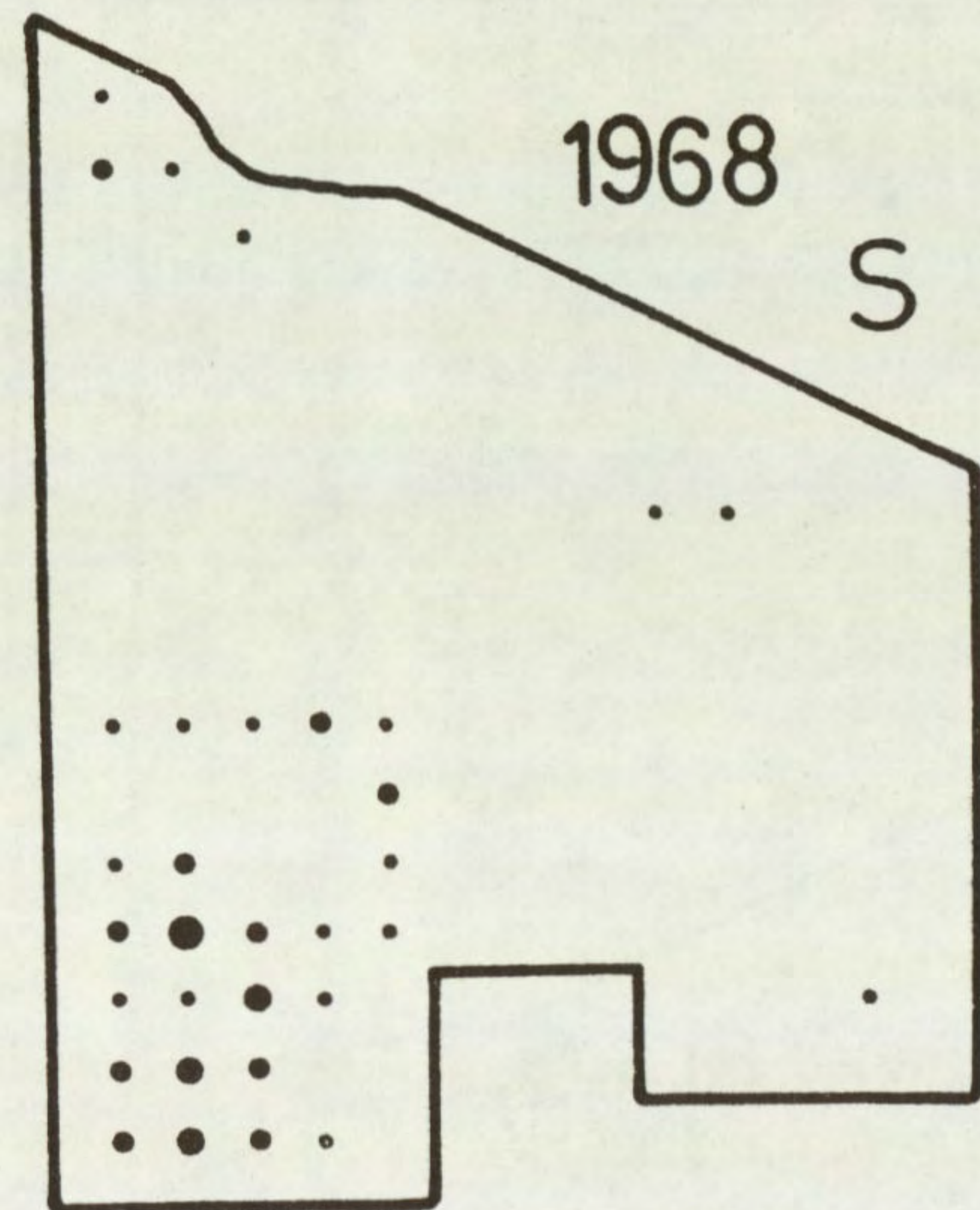
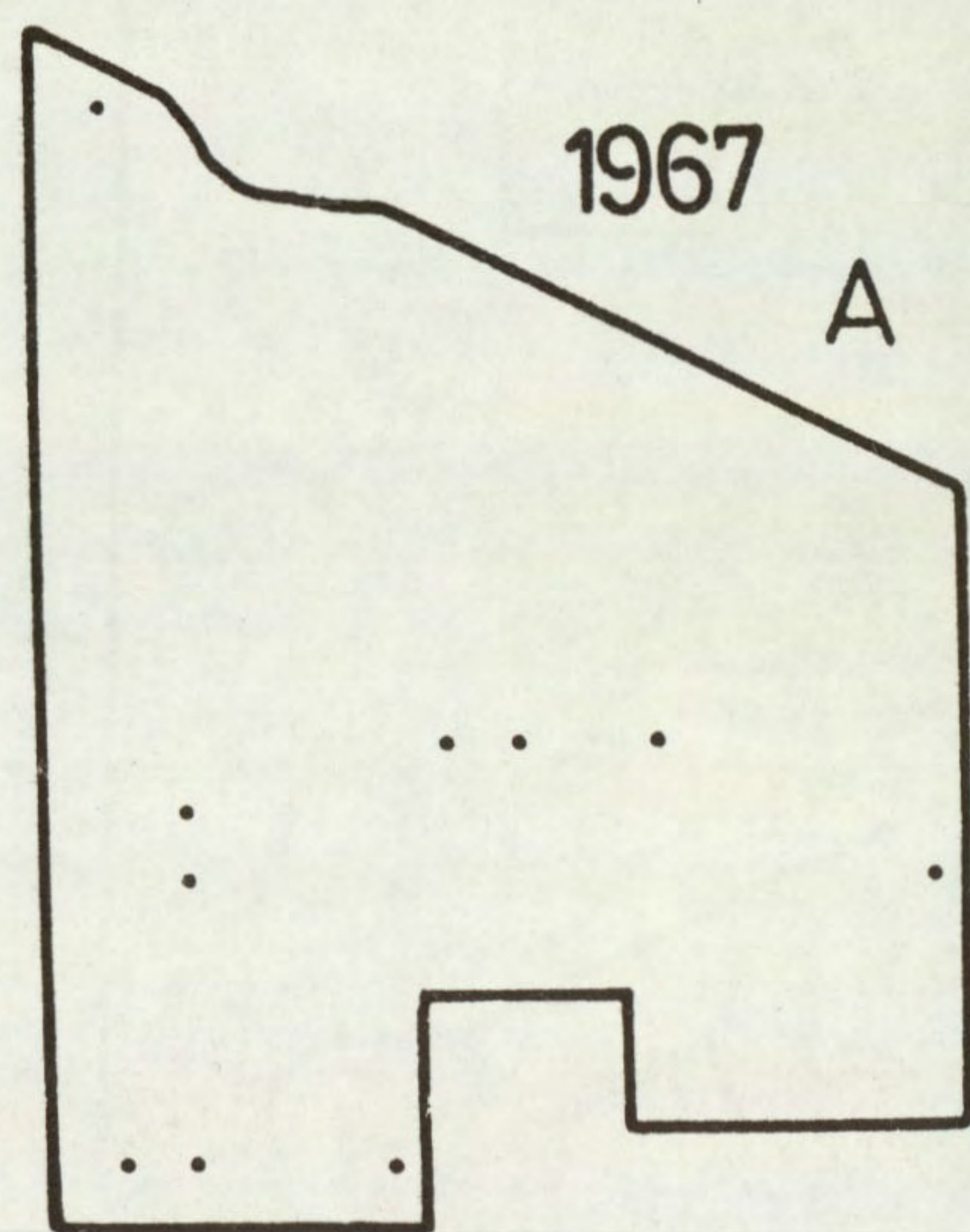
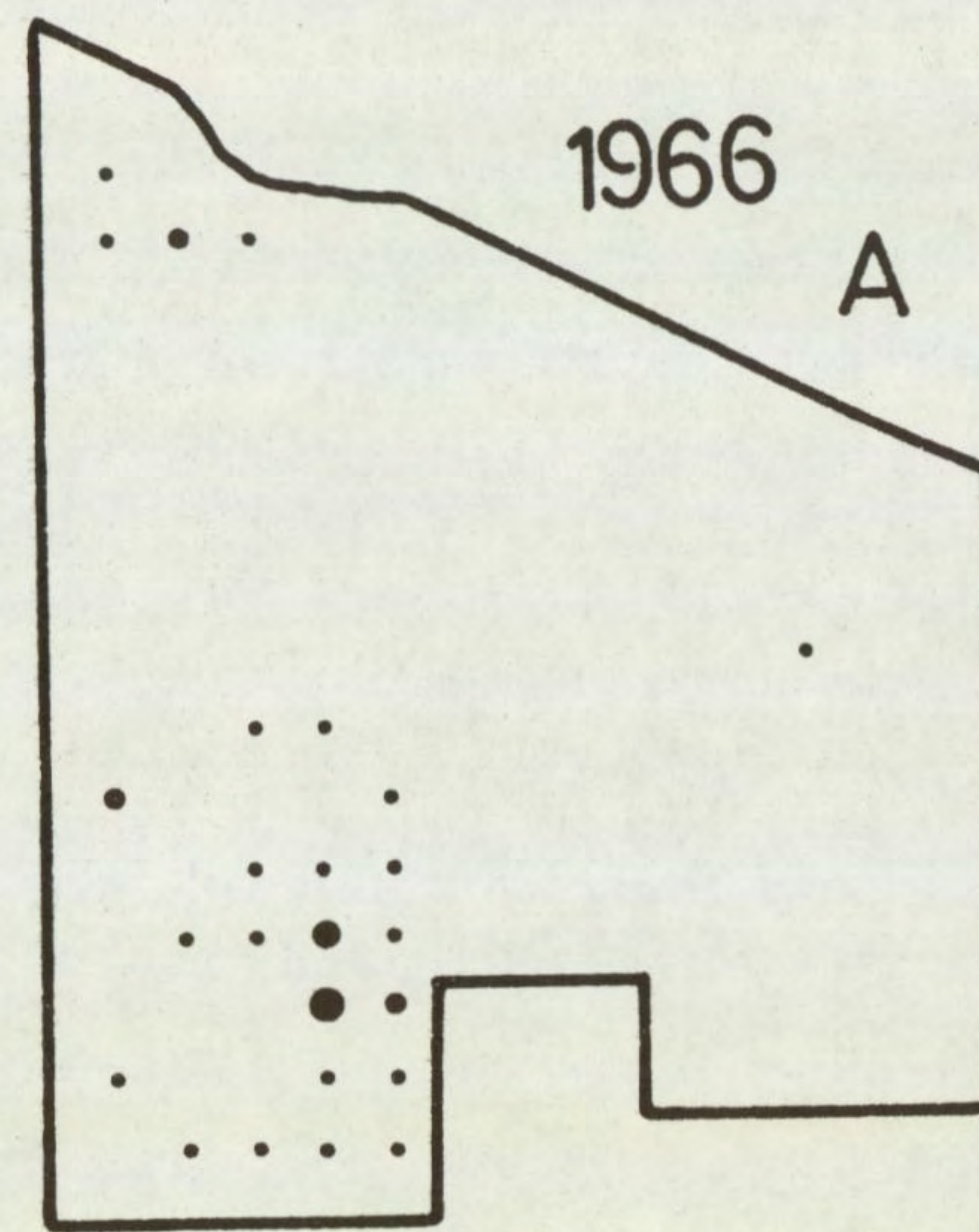
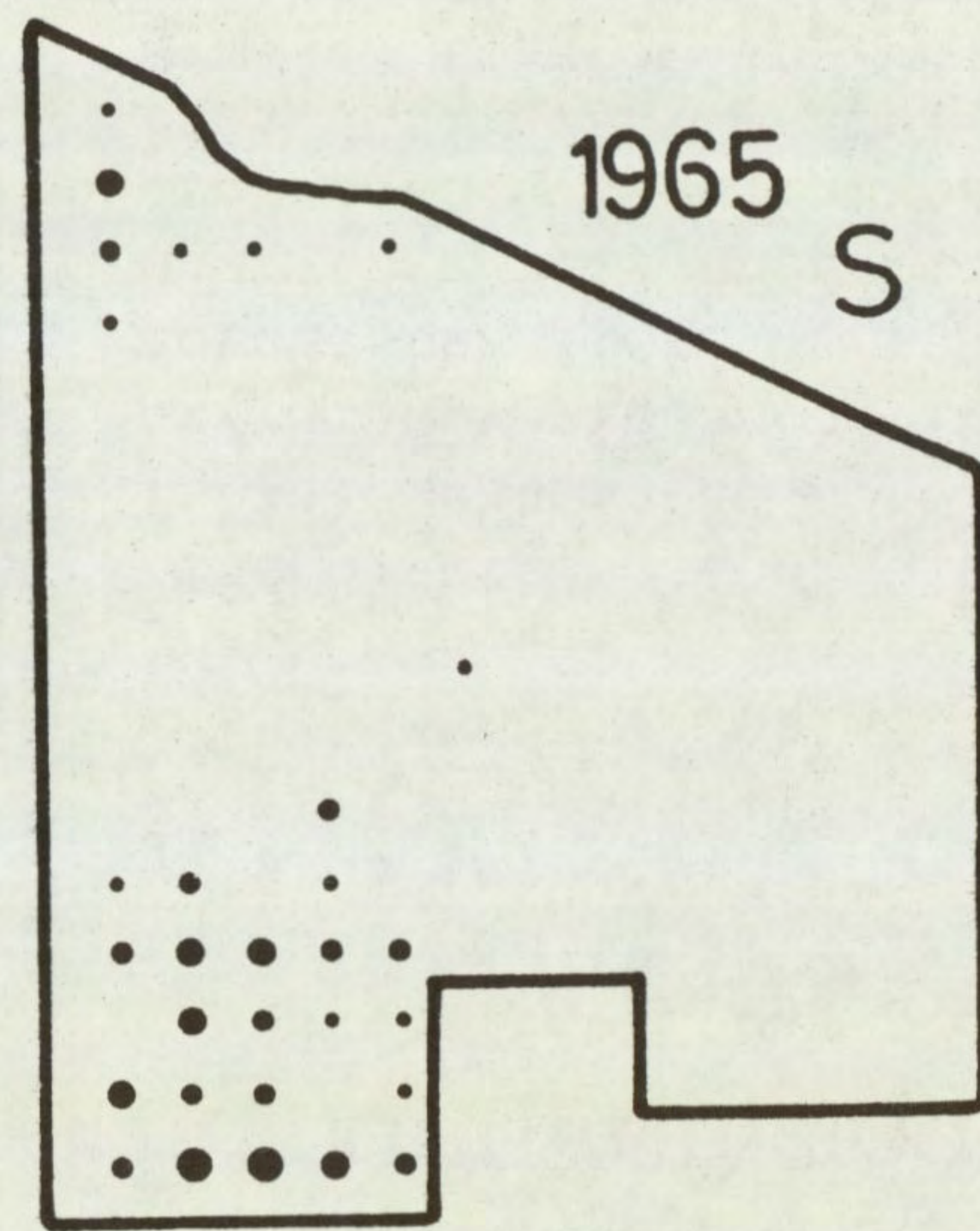
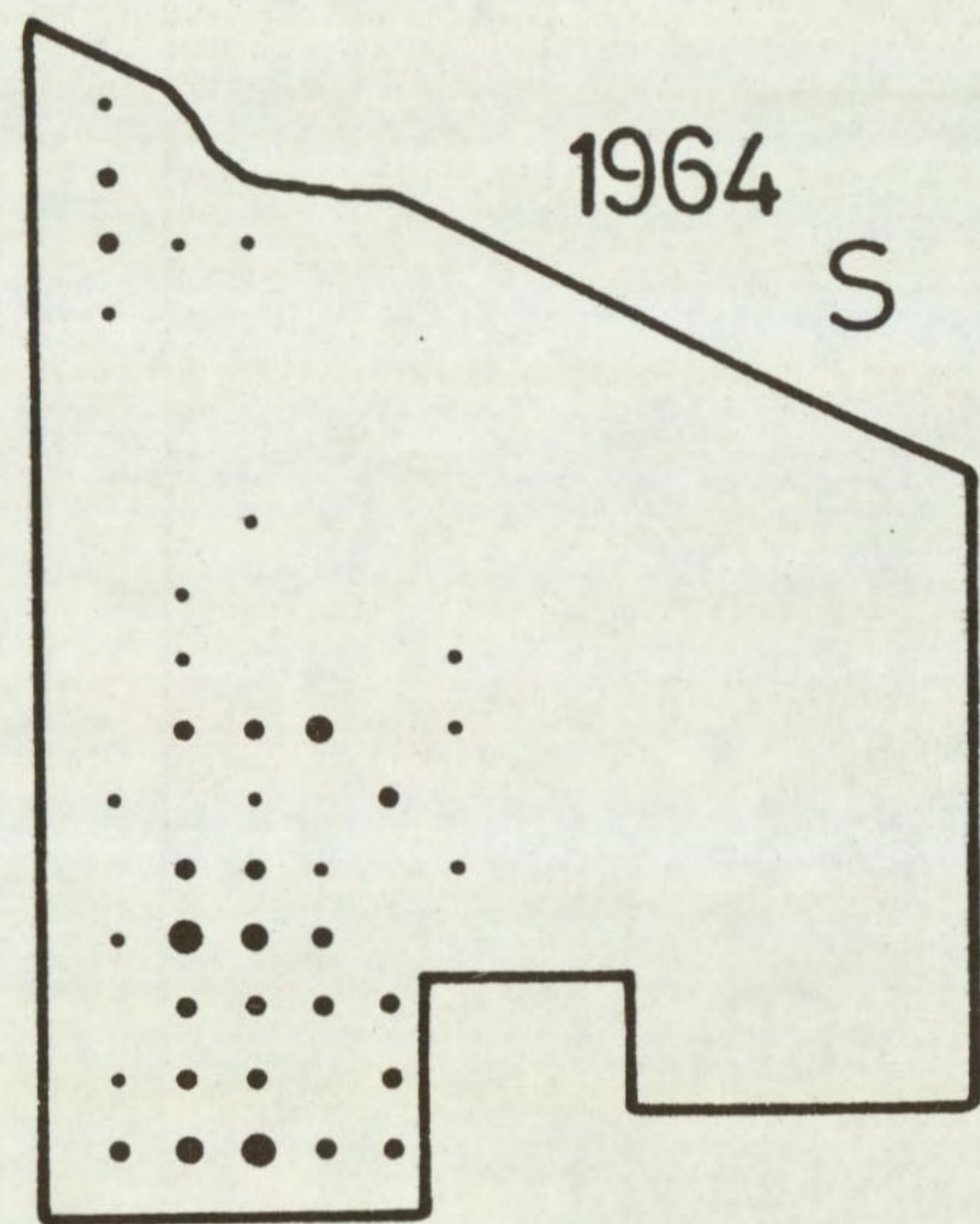
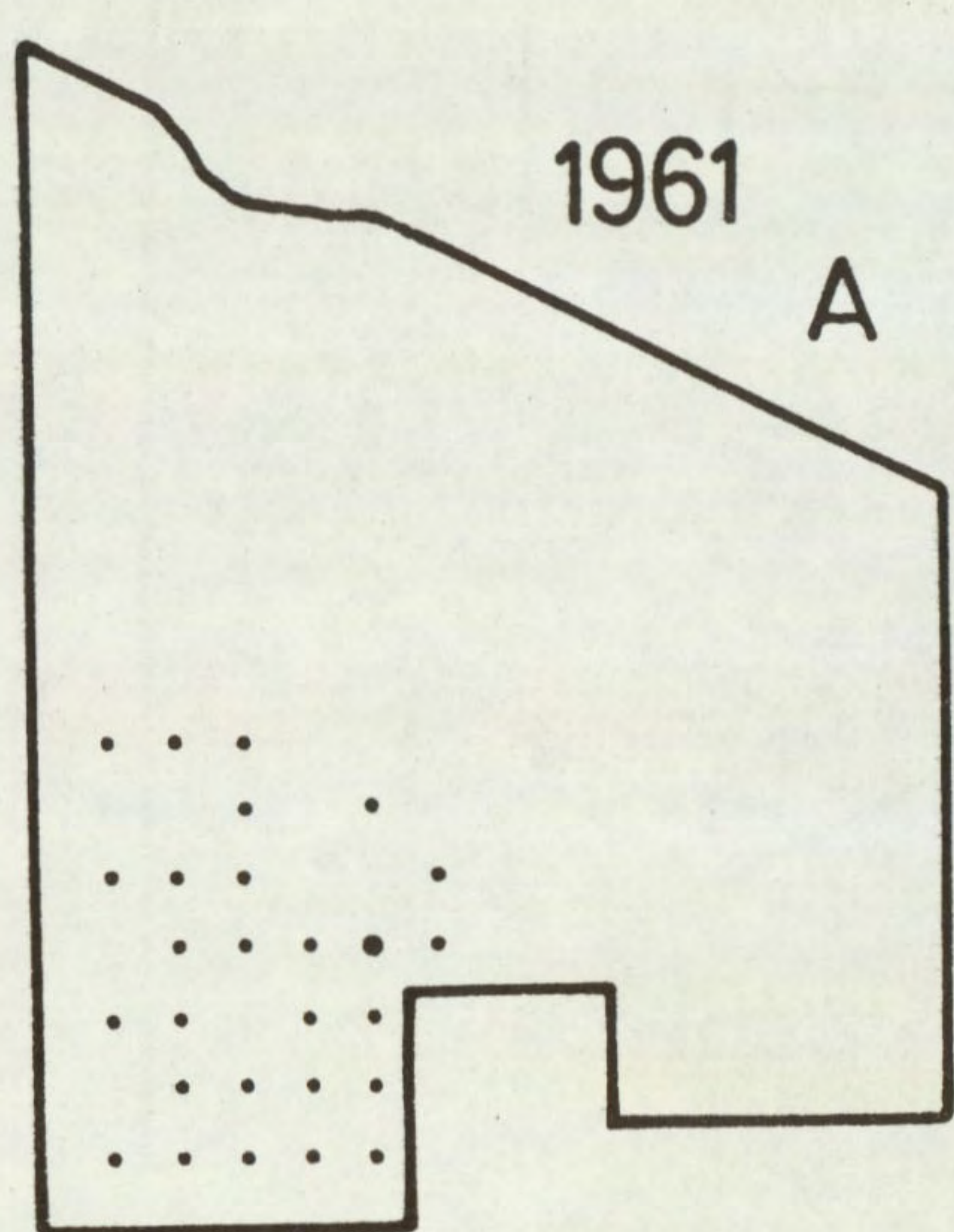


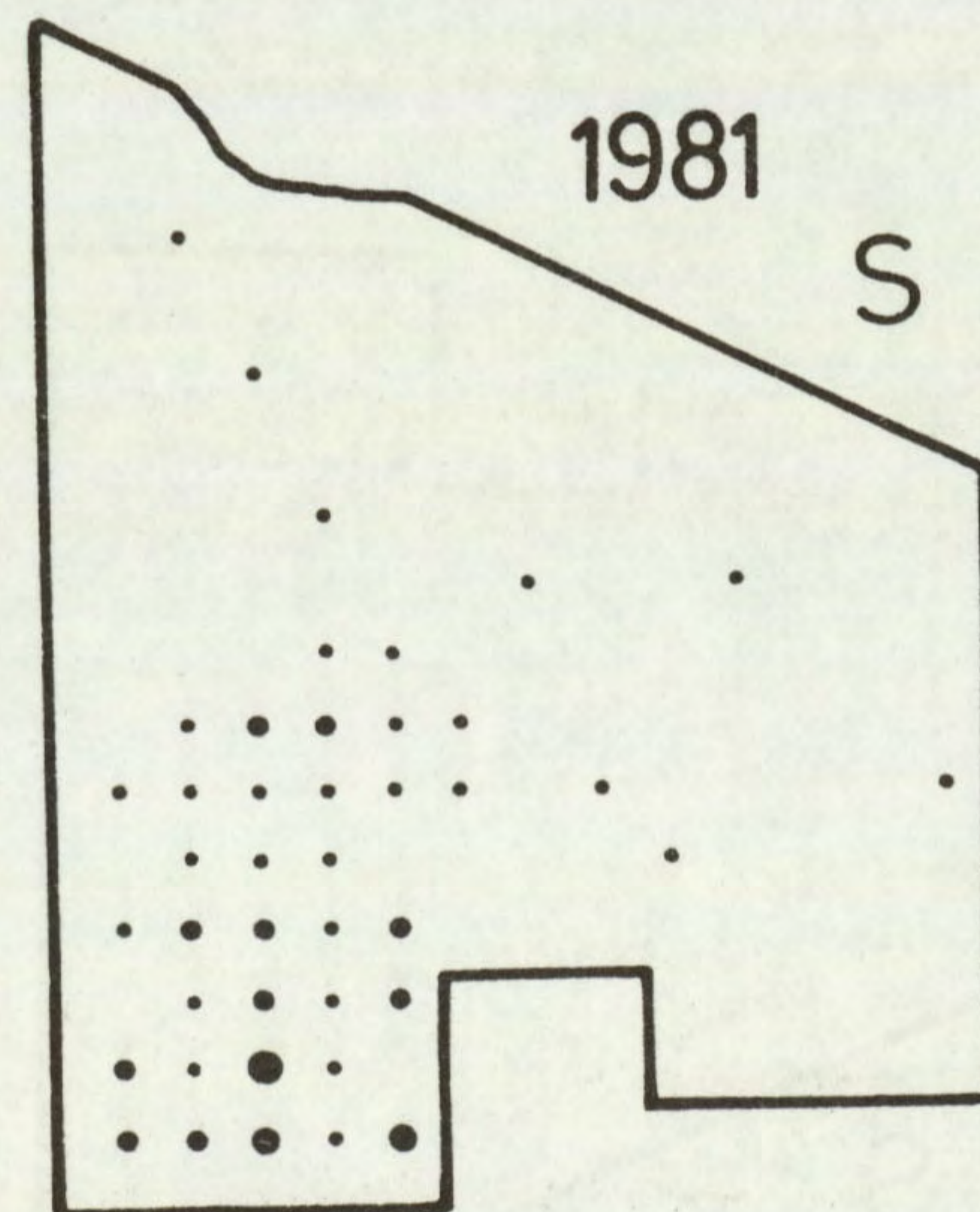
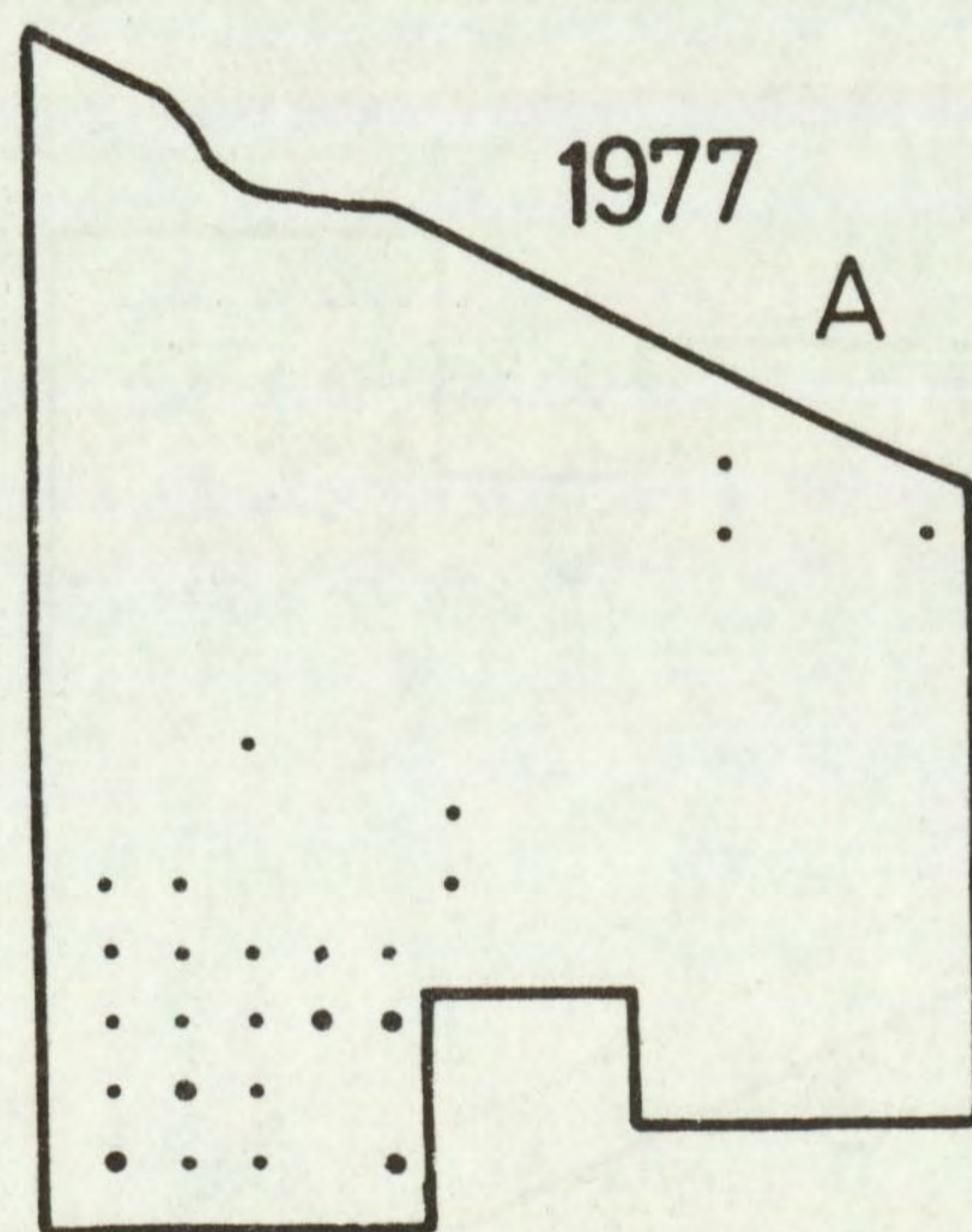
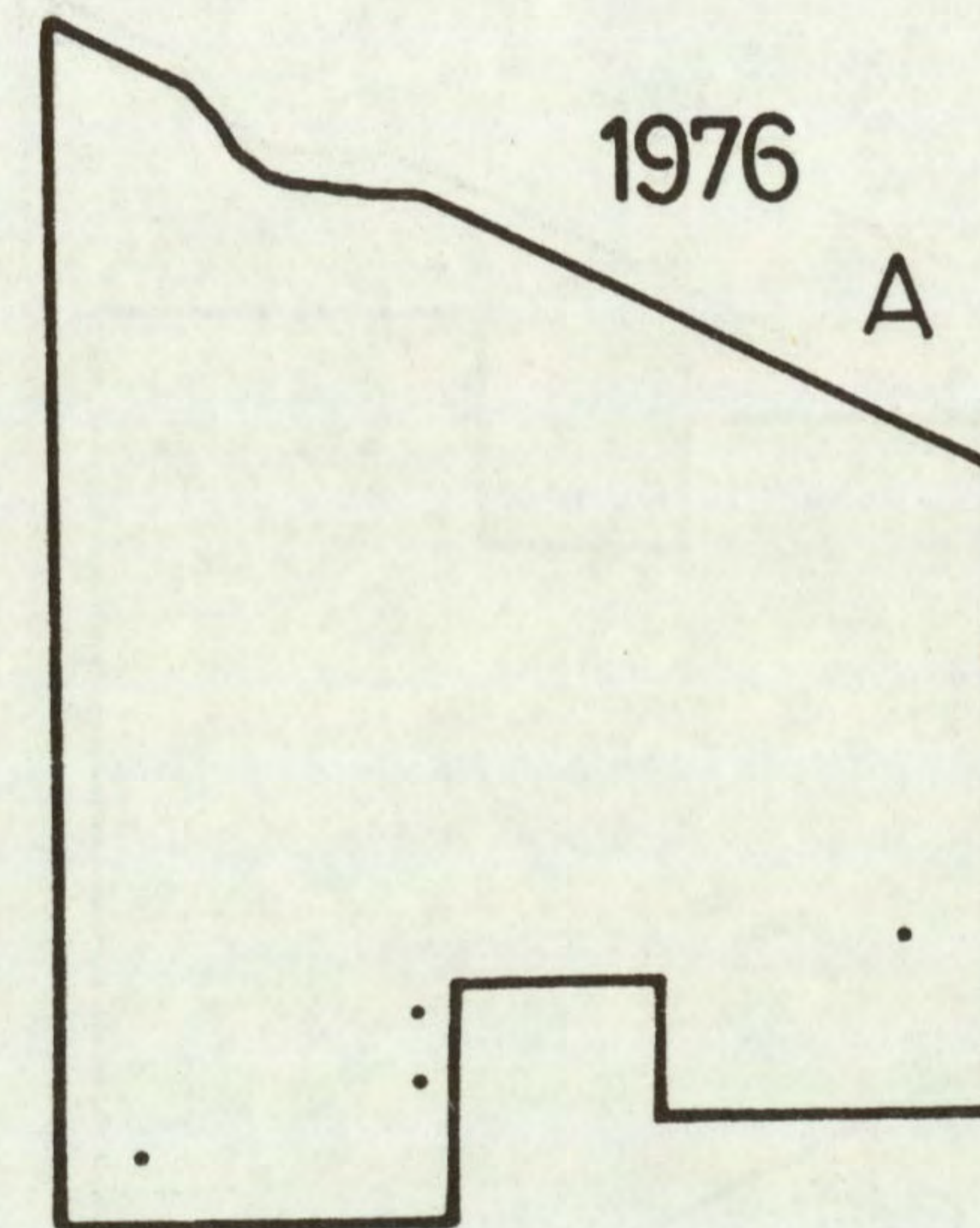
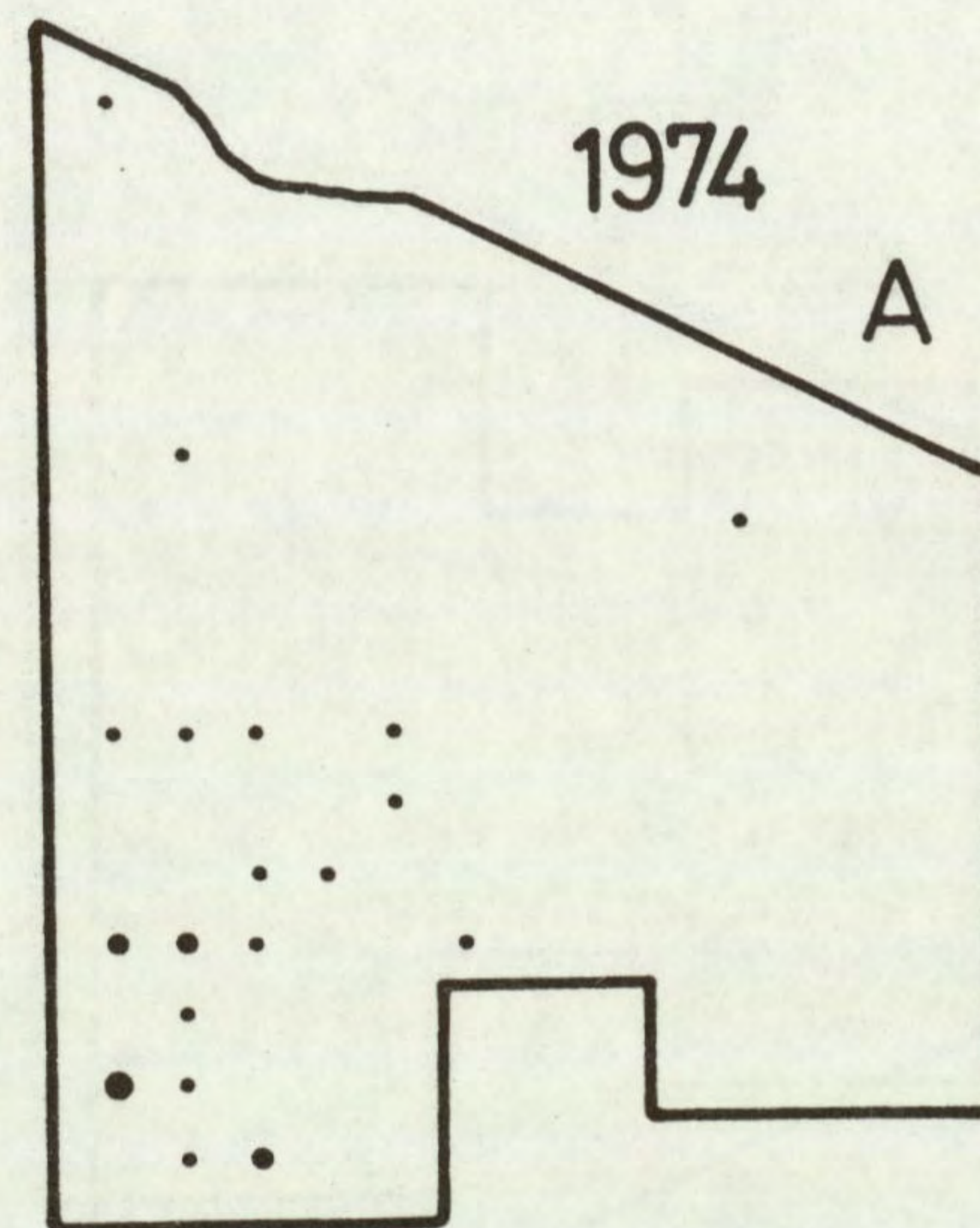
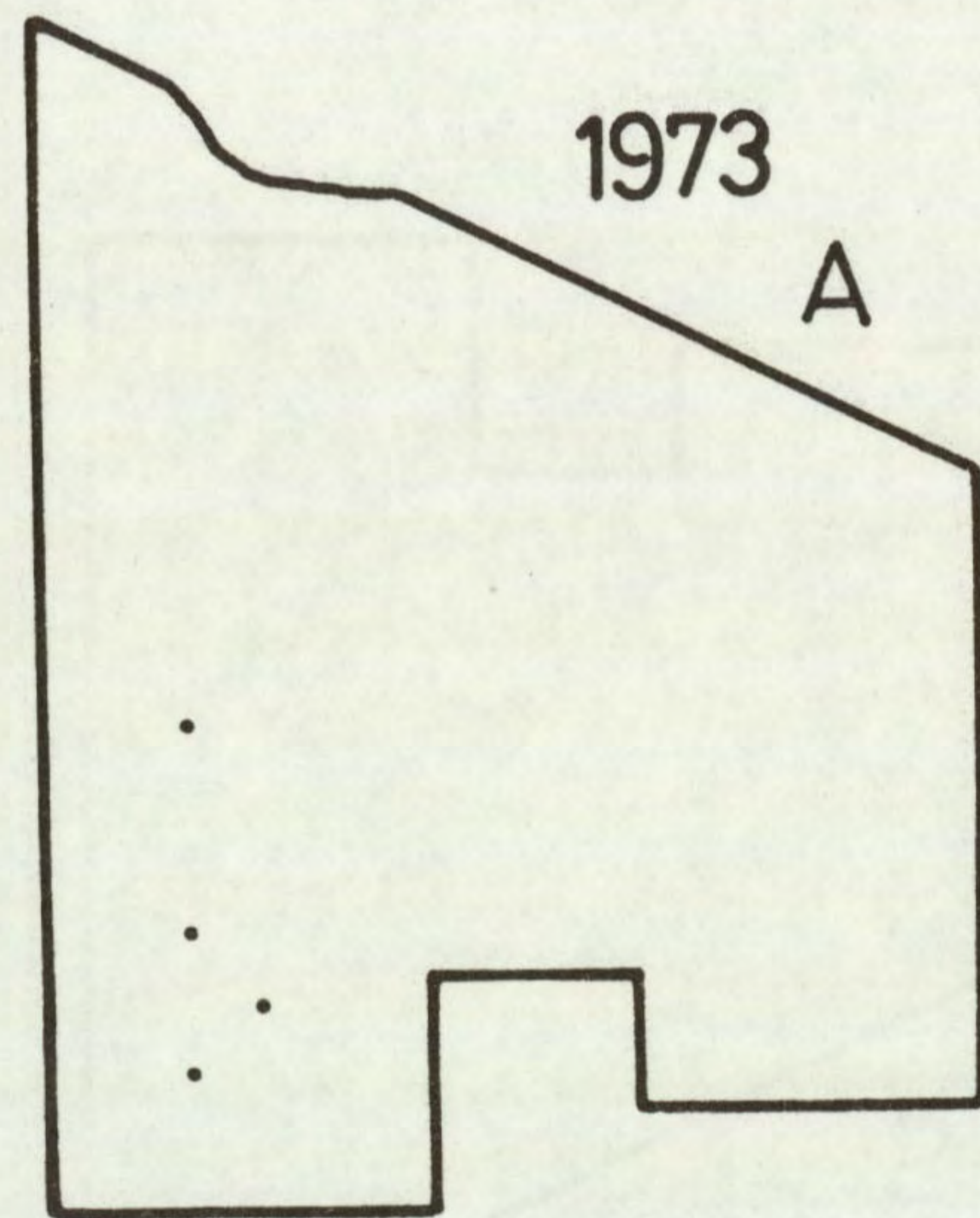
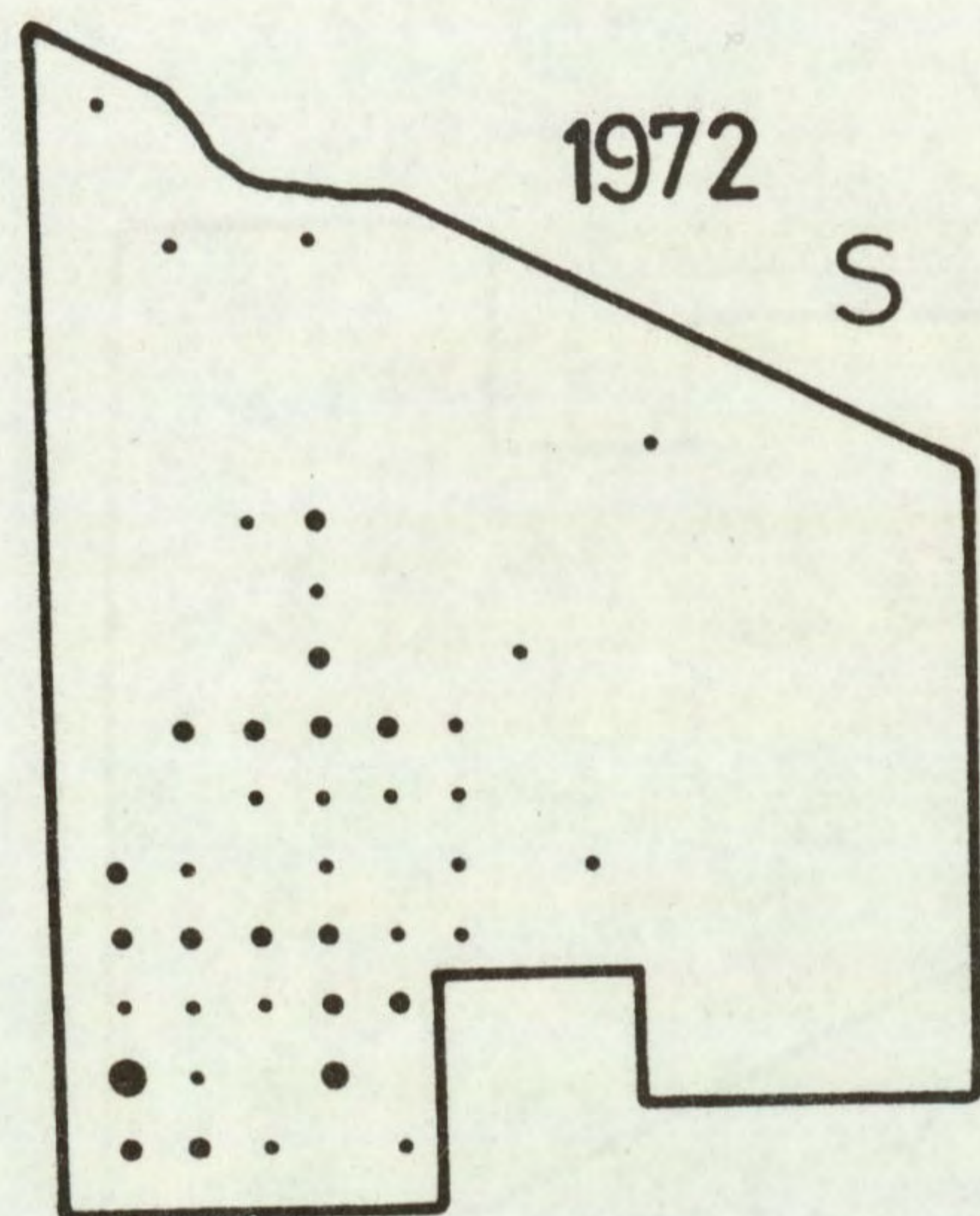


Fumaria officinalis

When the field was ploughed out of grass in 1960 and assessed in 1961, this weed occupied only the western half of the field, the seeds having remained dormant under the grass since an earlier cultivation. This was apparently during the 1939-45 war, when much grassland was ploughed for cereal growing.

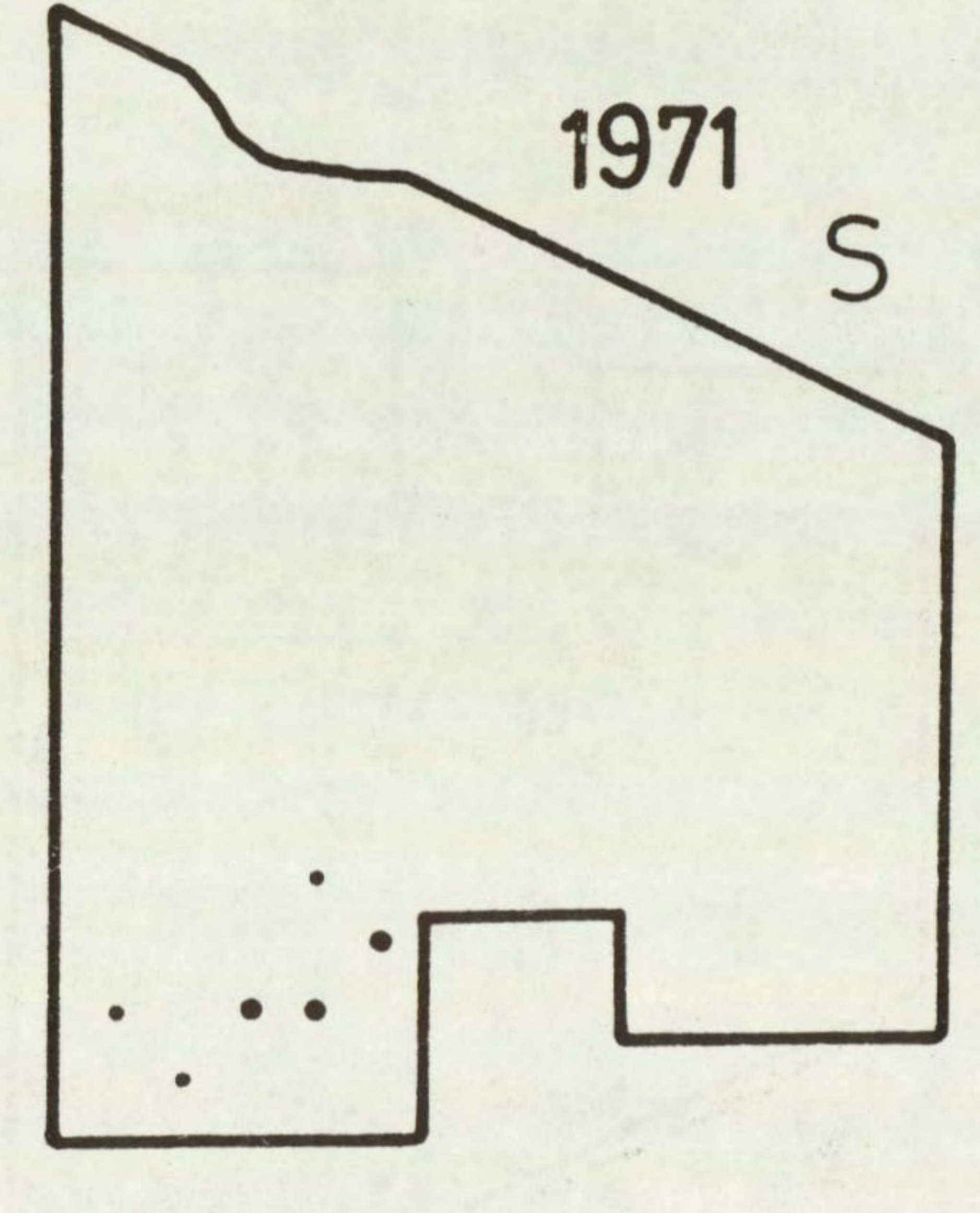
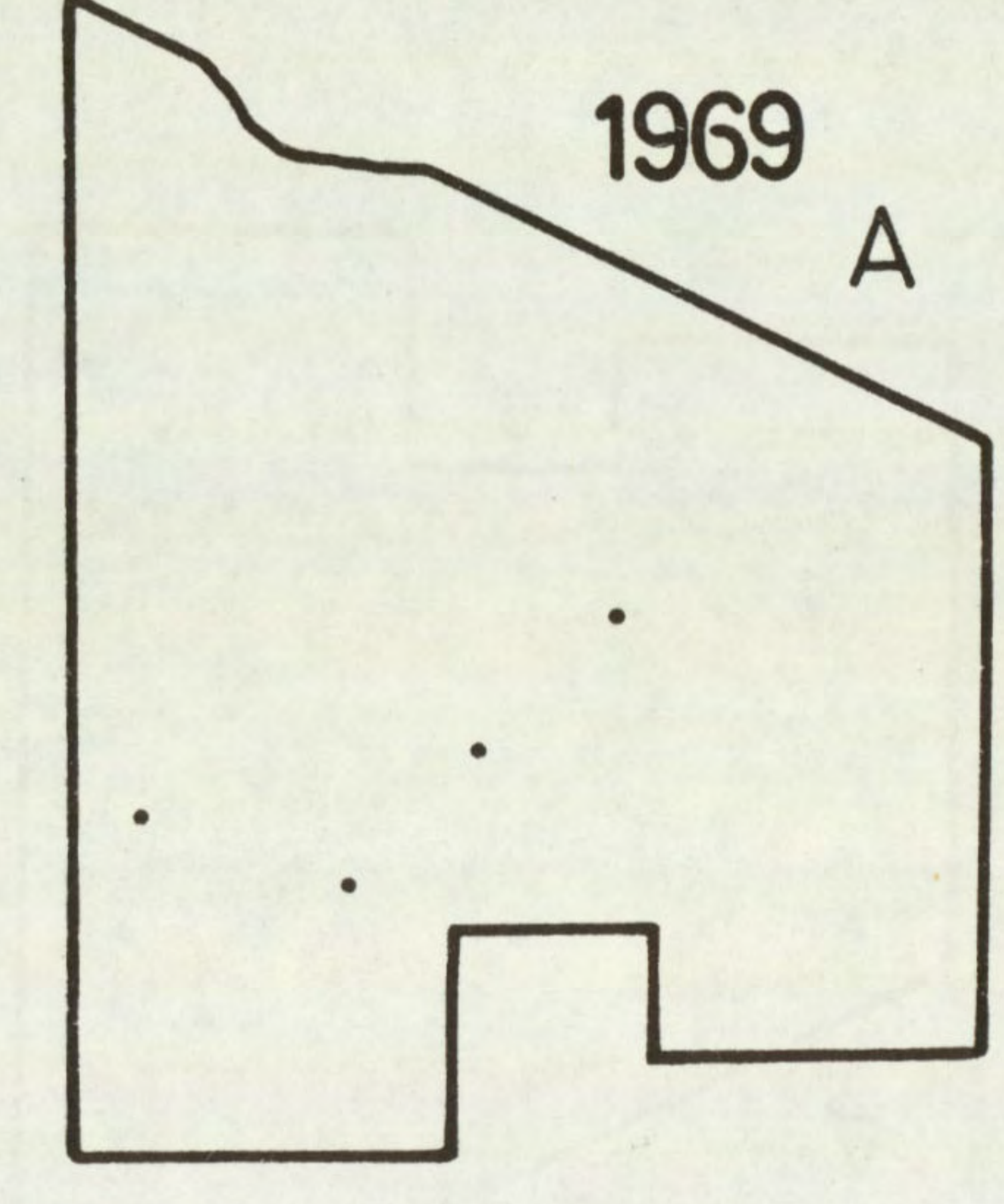
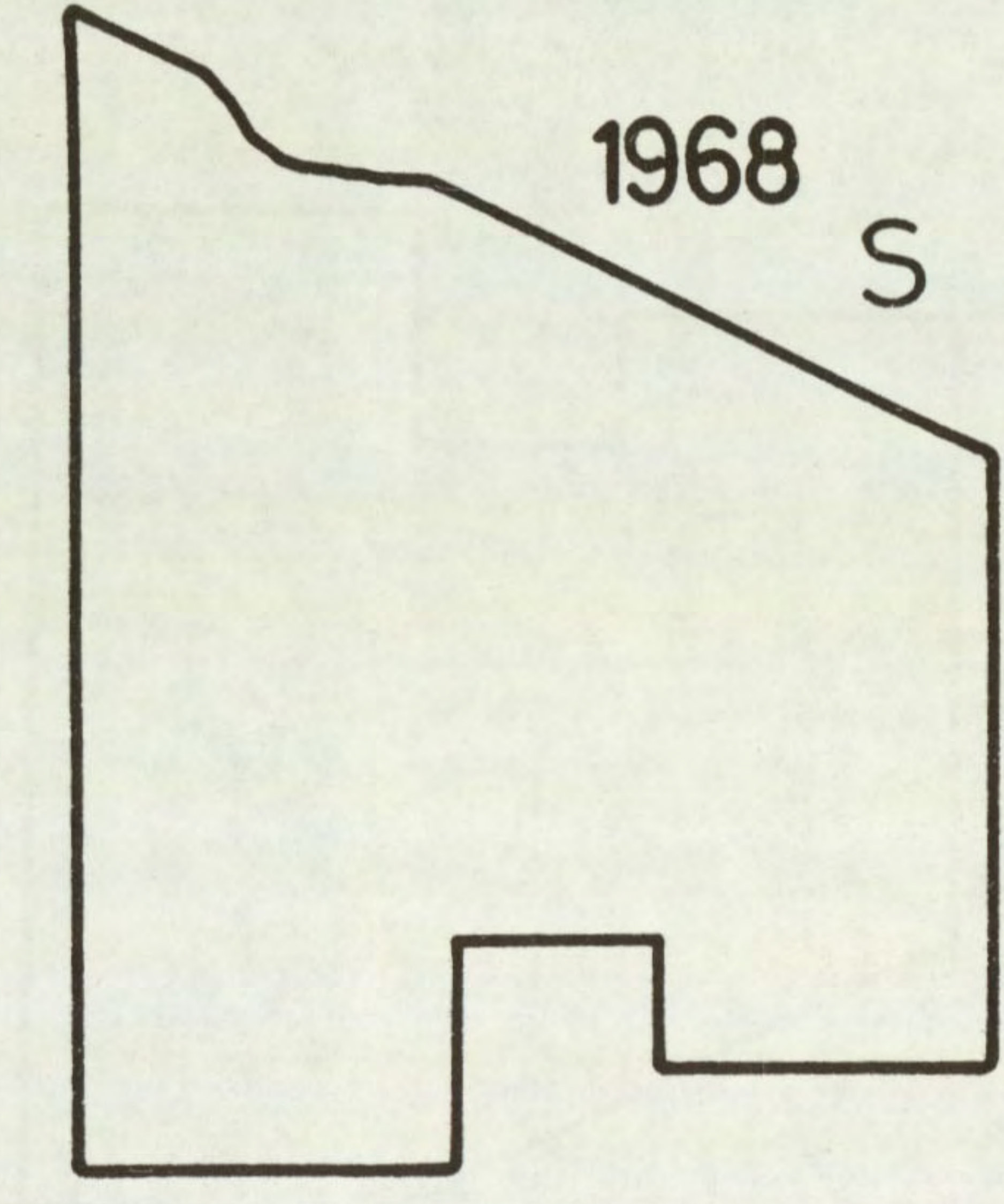
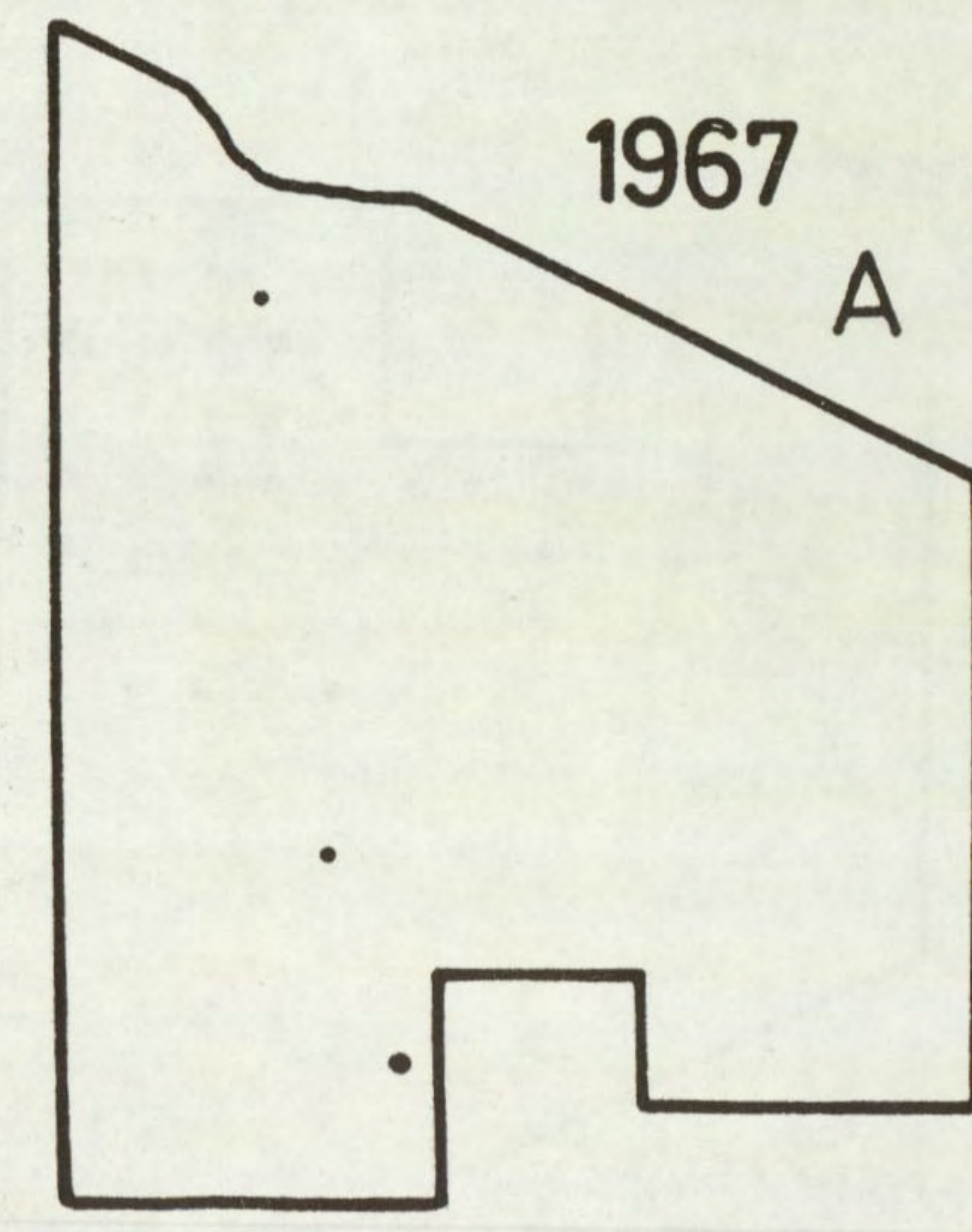
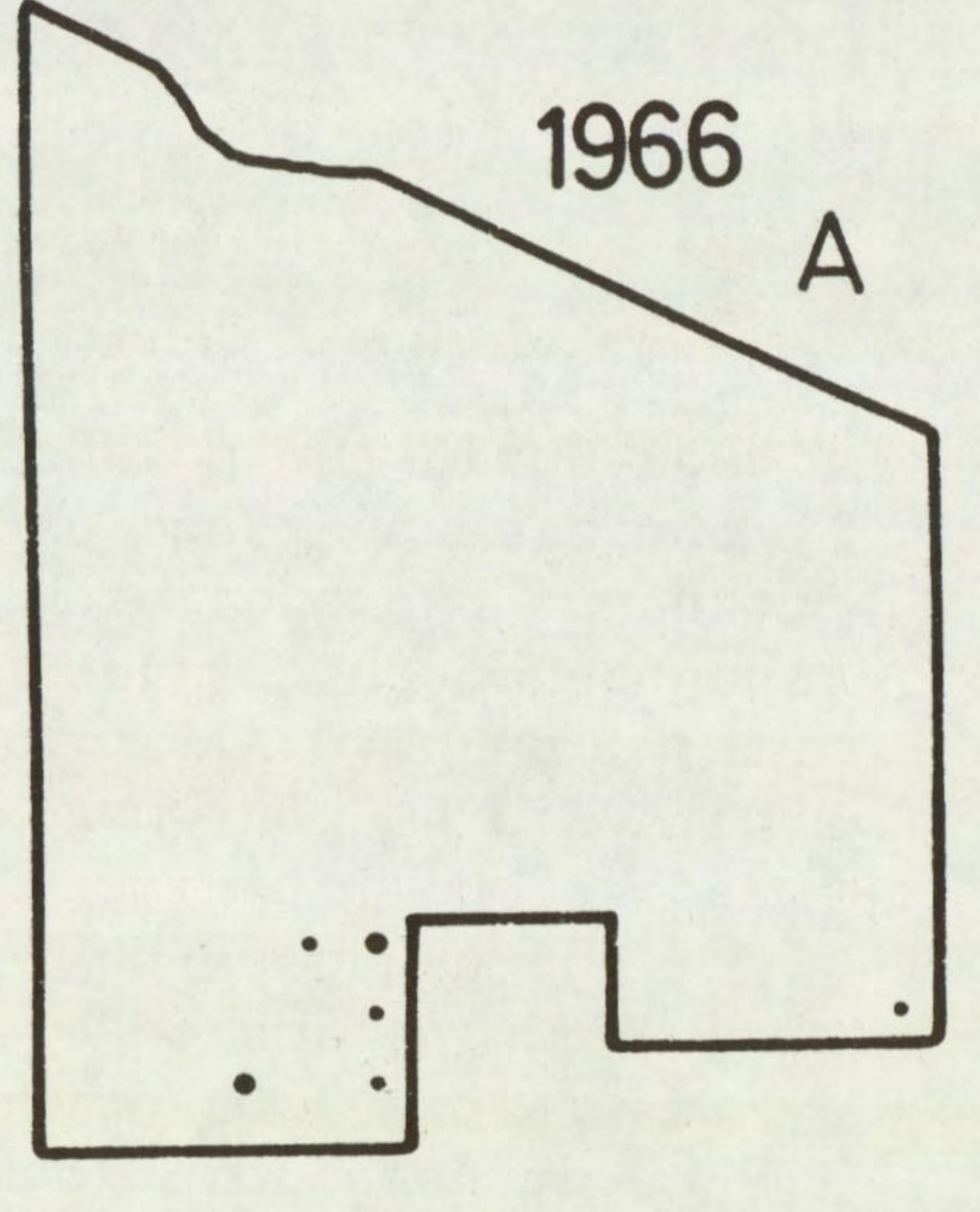
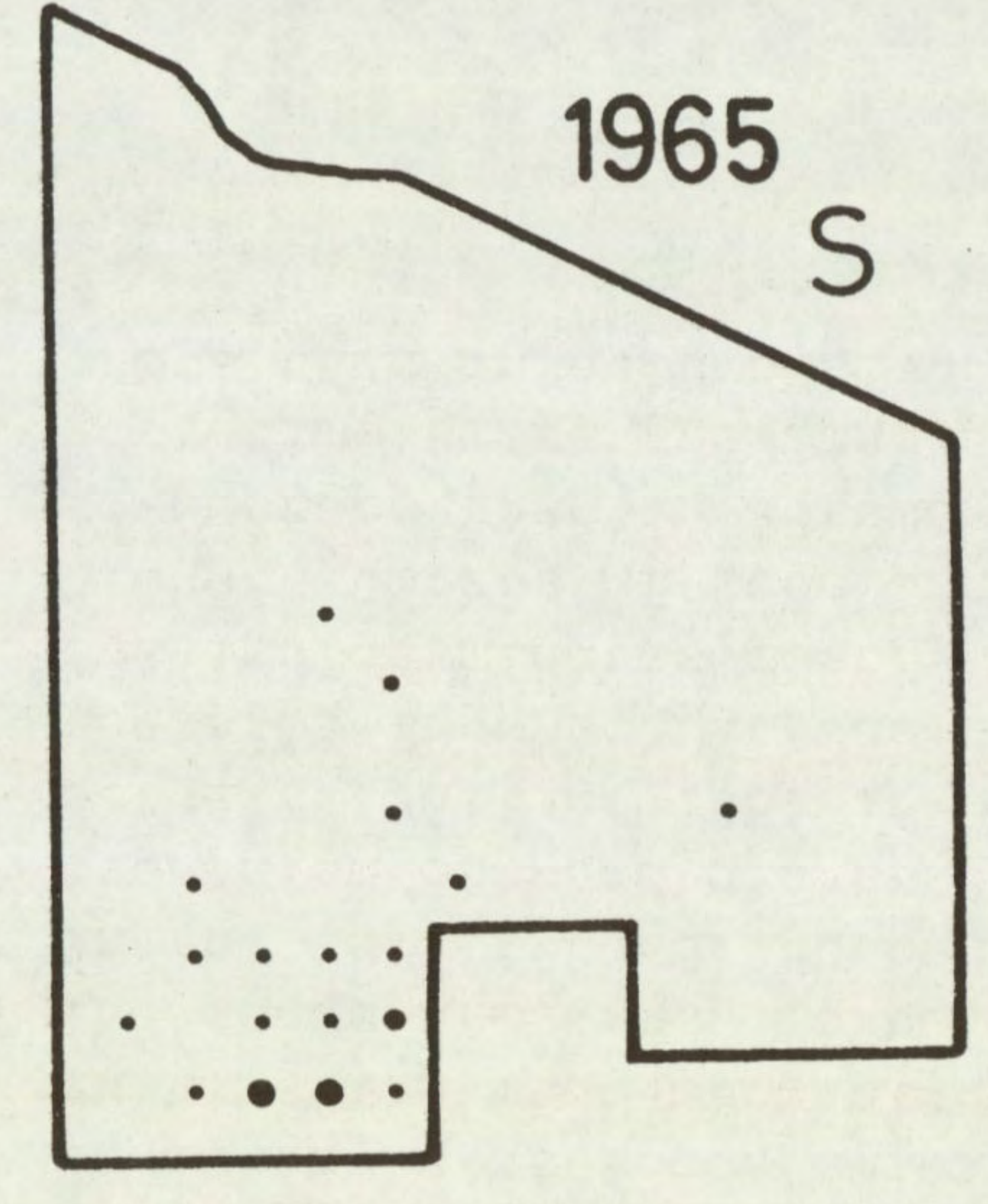
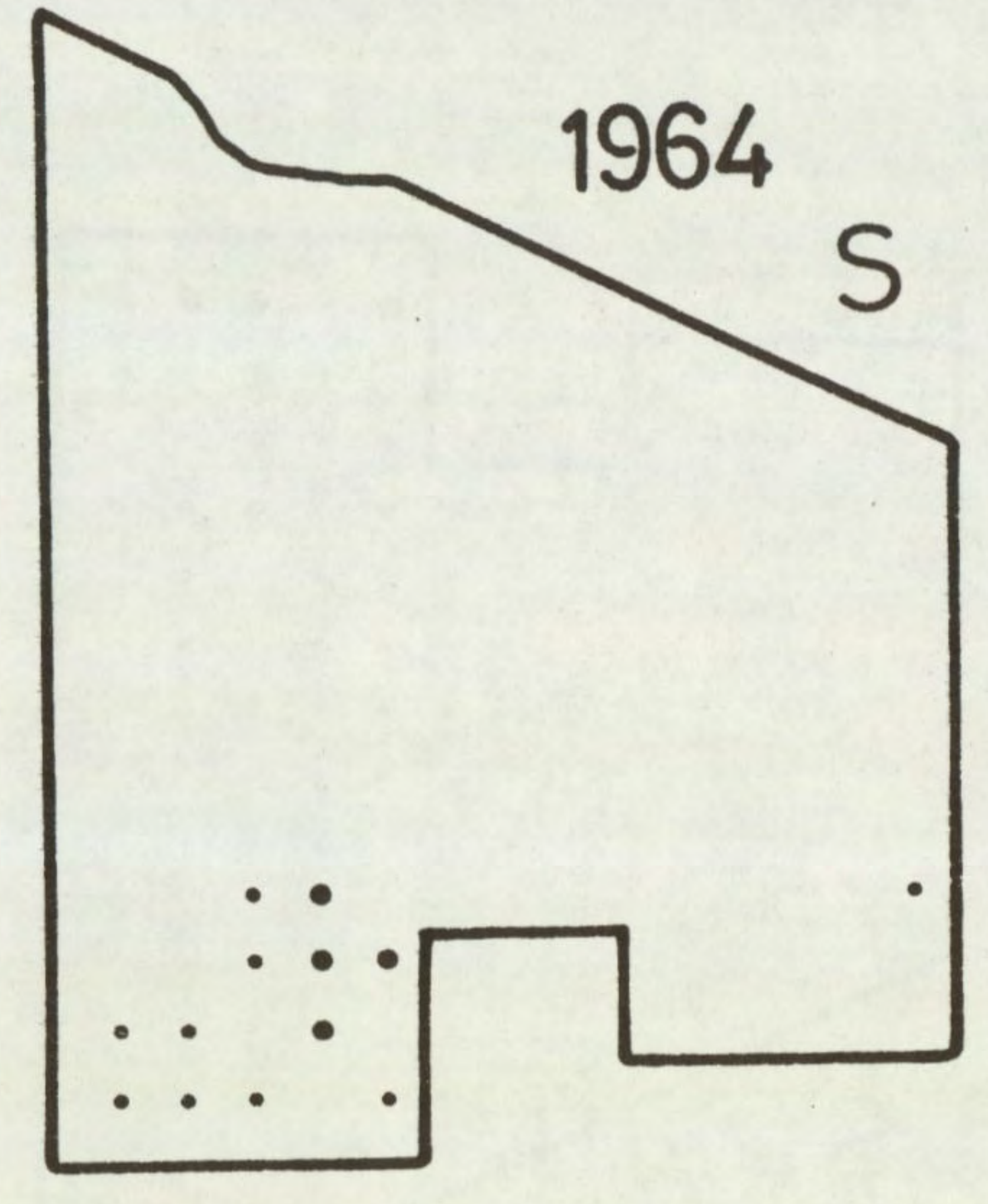
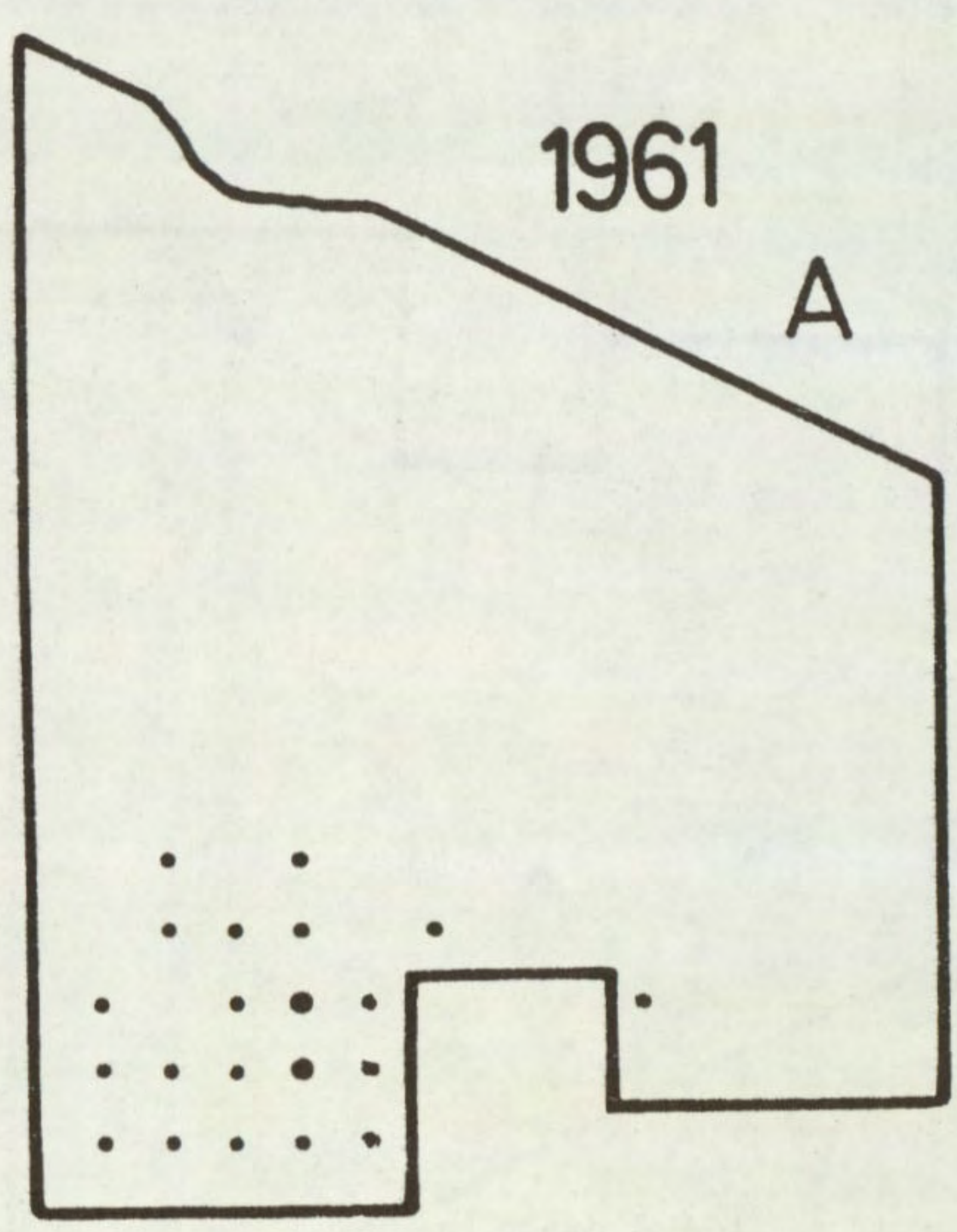
The plant does not disperse its seeds at all and it is interesting to note that as late as 1973 the line of this previous cultivation could still be seen across the field, some thirty years later. This weed must then rely upon being planted as a contaminant of crop seed. Once introduced it can survive, as in this field, for many years. The density in 1981 was similar to that in 1961.

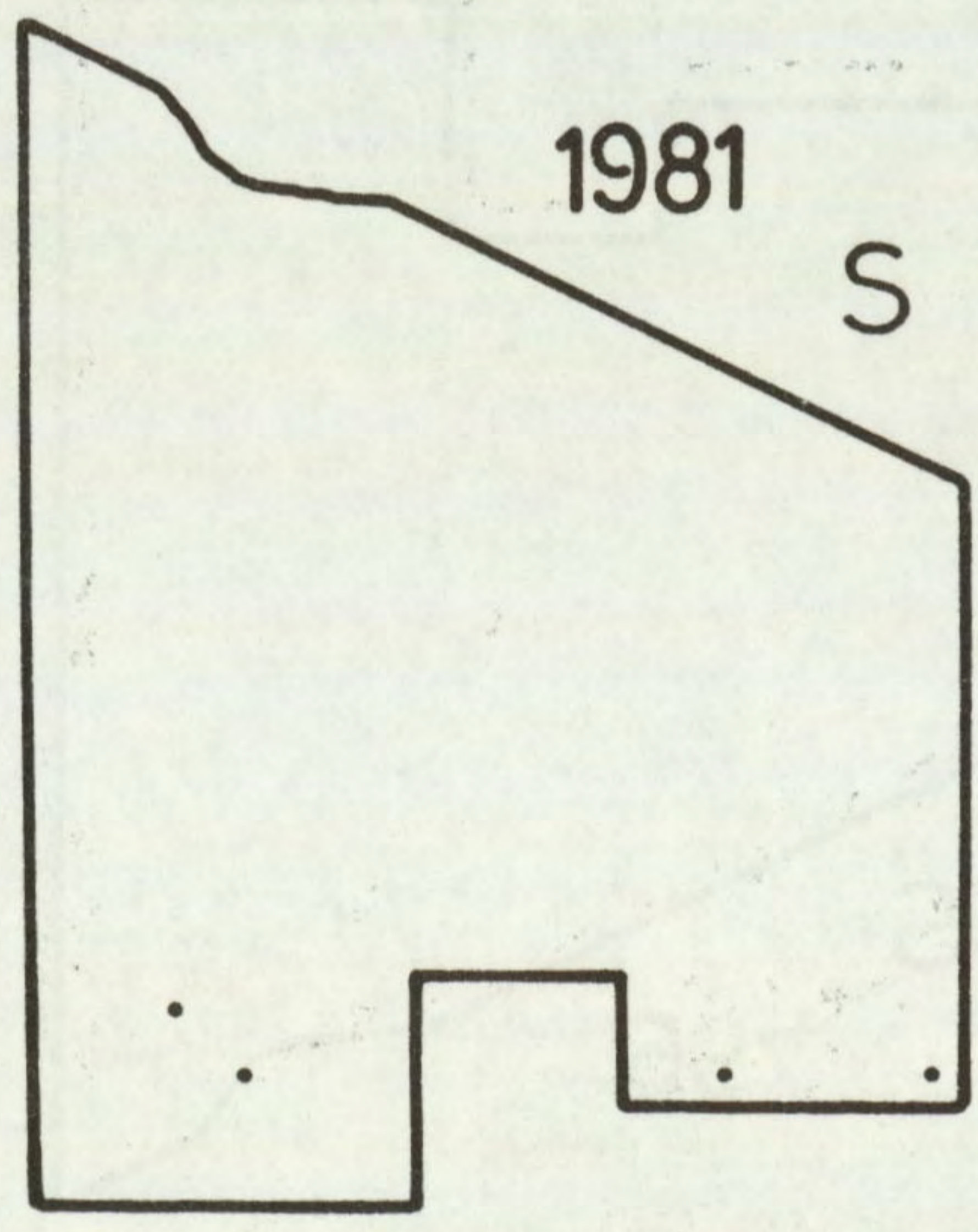
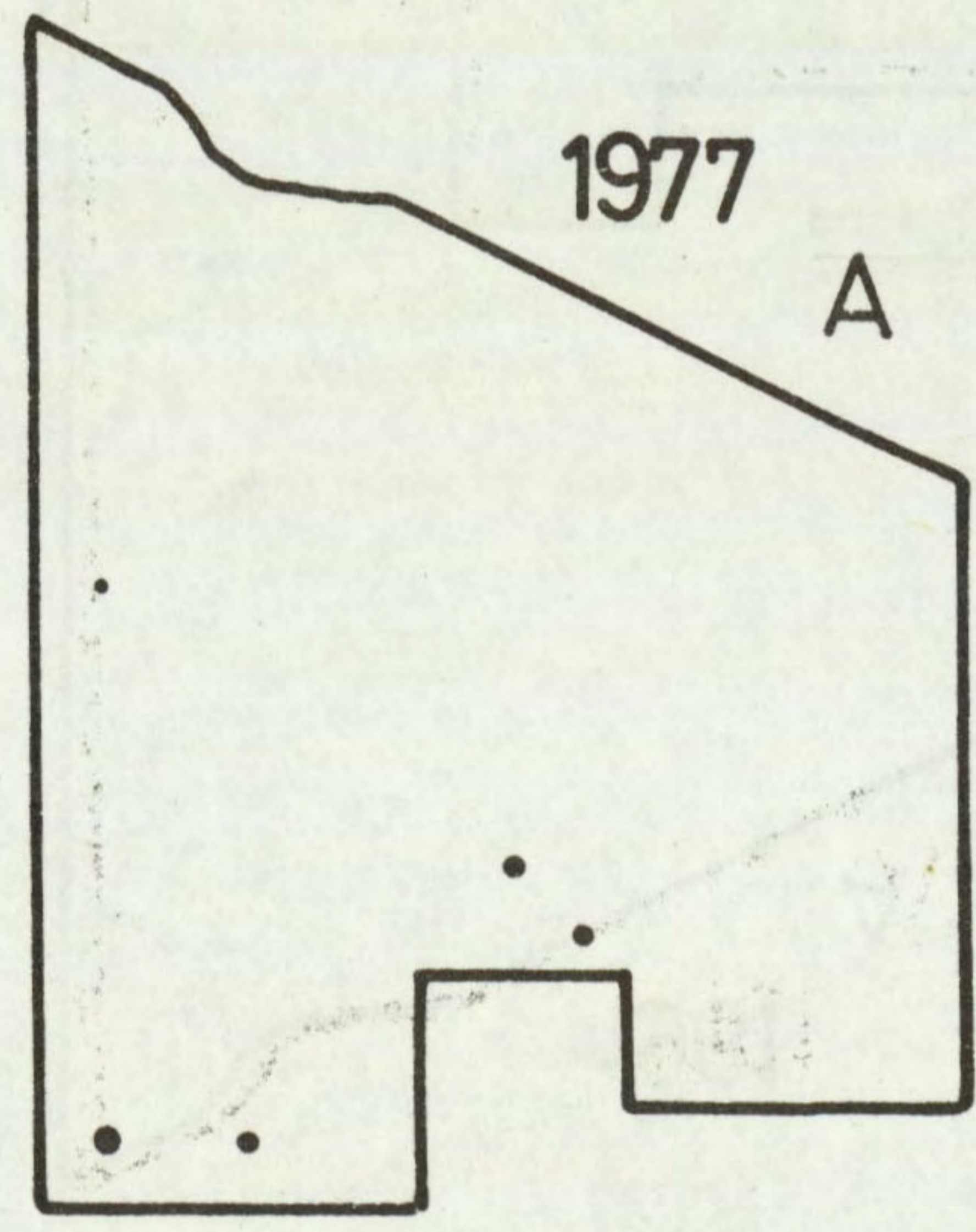
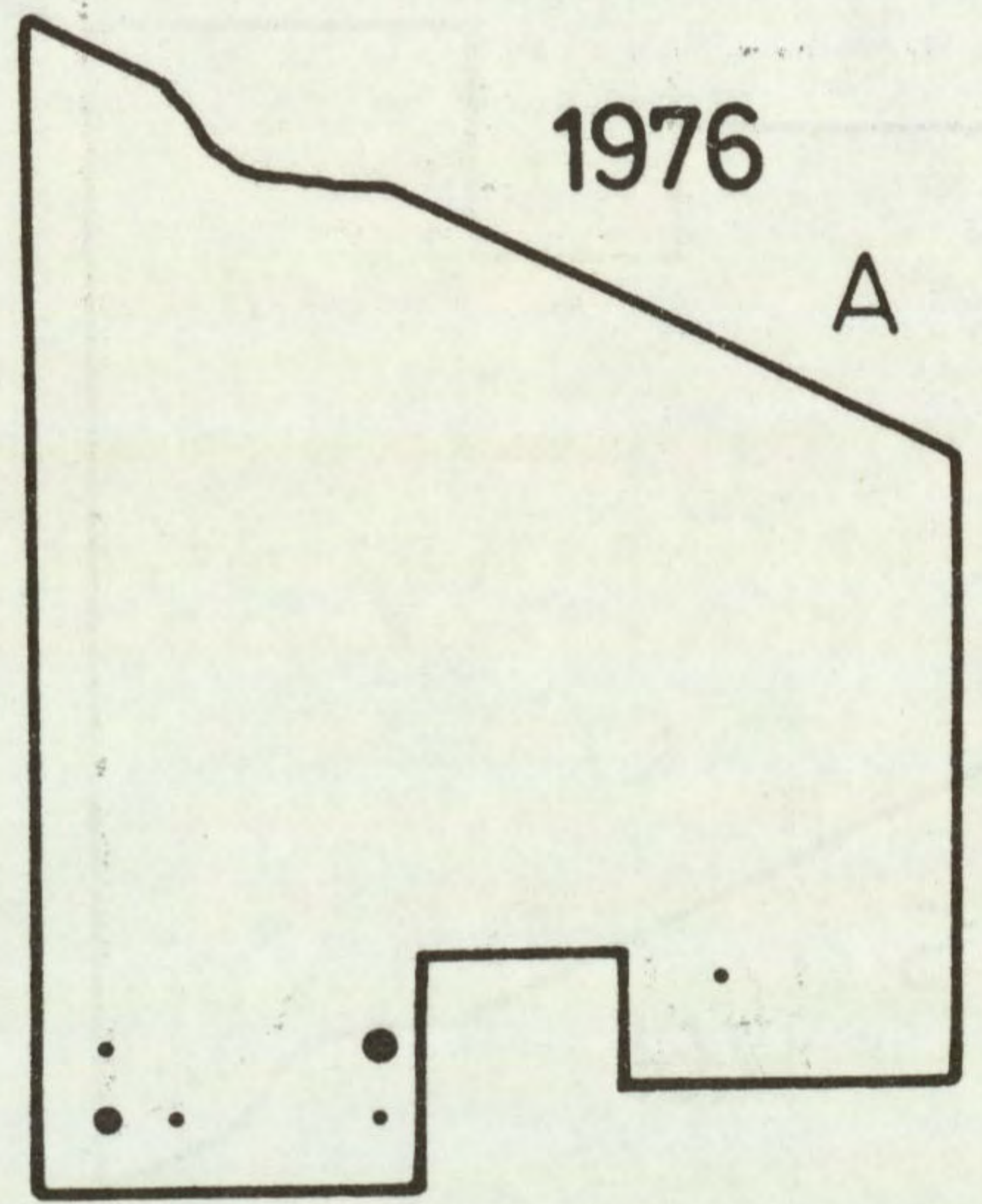
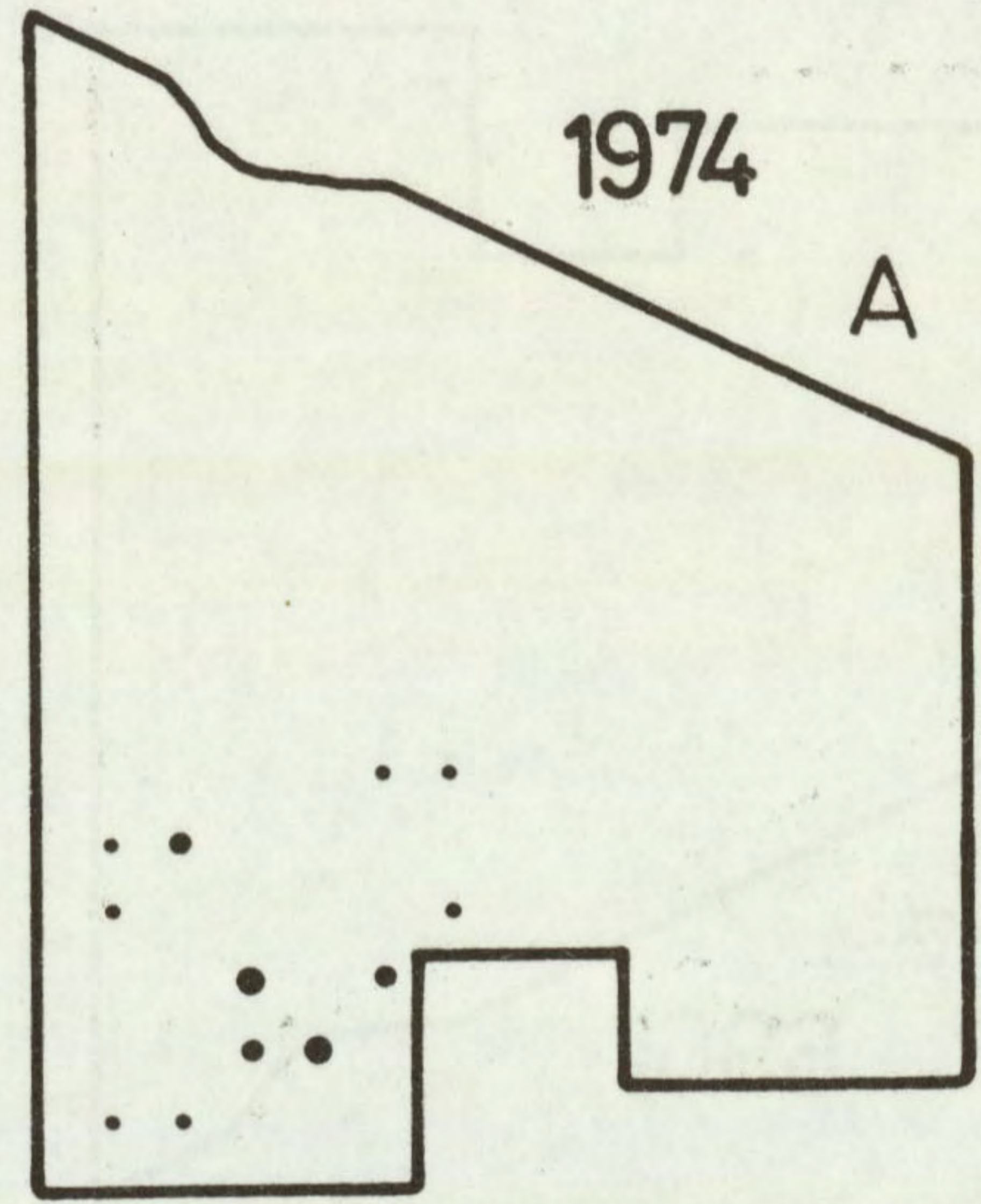
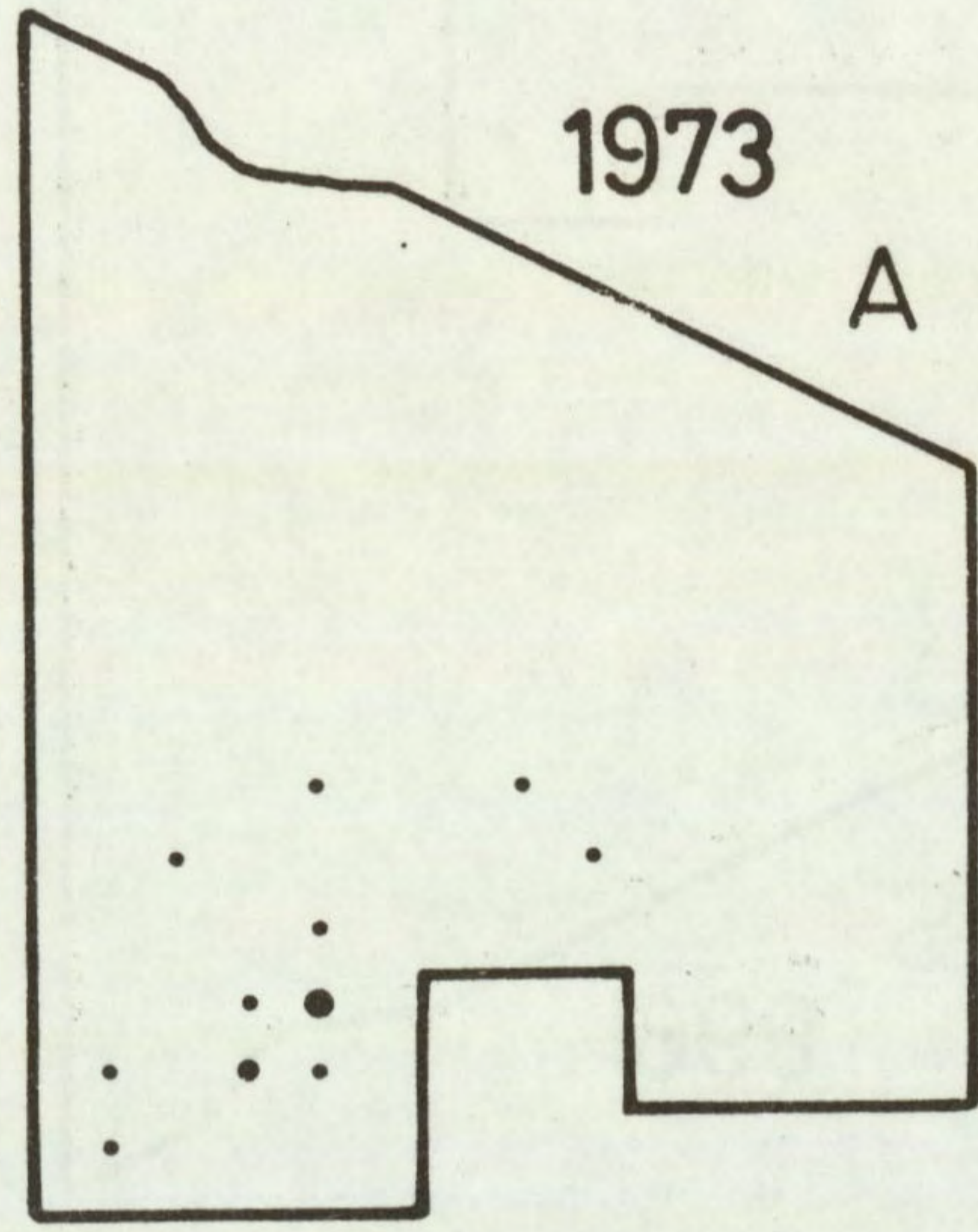
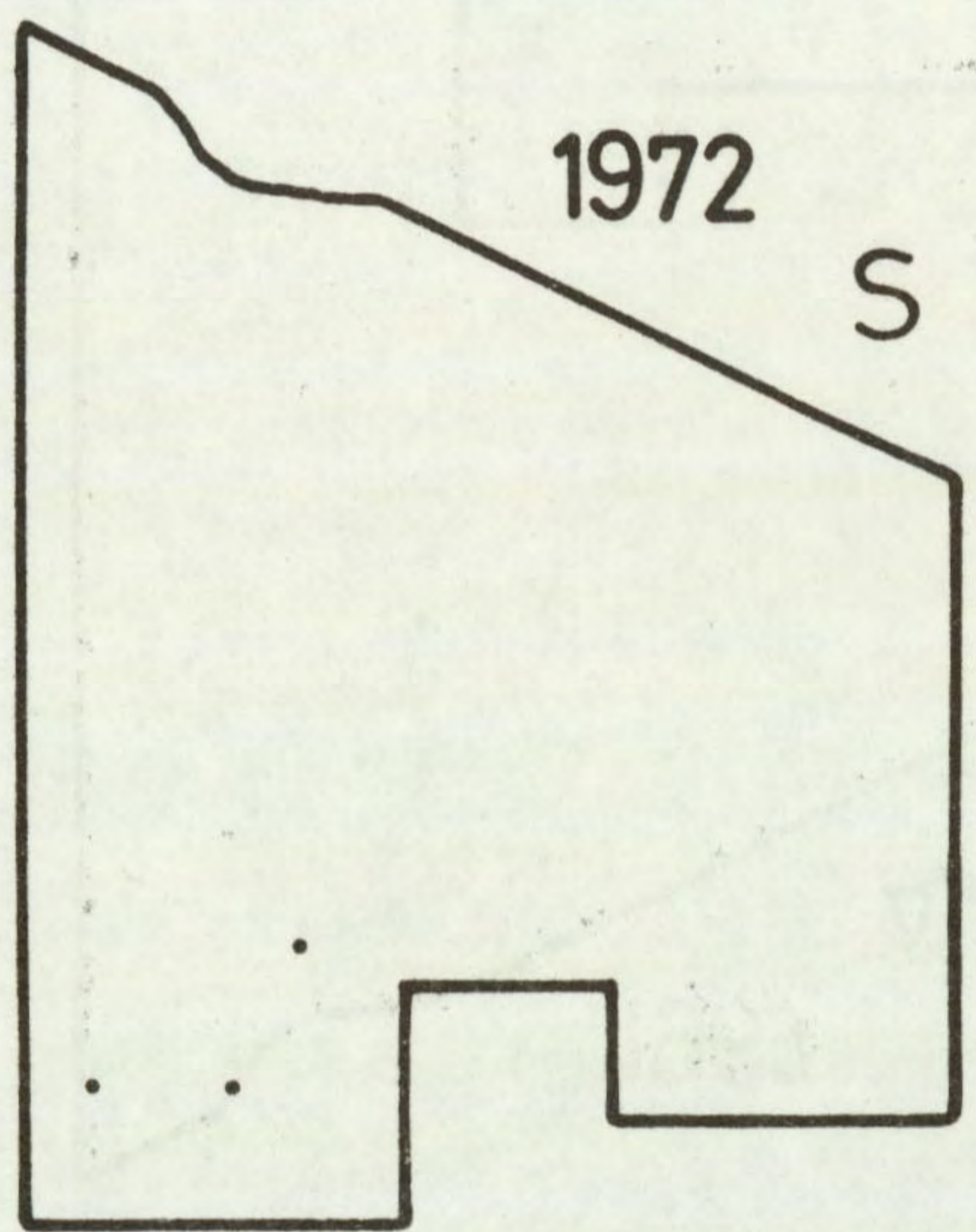




Aethusa cynapium

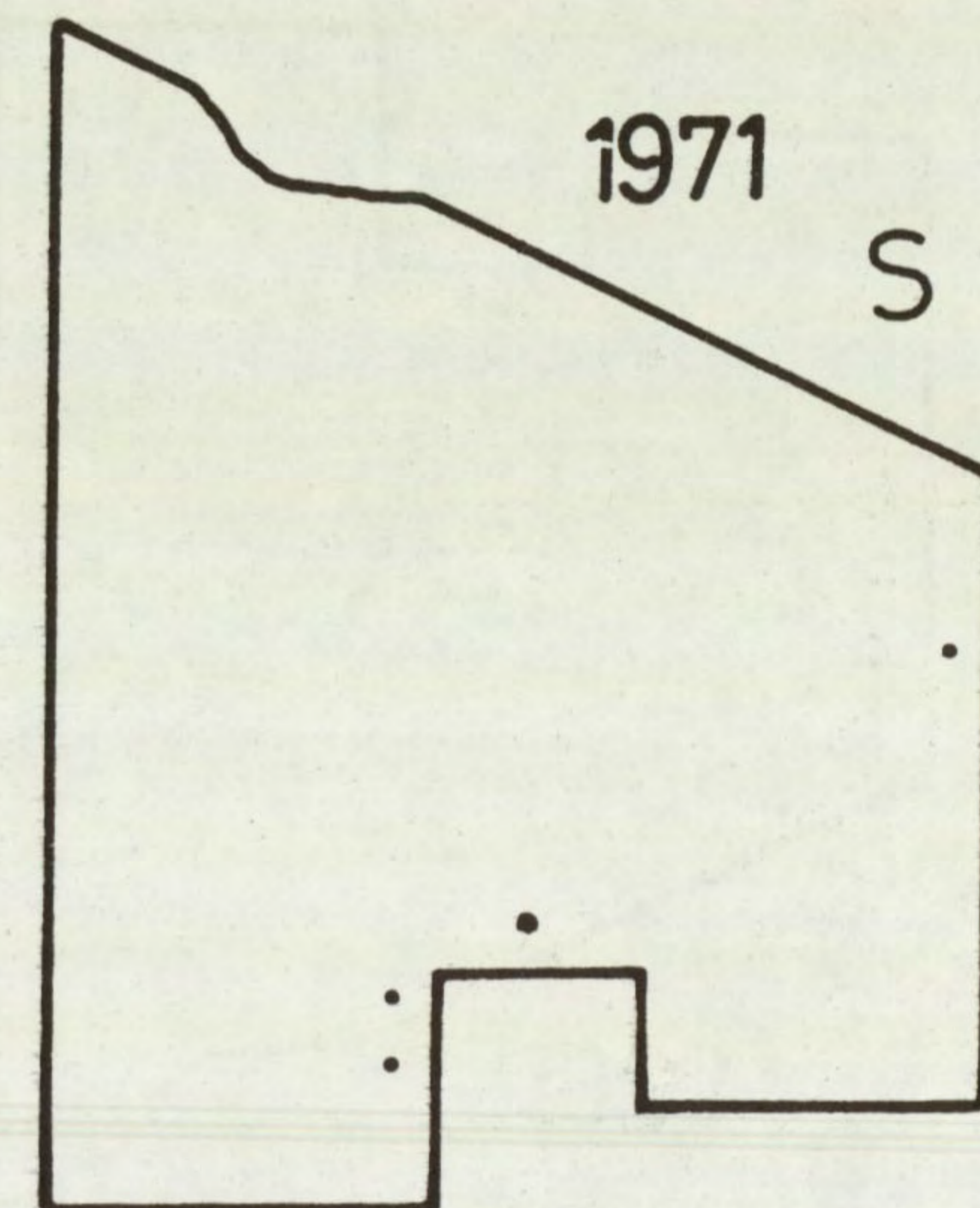
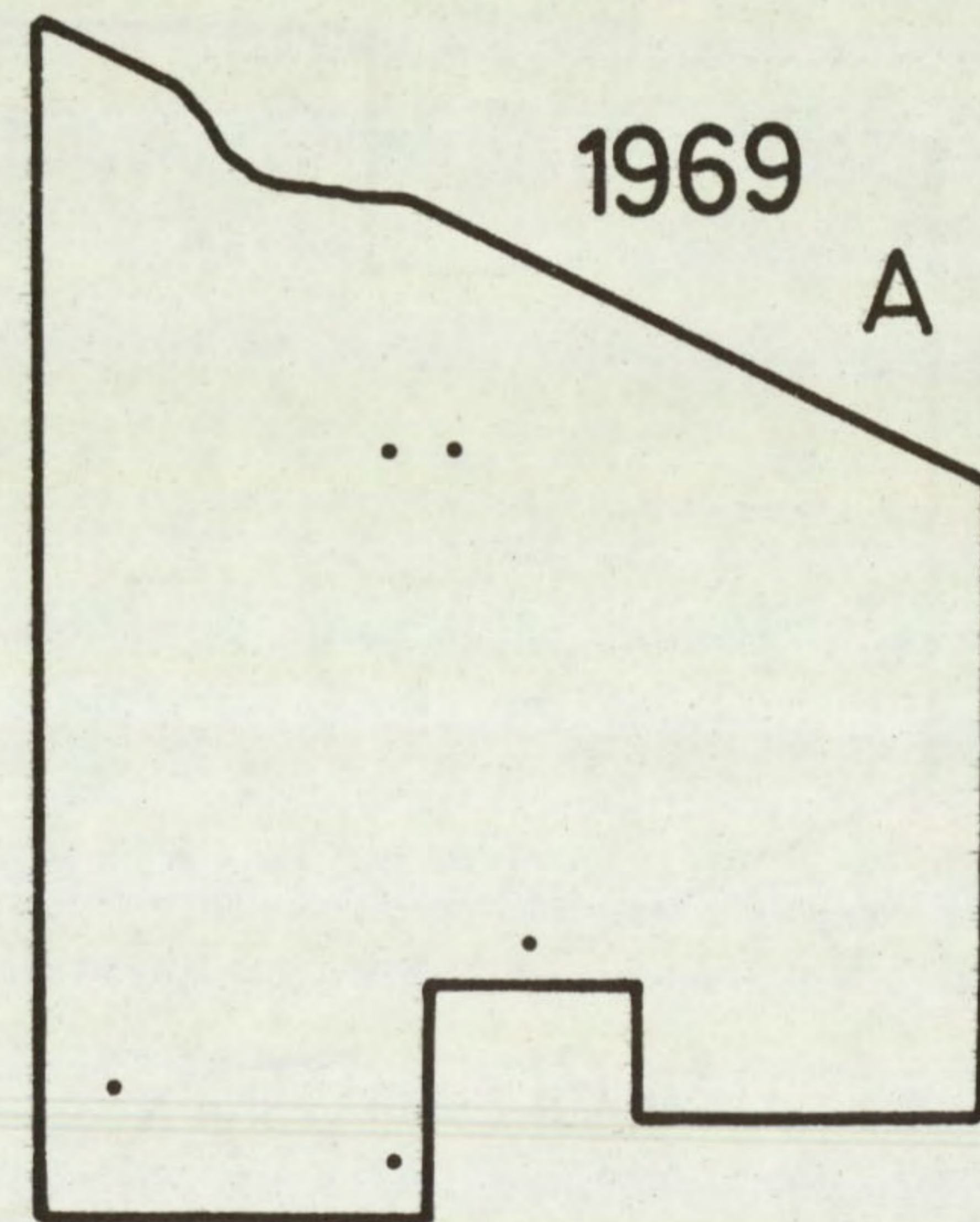
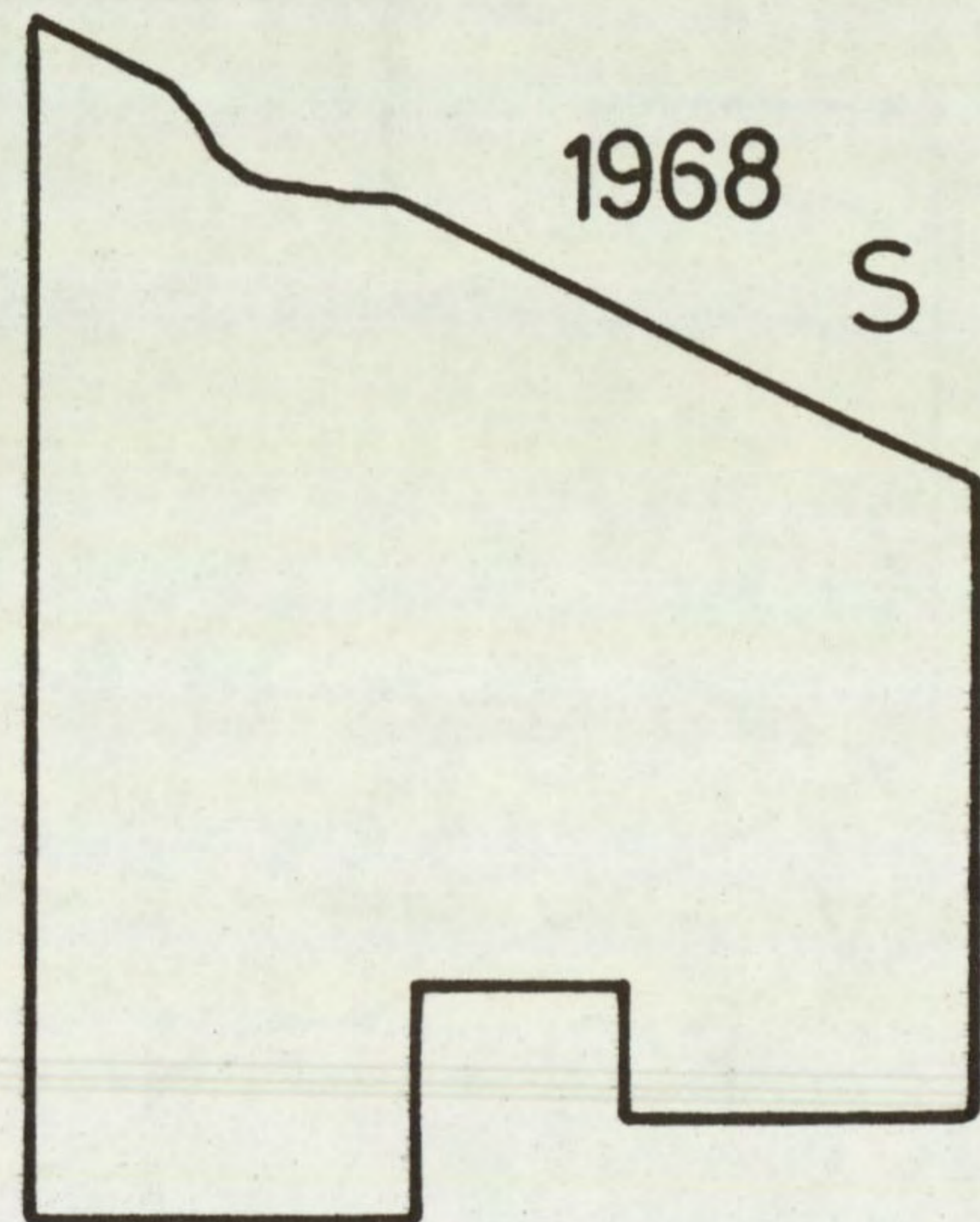
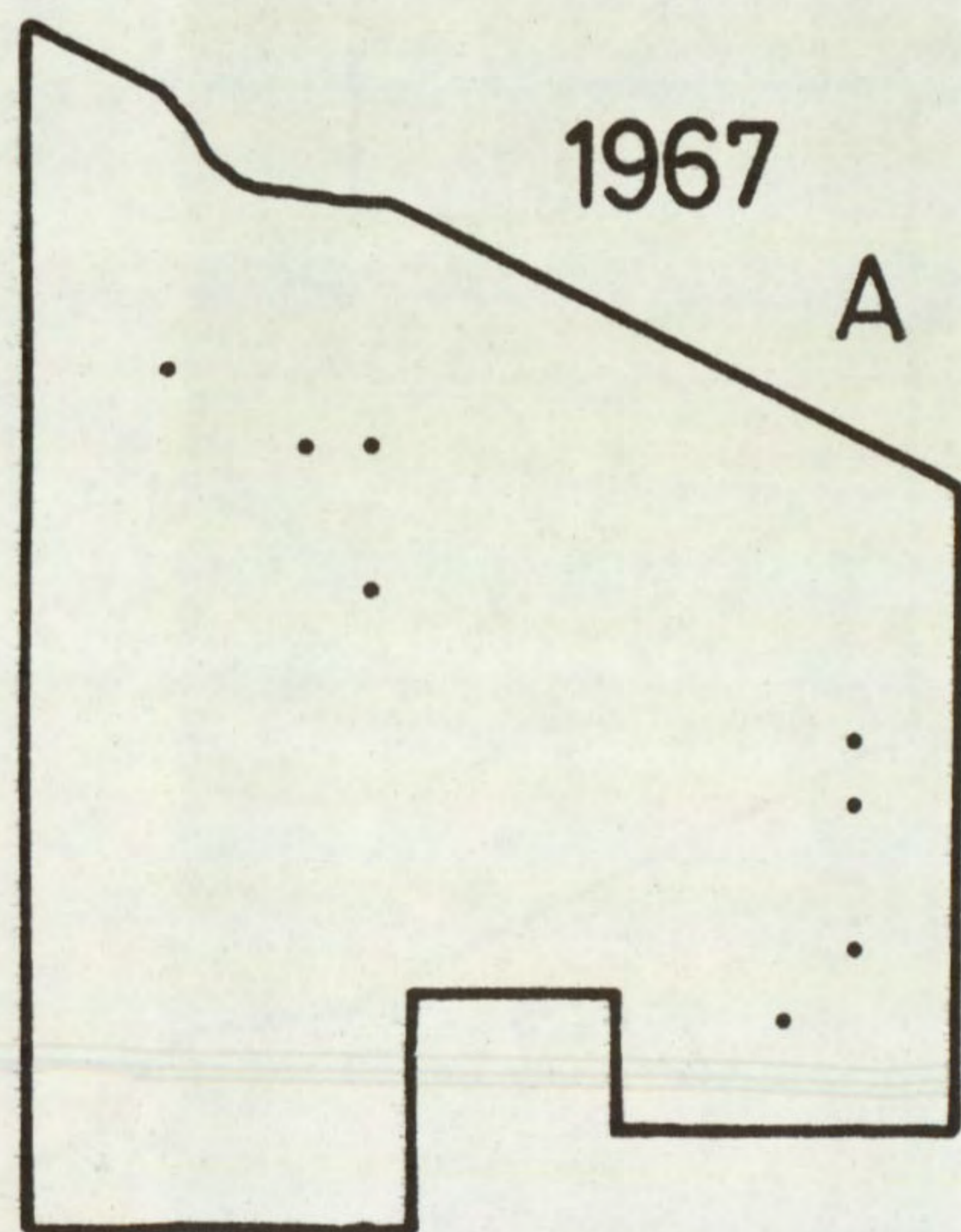
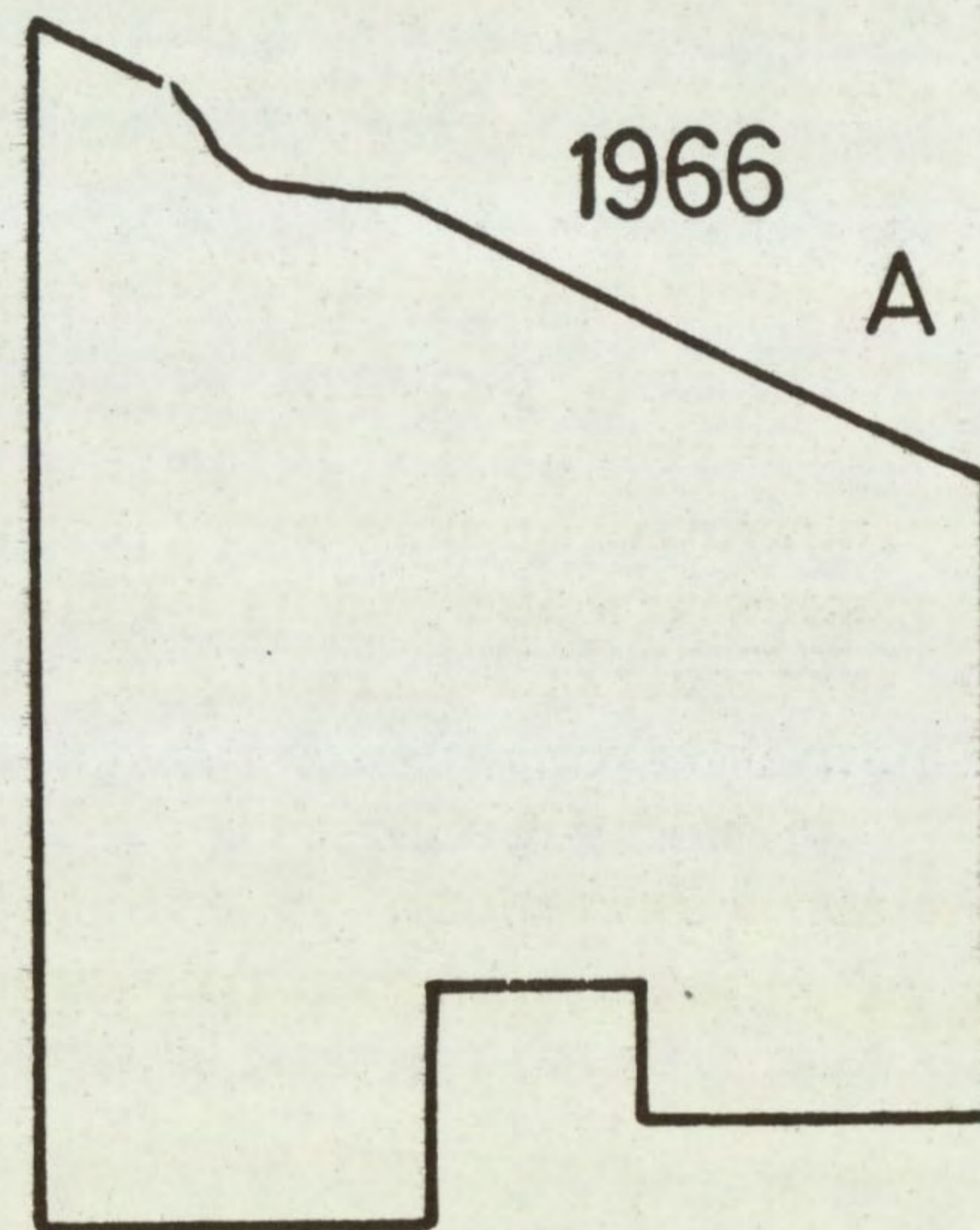
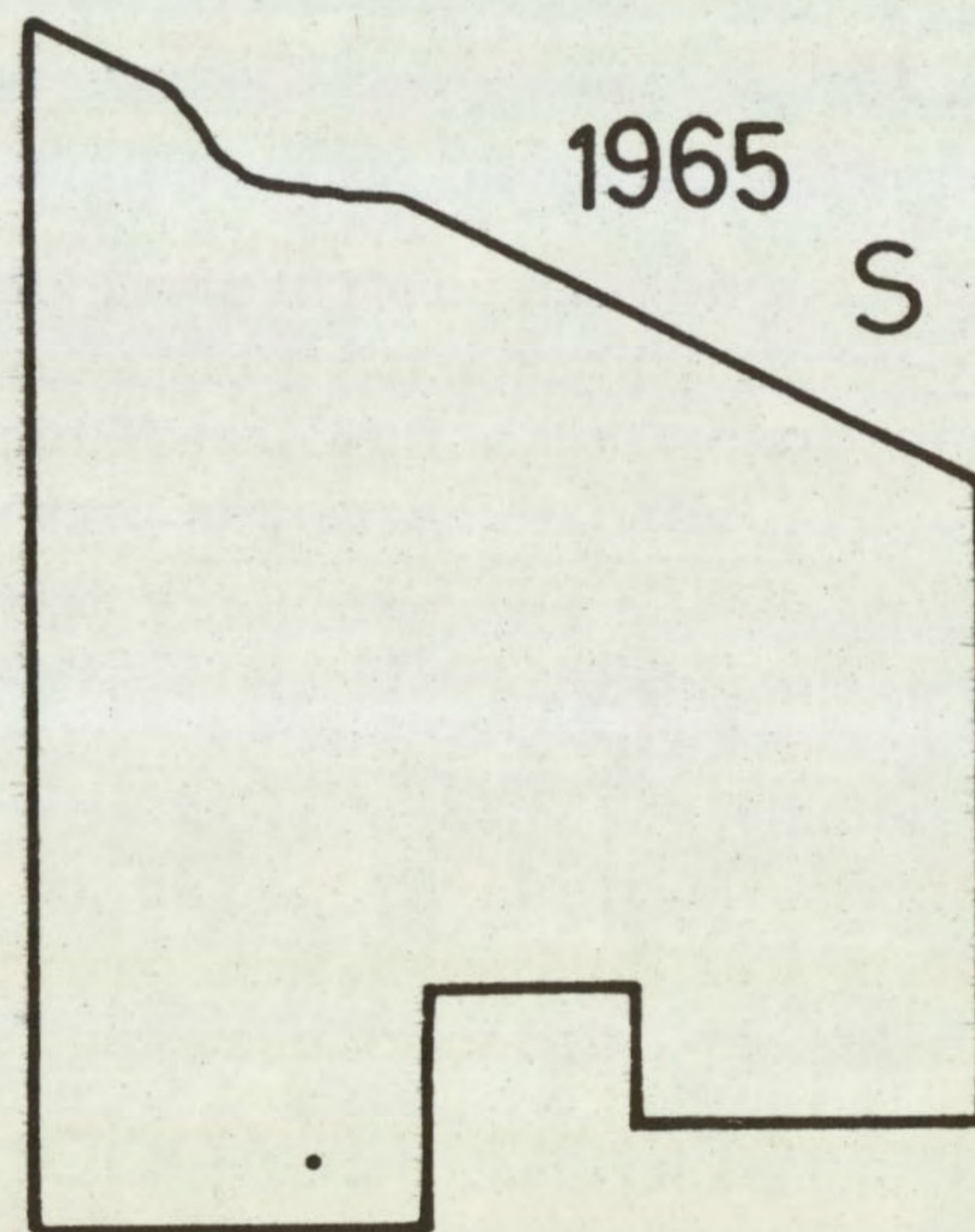
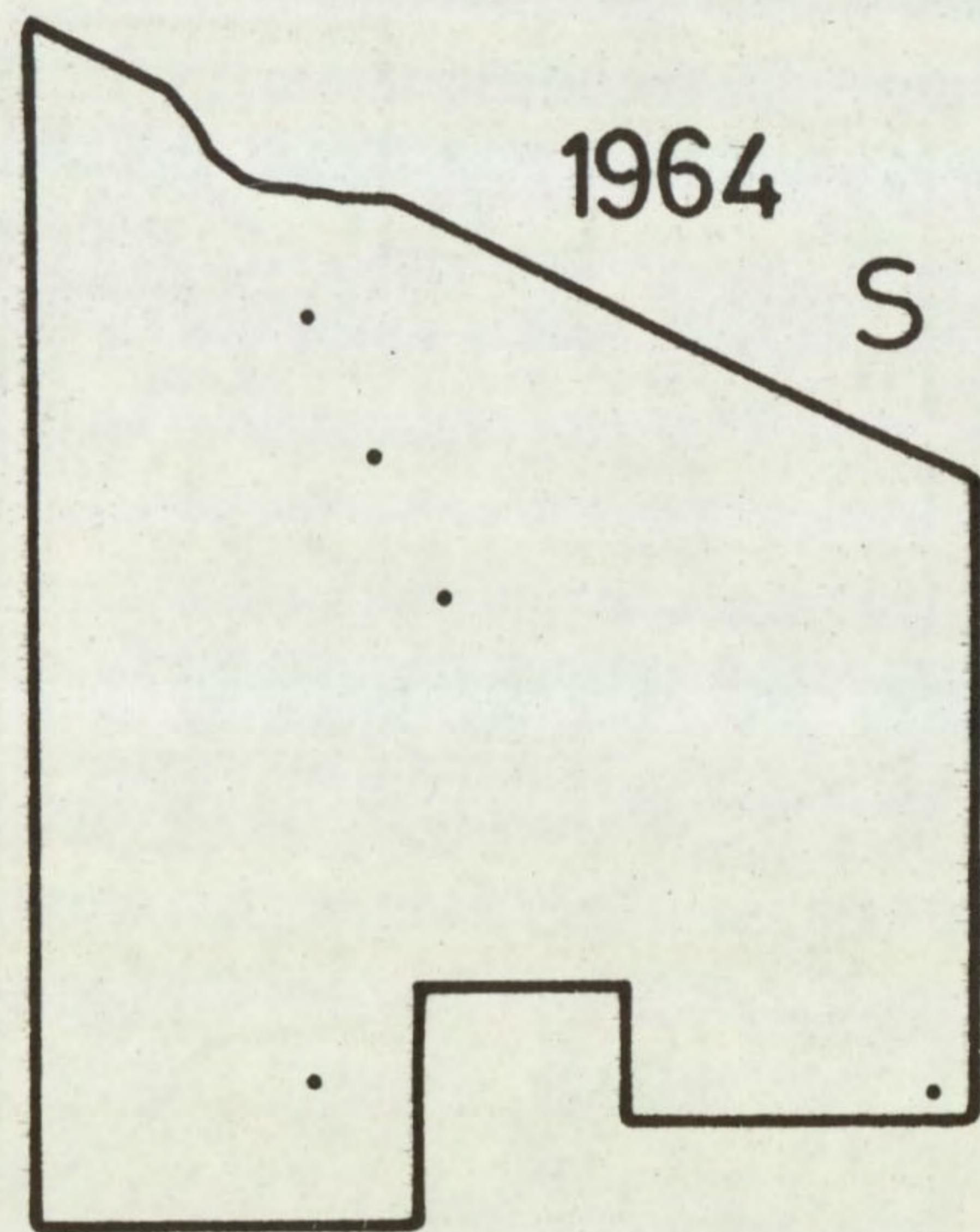
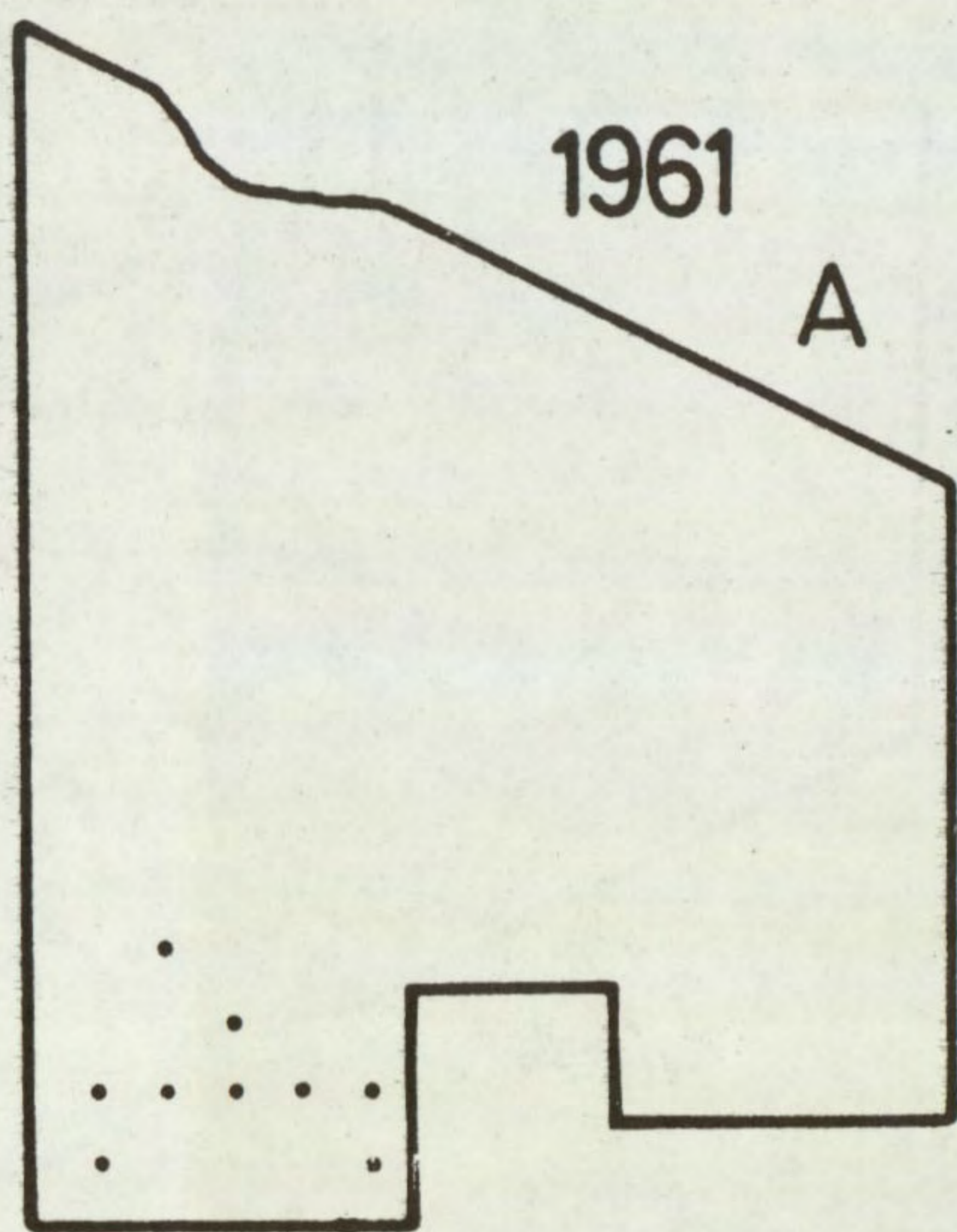
Like *Fumaria officinalis*, this weed was sown unwittingly as a contaminant of crop seed in a cultivation made probably during the 1939-45 war. The seeds are known to be able to survive many years in the soil if undisturbed. The weed has no mechanism of seed dispersal and in all the assessments between 1961 and 1981 it has remained mainly within the area in which it was originally planted. This species germinates mostly in spring and consequently higher numbers of seedlings were recorded in spring-sown crops than in autumn-sown ones. On average, four times more seedlings occurred in spring-sown crops than in autumn-sown ones.

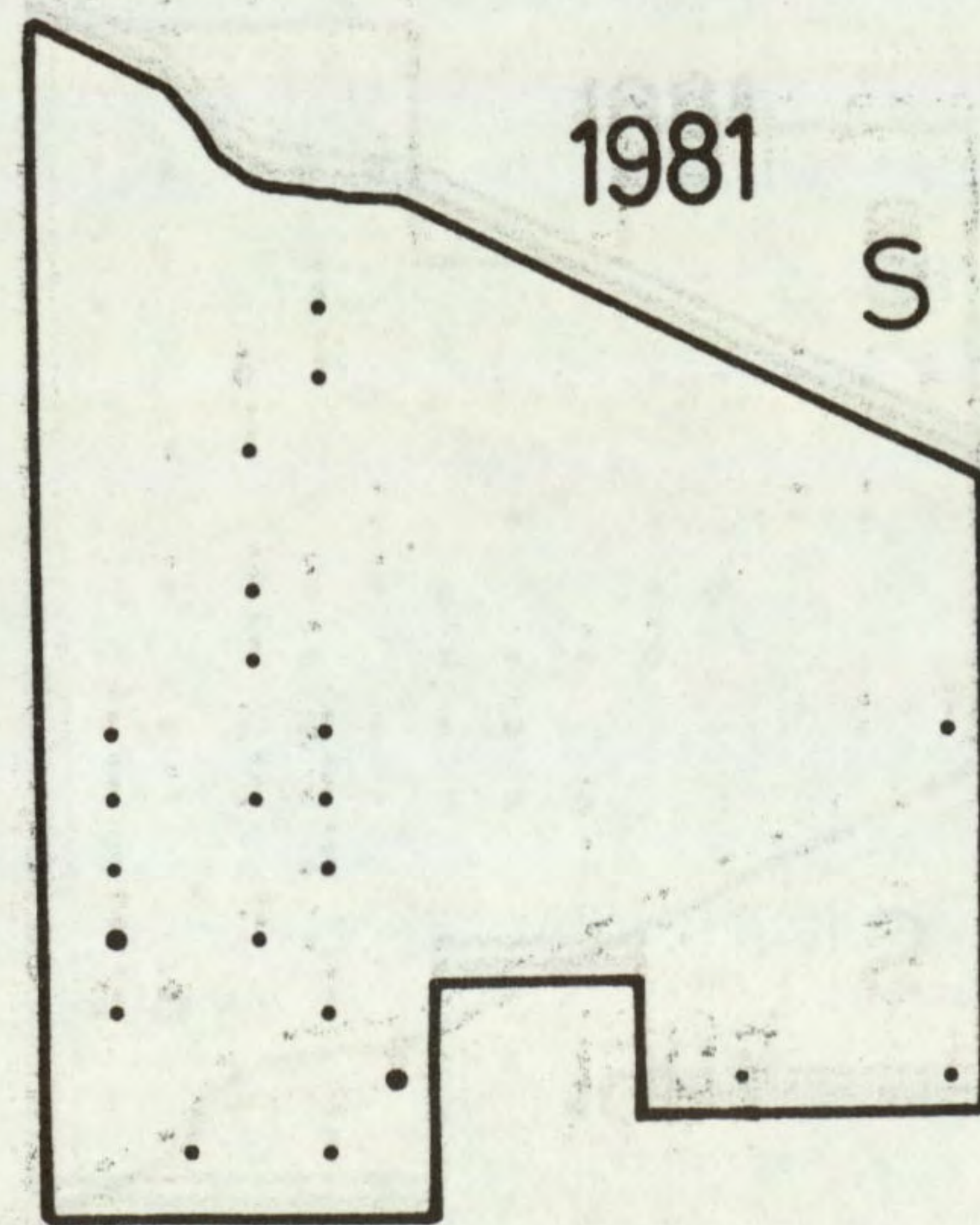
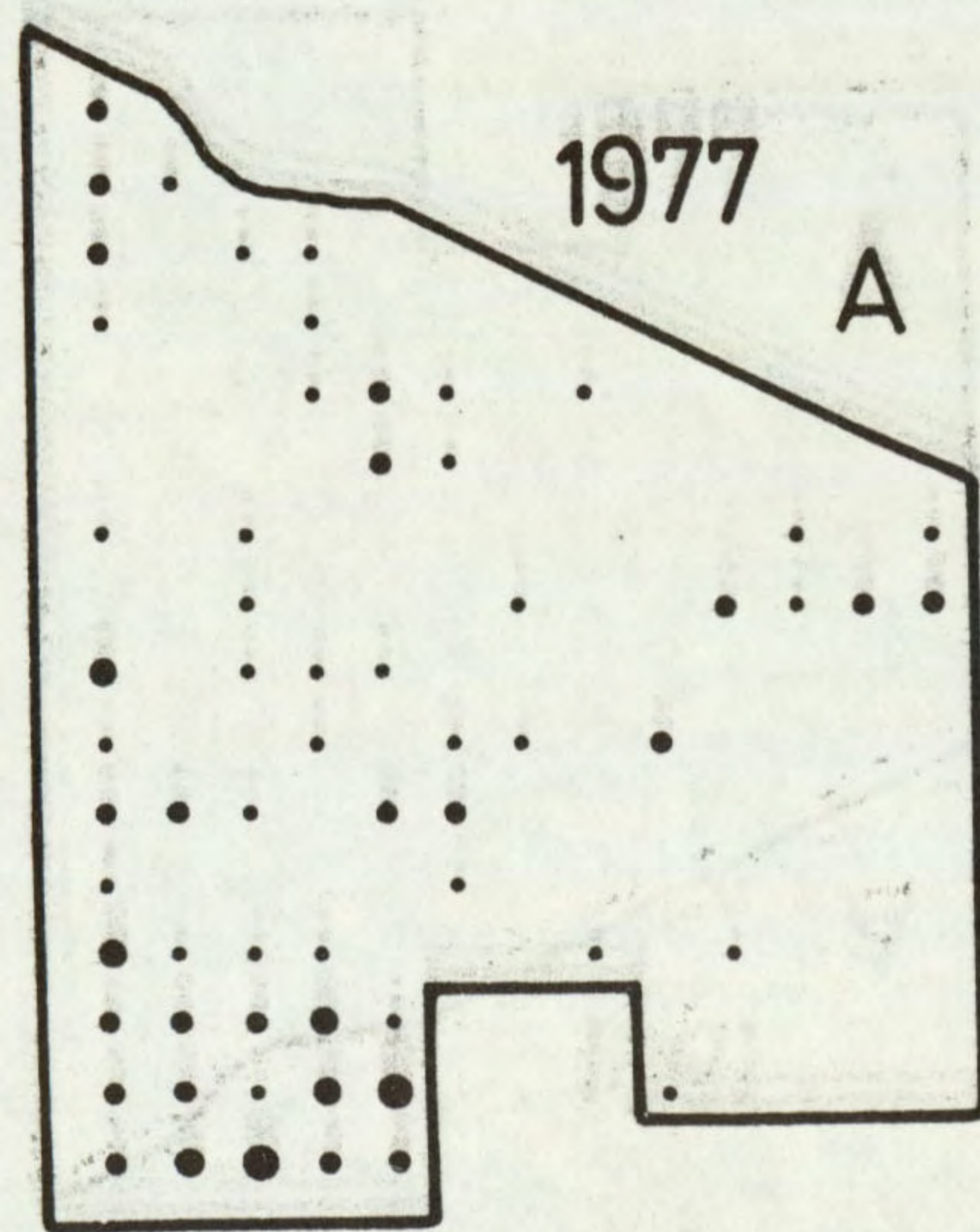
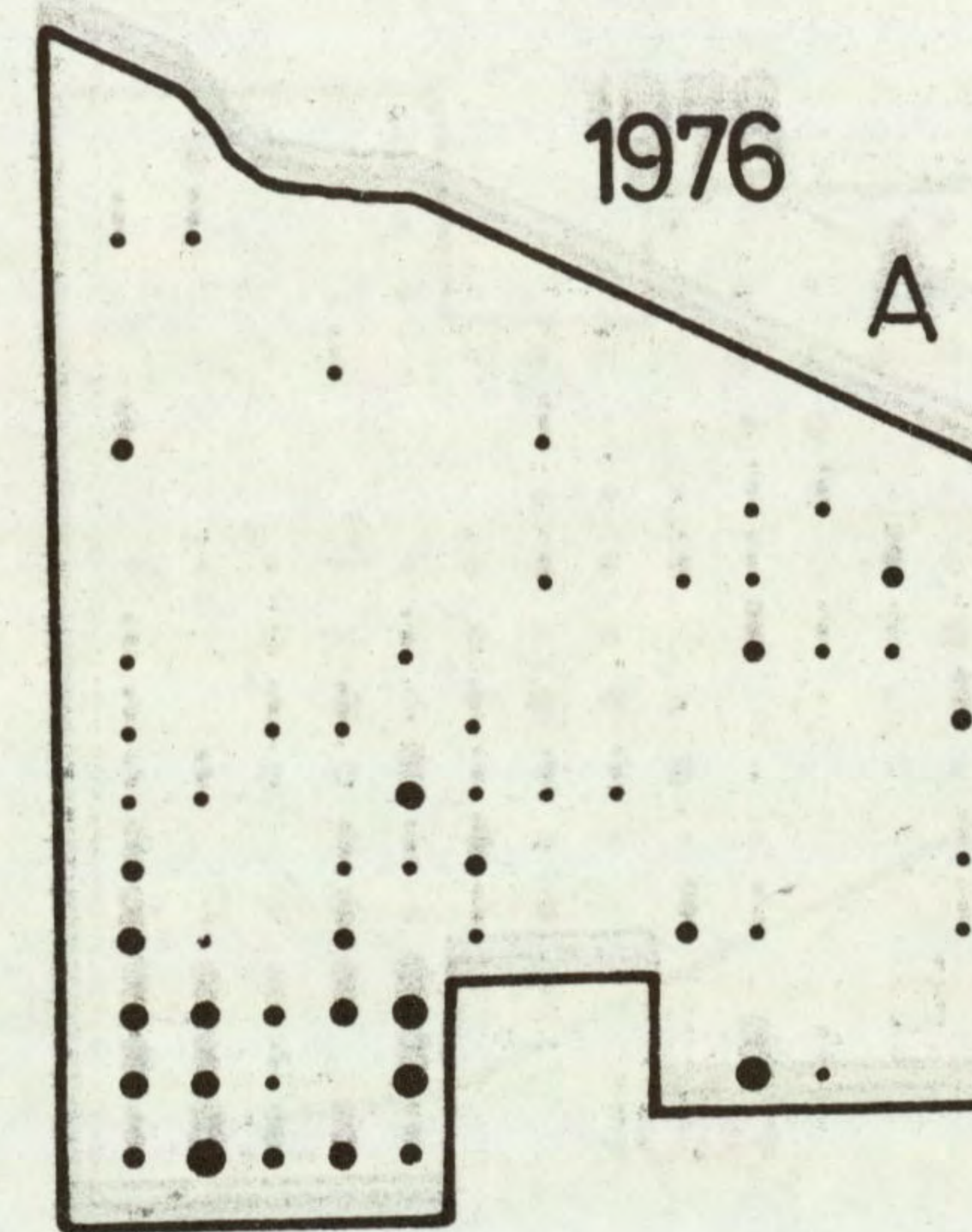
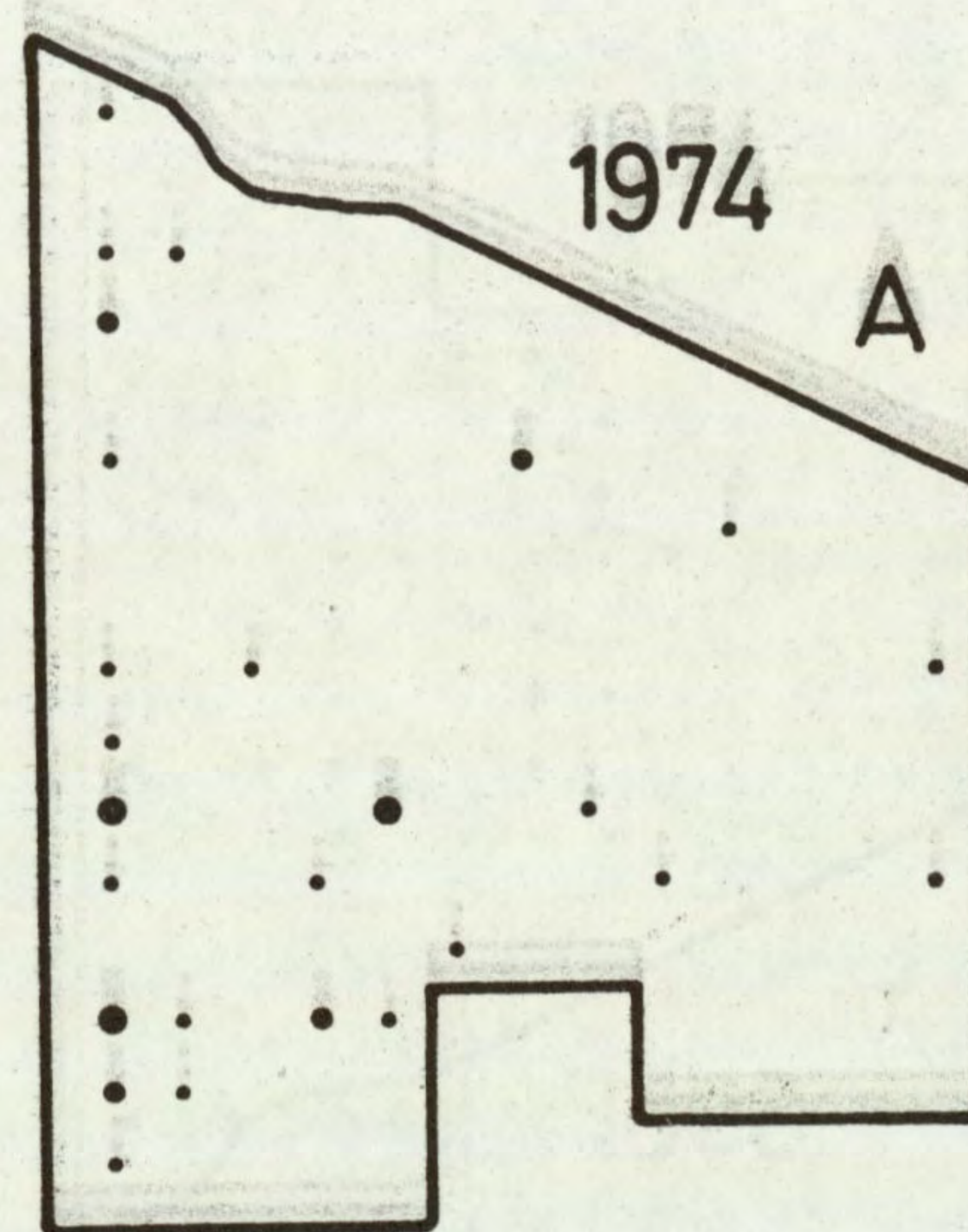
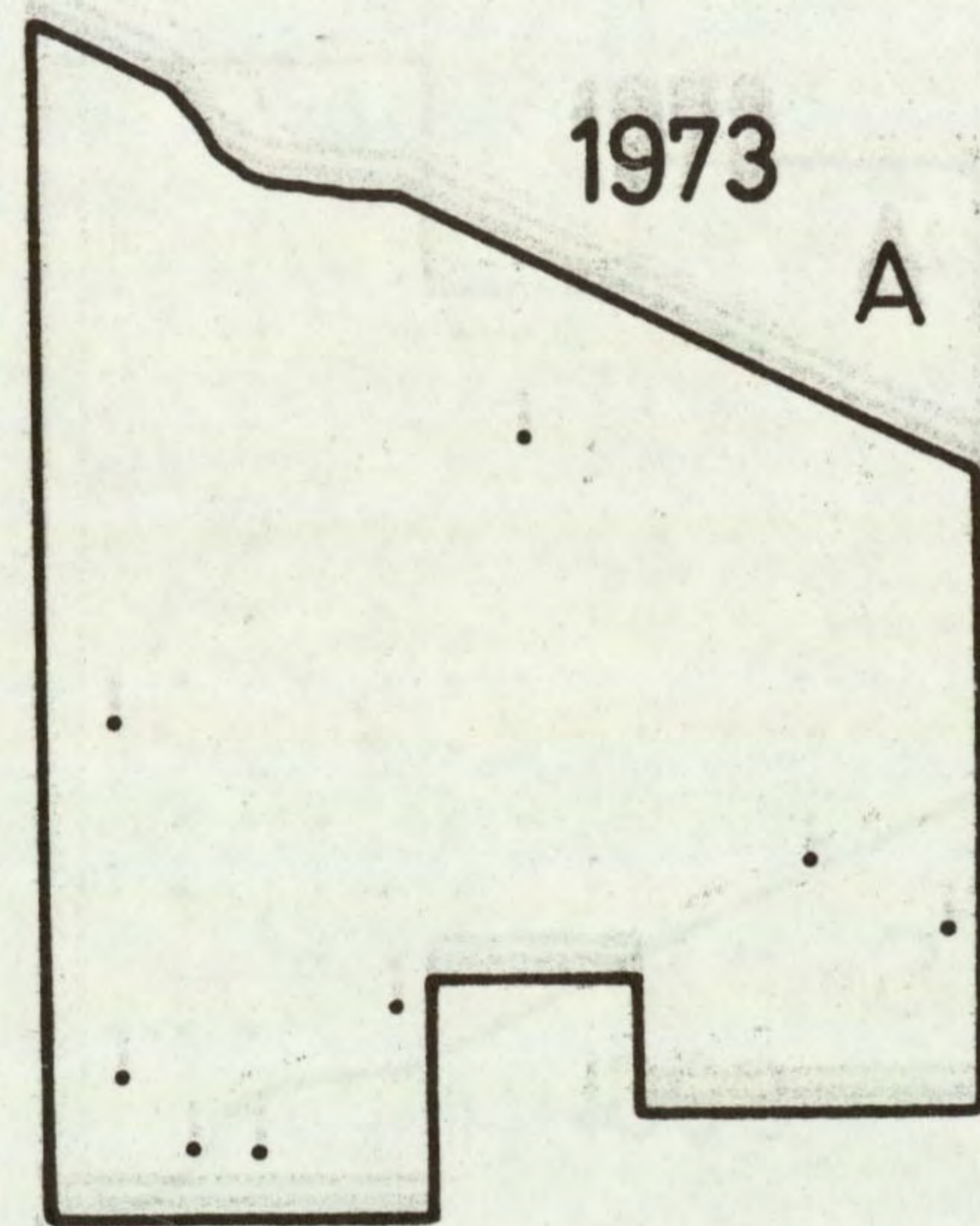
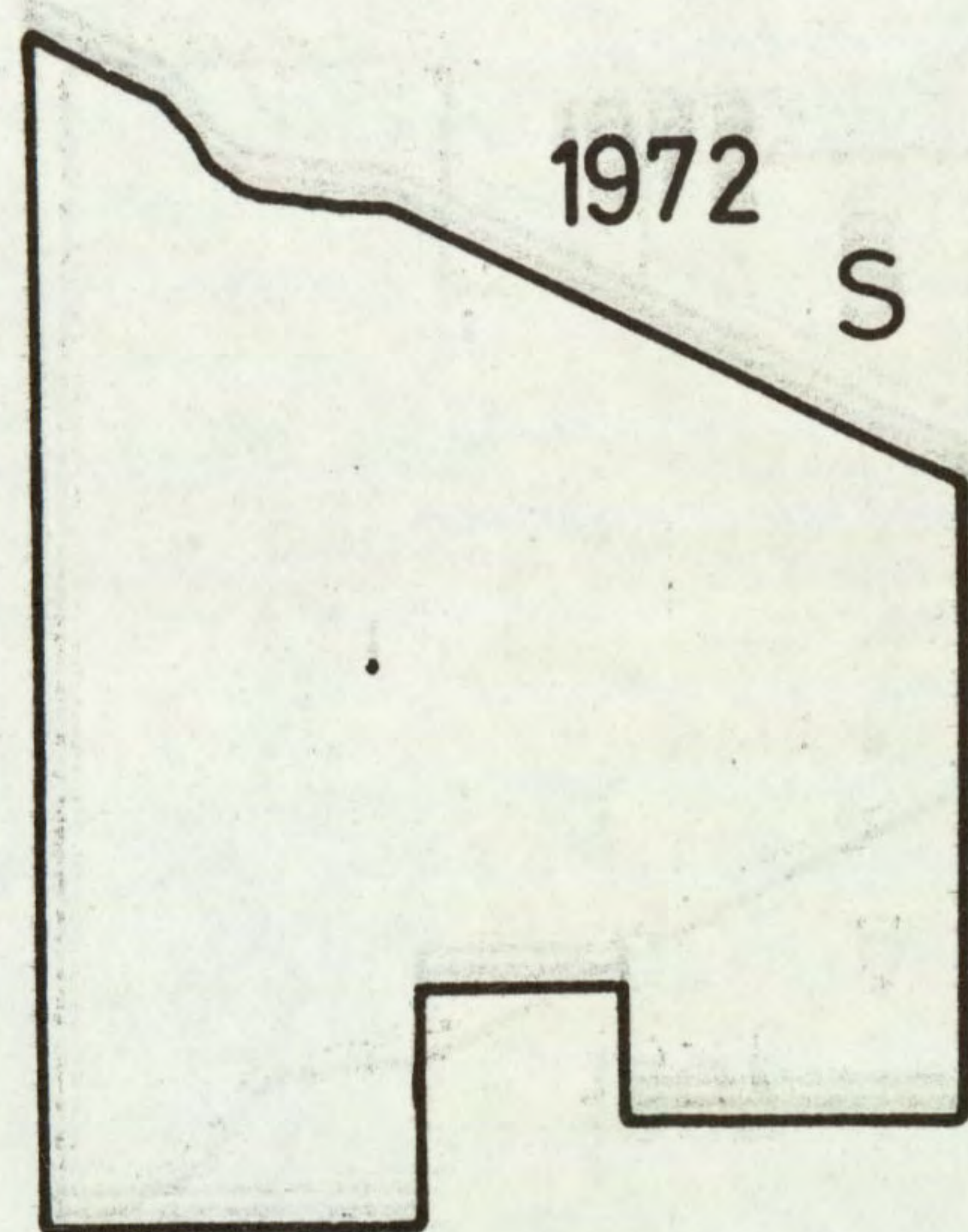




Papaver rhoeas

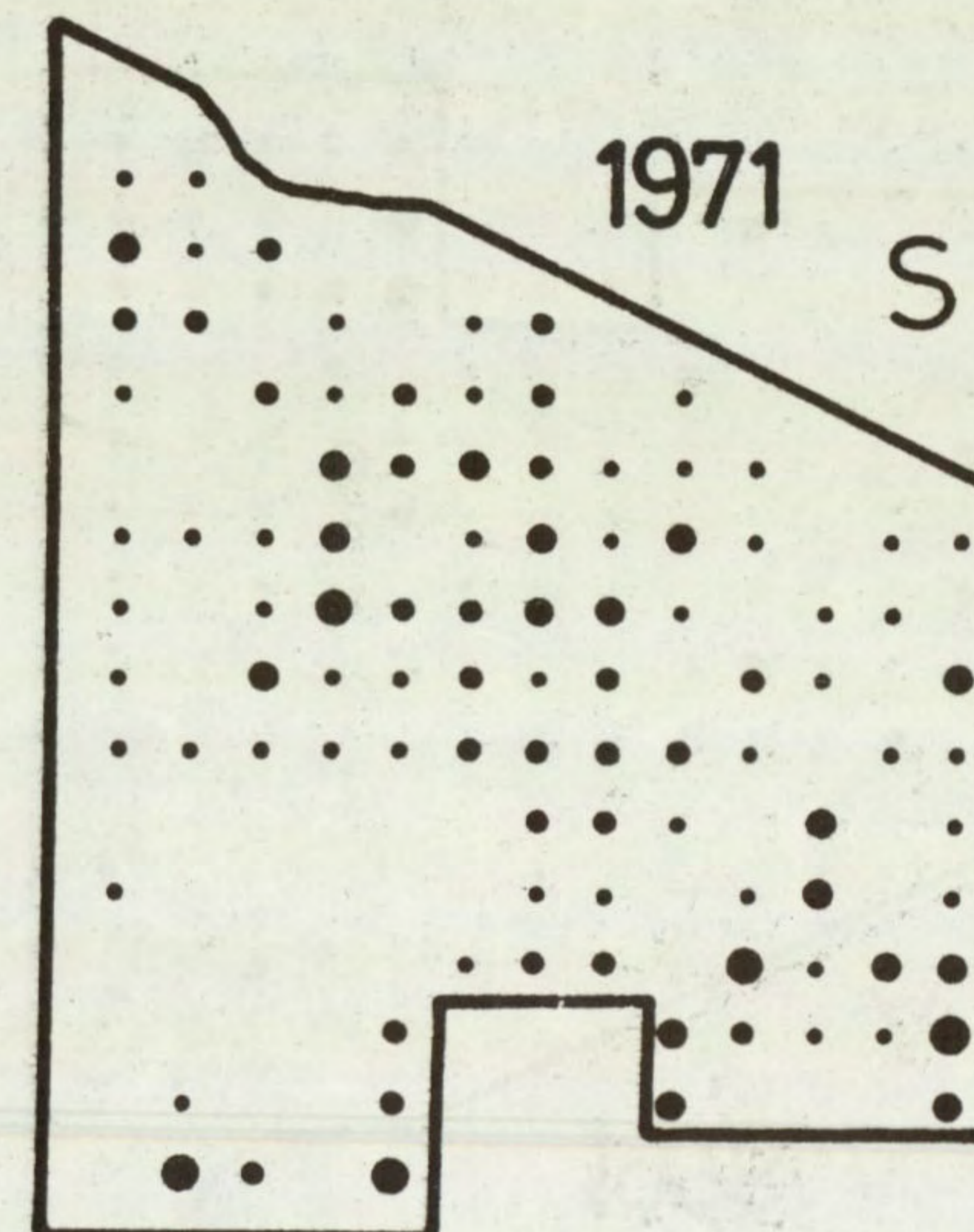
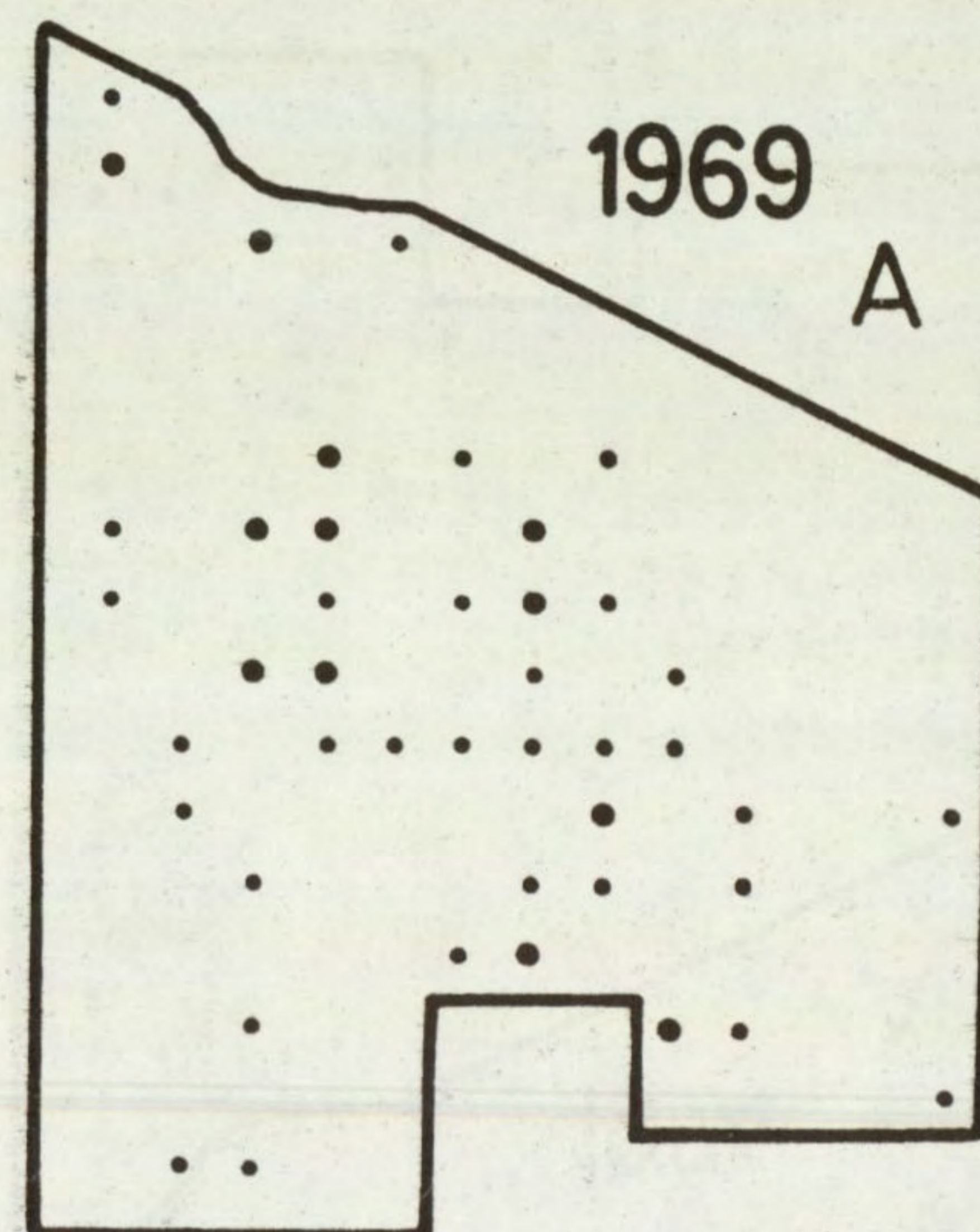
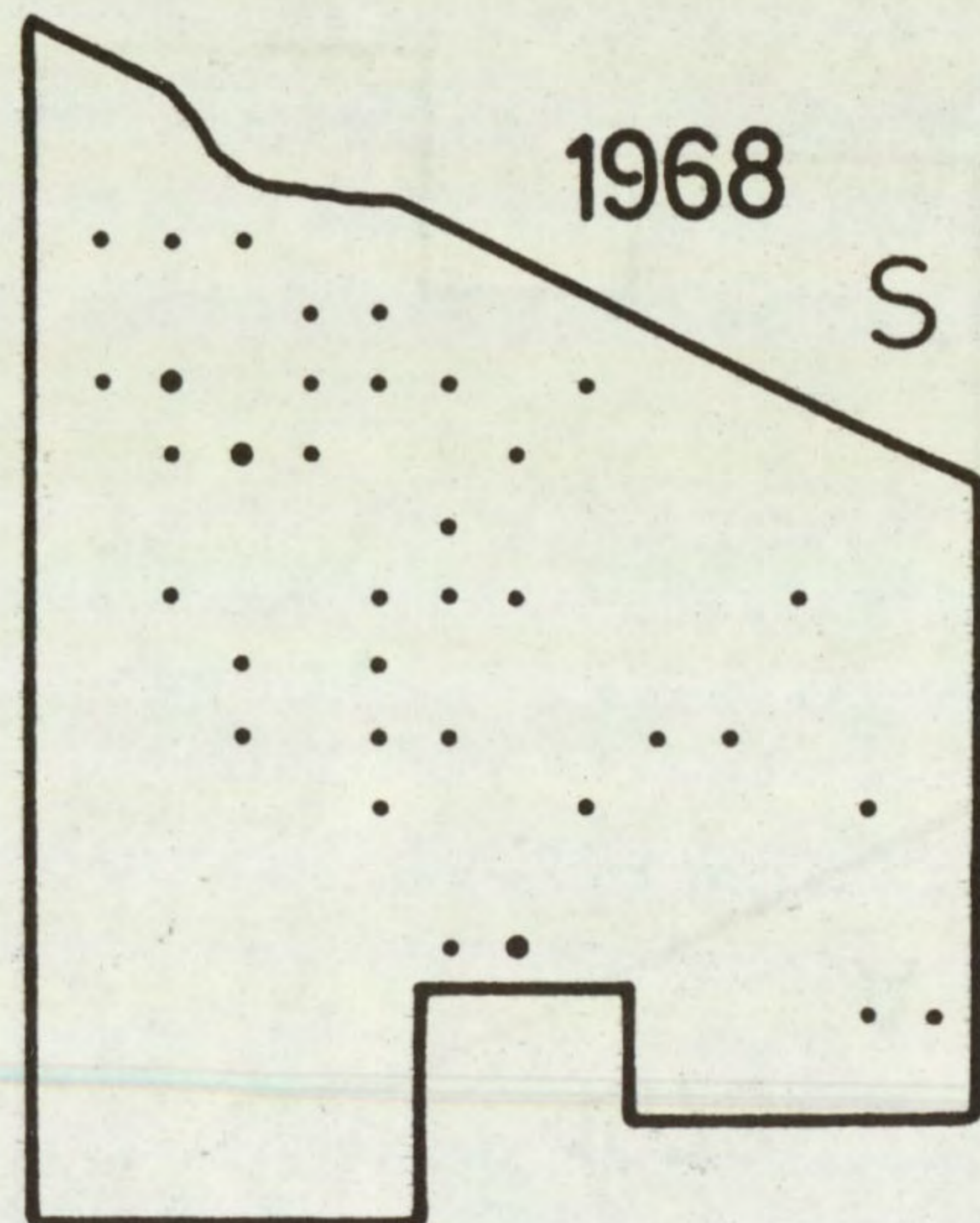
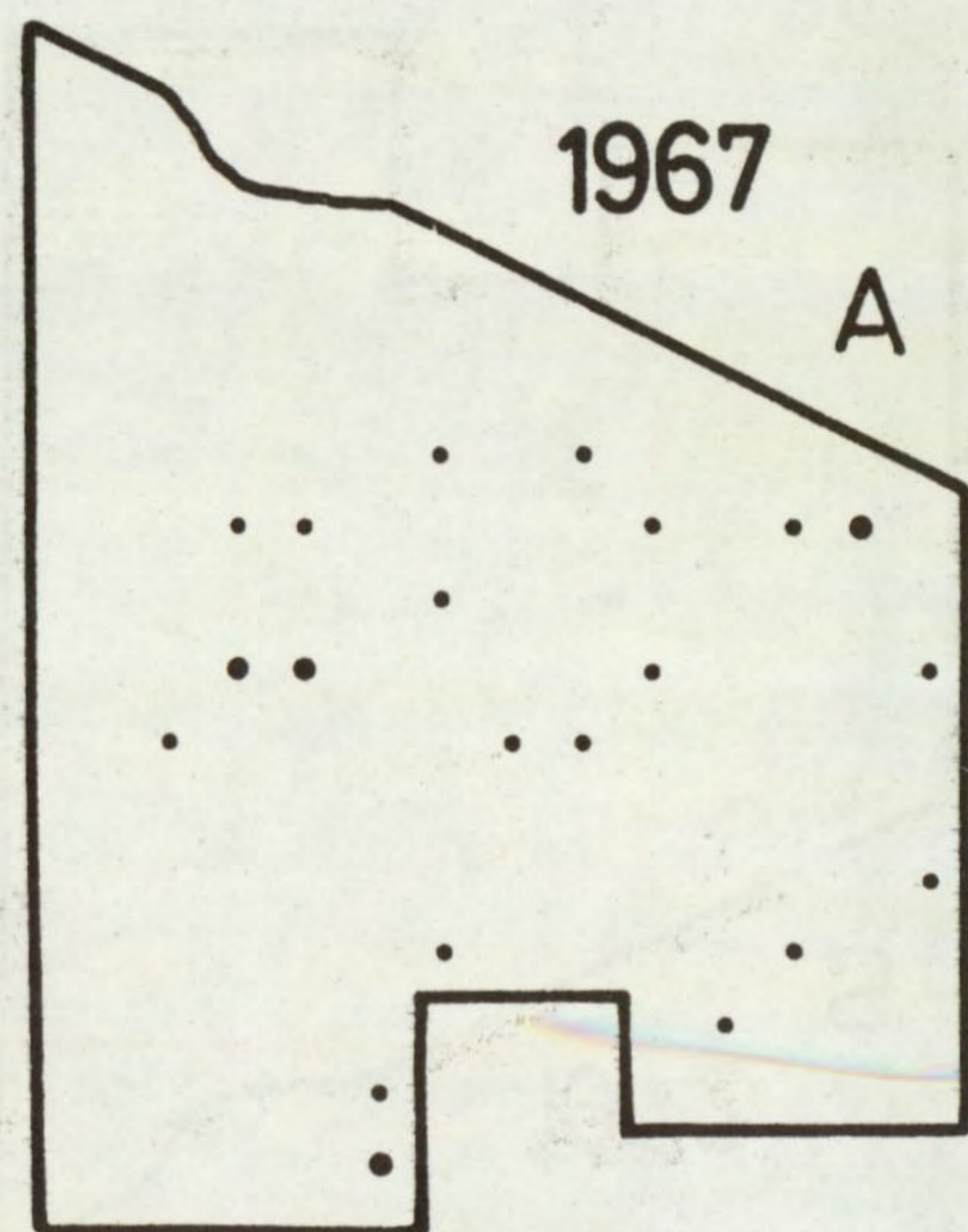
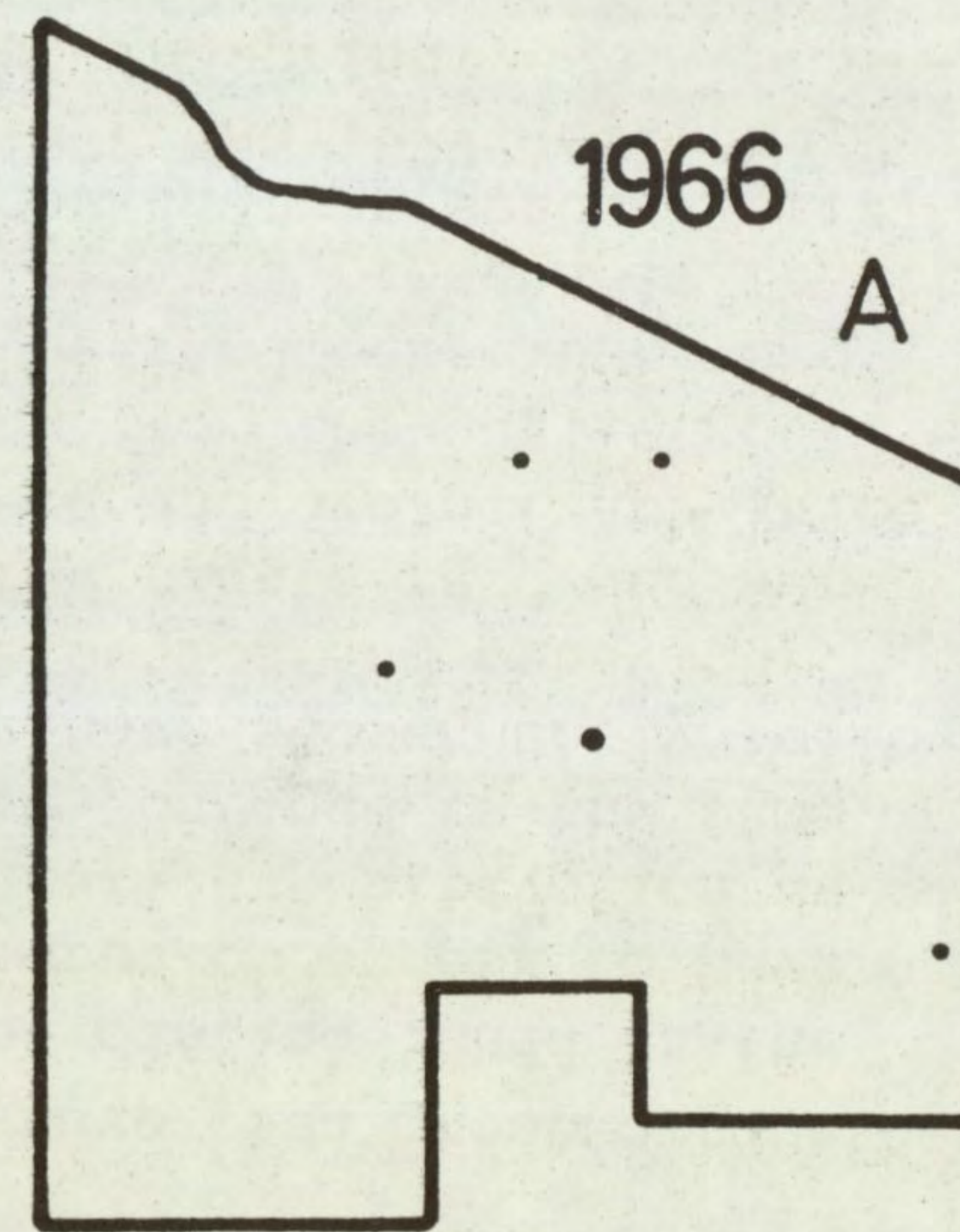
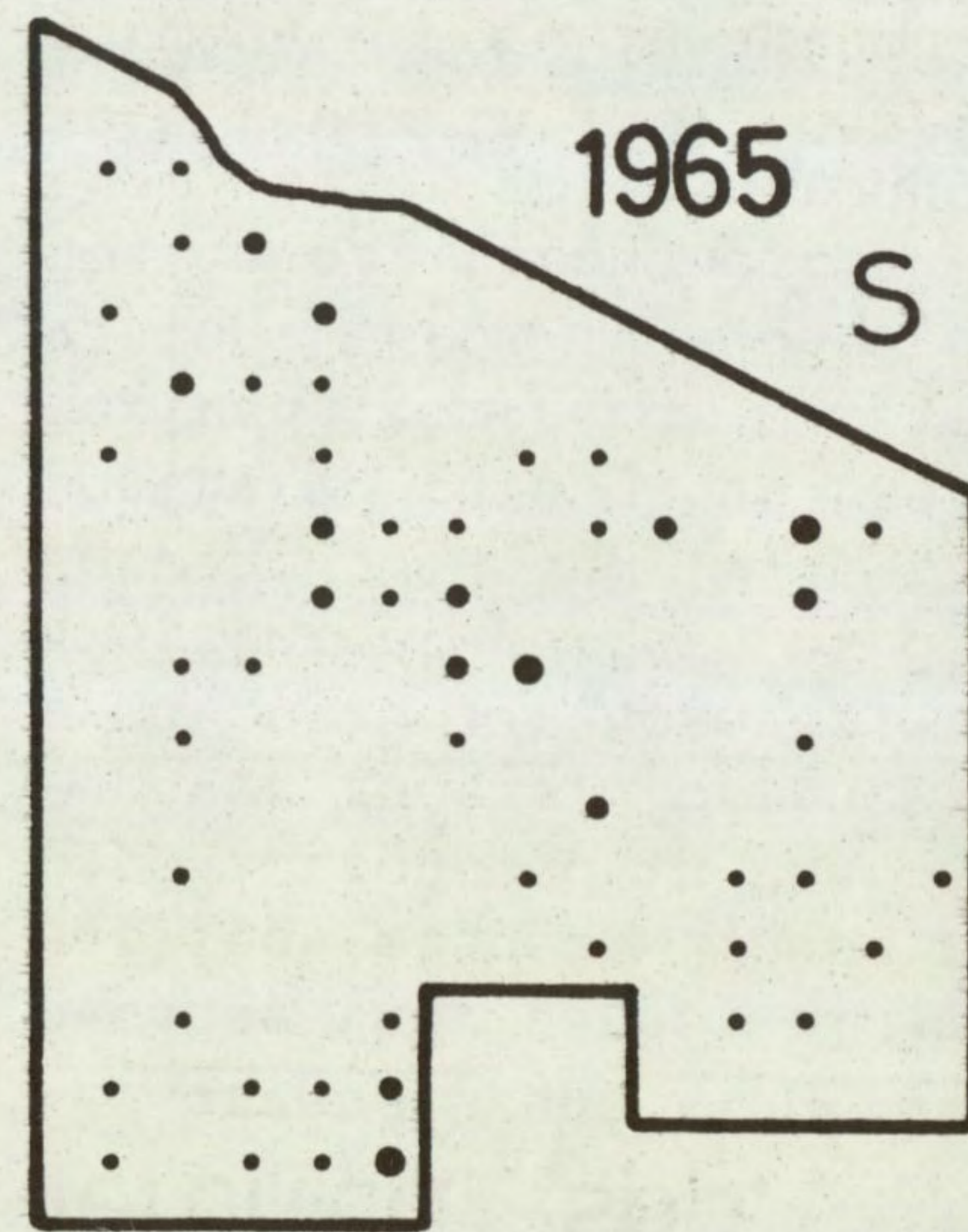
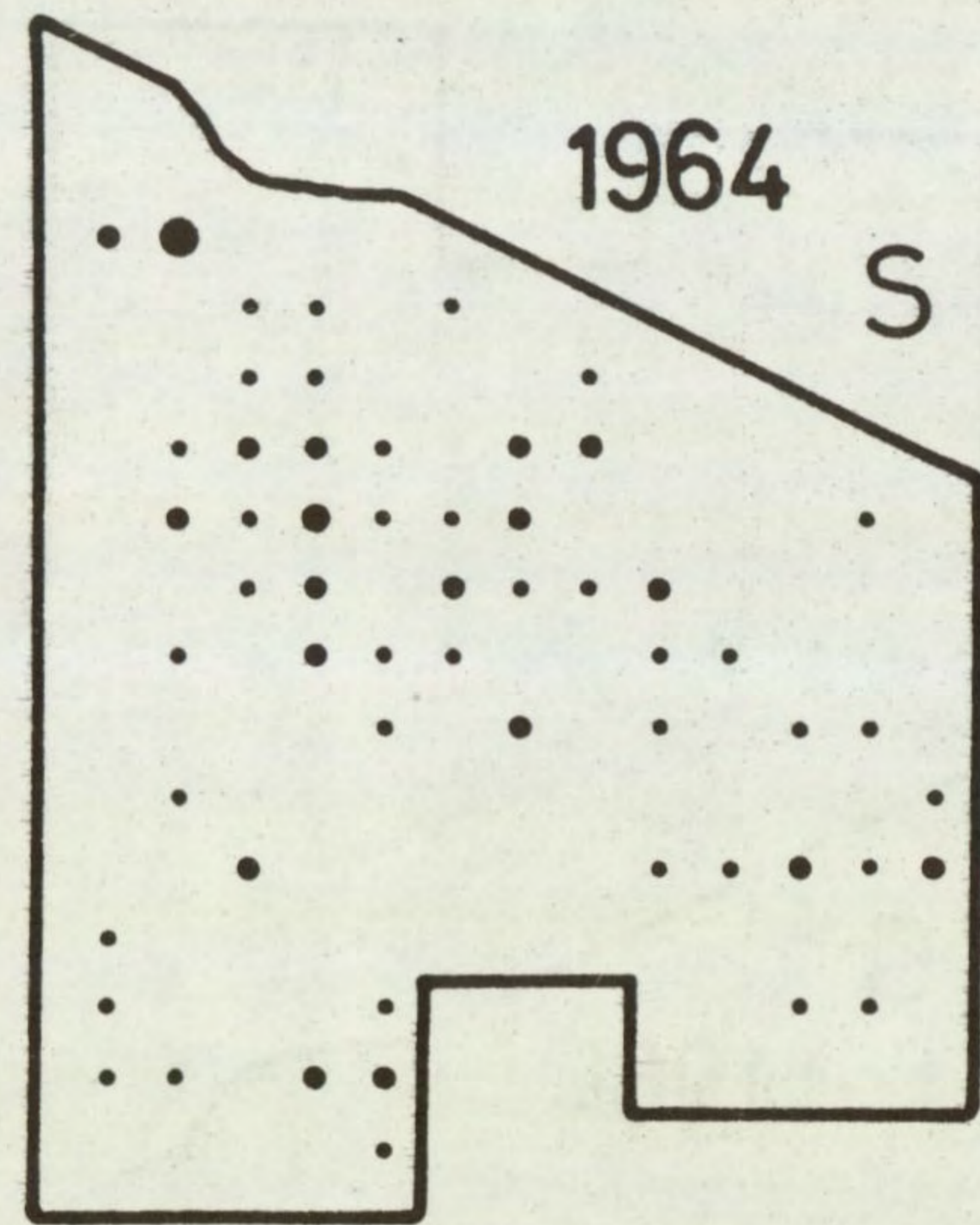
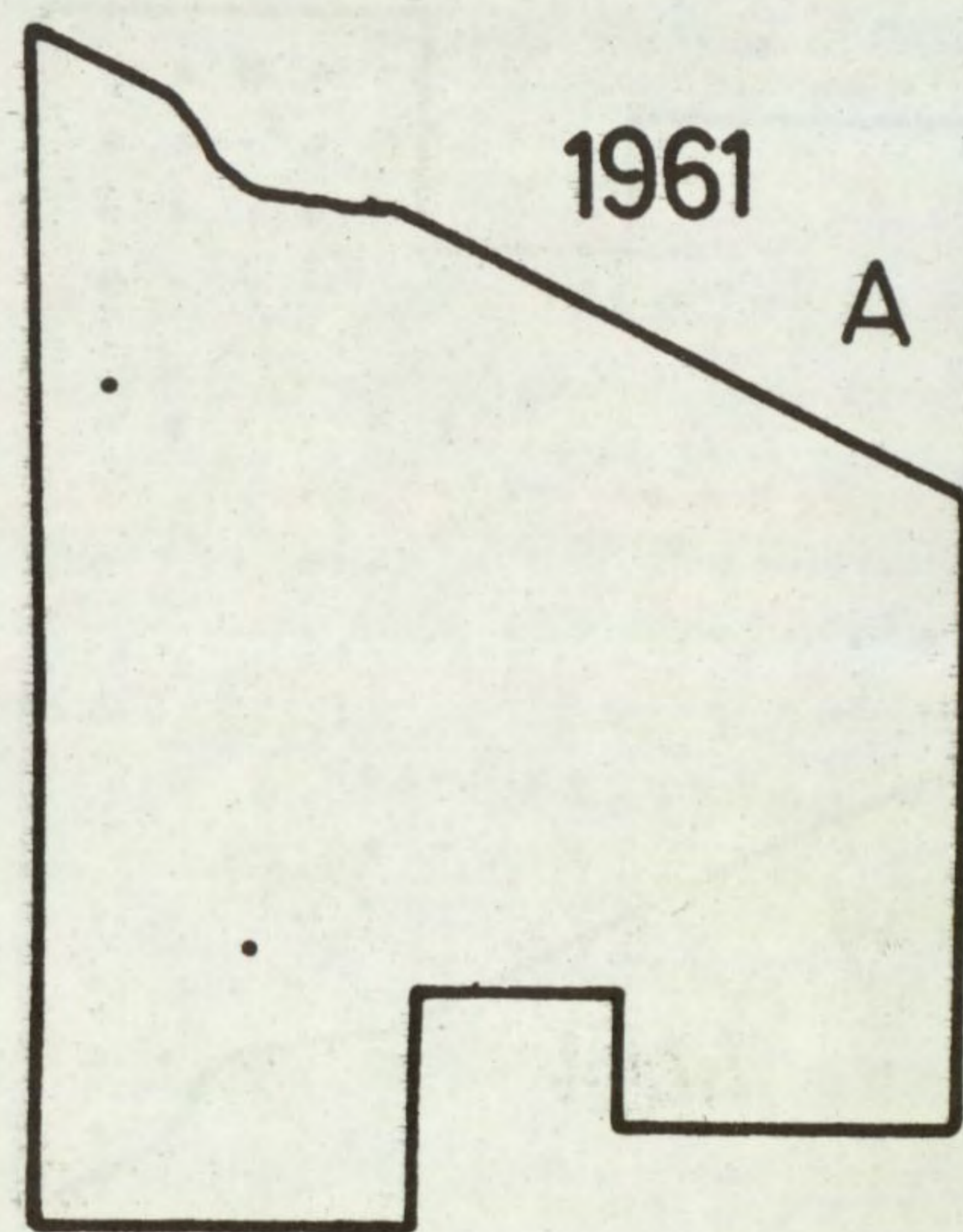
The area occupied by this species in 1961 after the field was ploughed out of grass indicates another earlier cultivation, which, because it conforms to the line of the original fence (Fig. 1) erected at some time during the previous eleven years, was more recent than the cultivation delimited by *Fumaria officinalis* and *Aethusa cynapium*. Again, like them, once planted this species persists indefinitely, a strong argument for planting clean crop seed. Similarly, it has remained very much where originally planted, having no mechanism for seed dispersal to a distance.

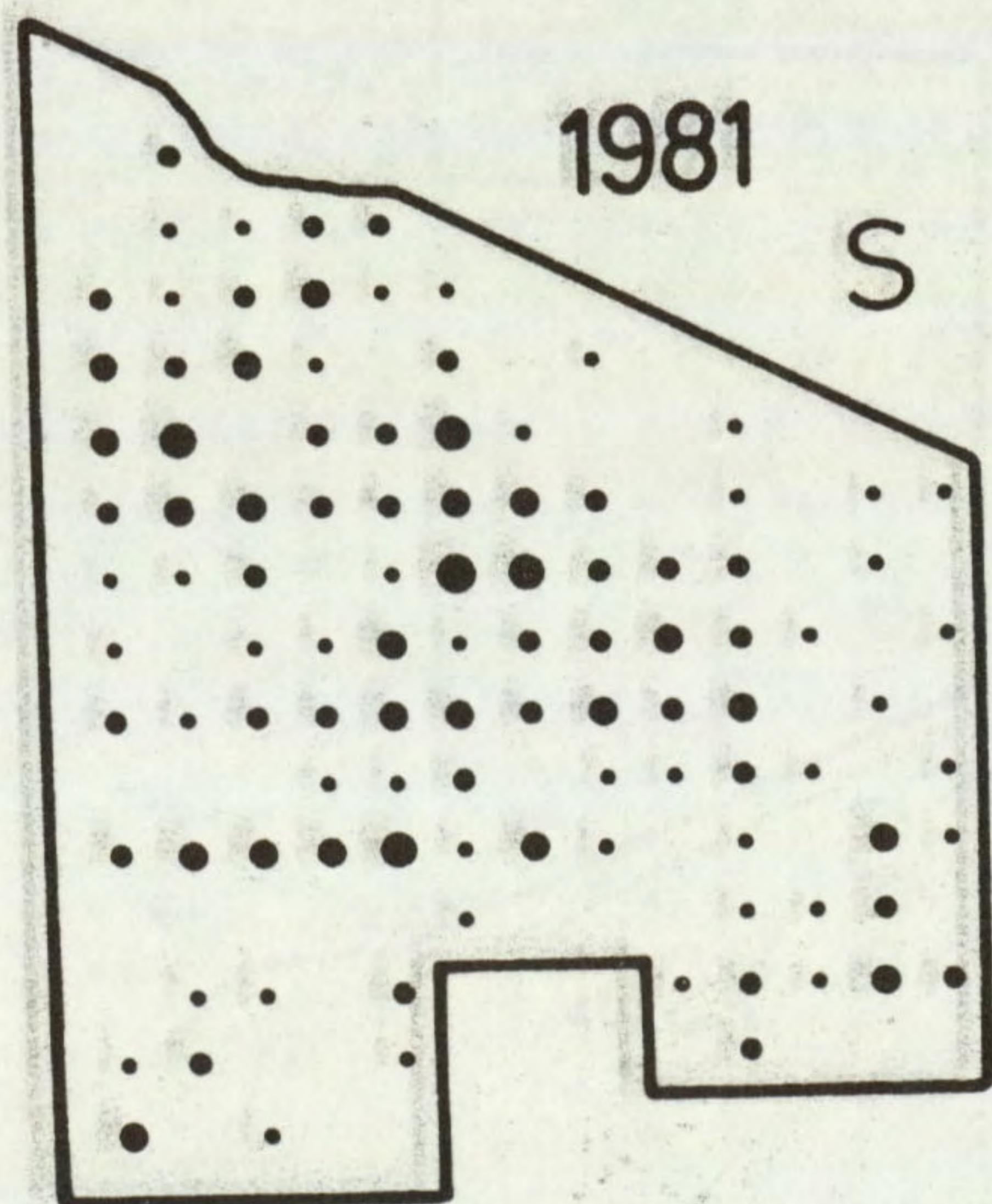
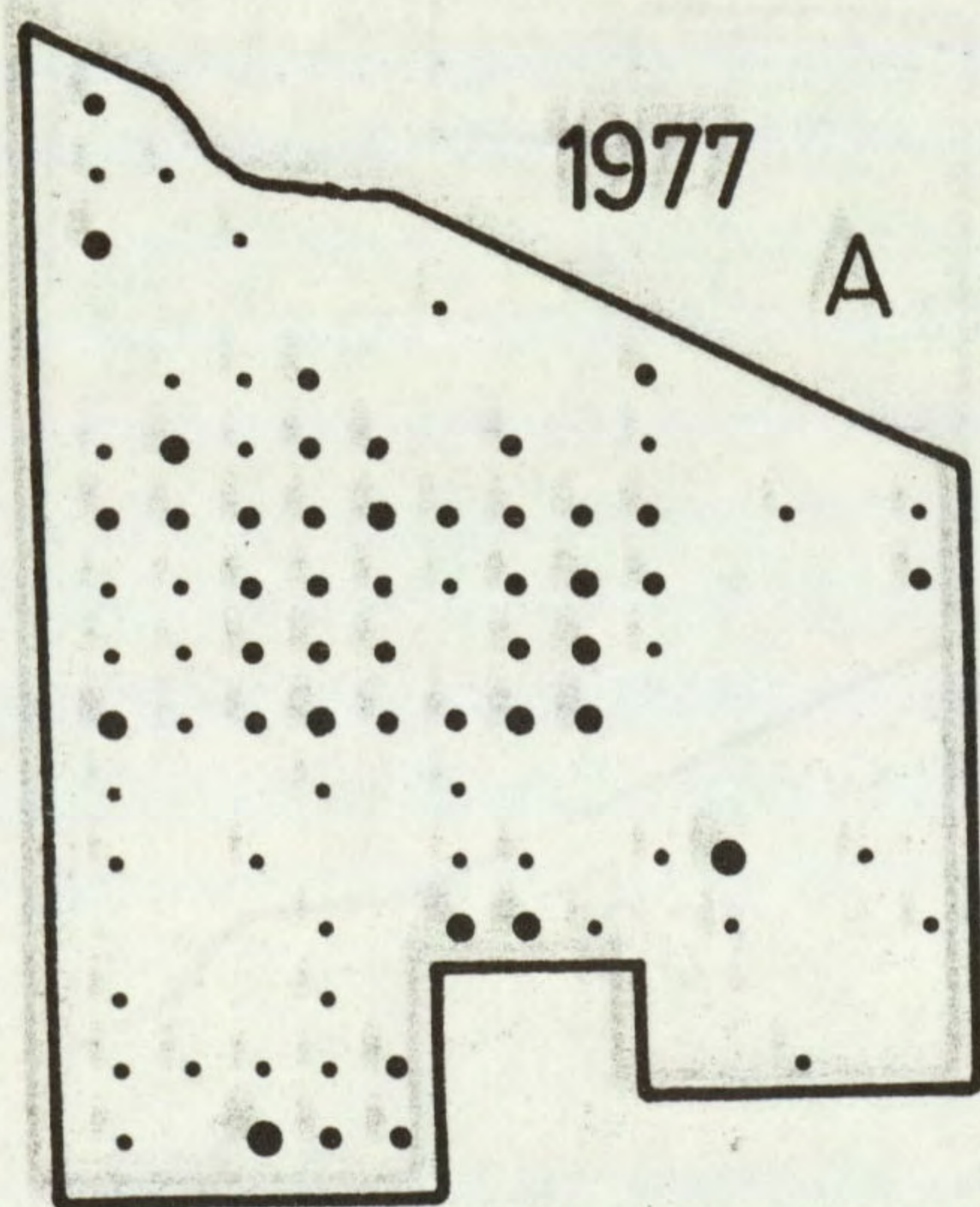
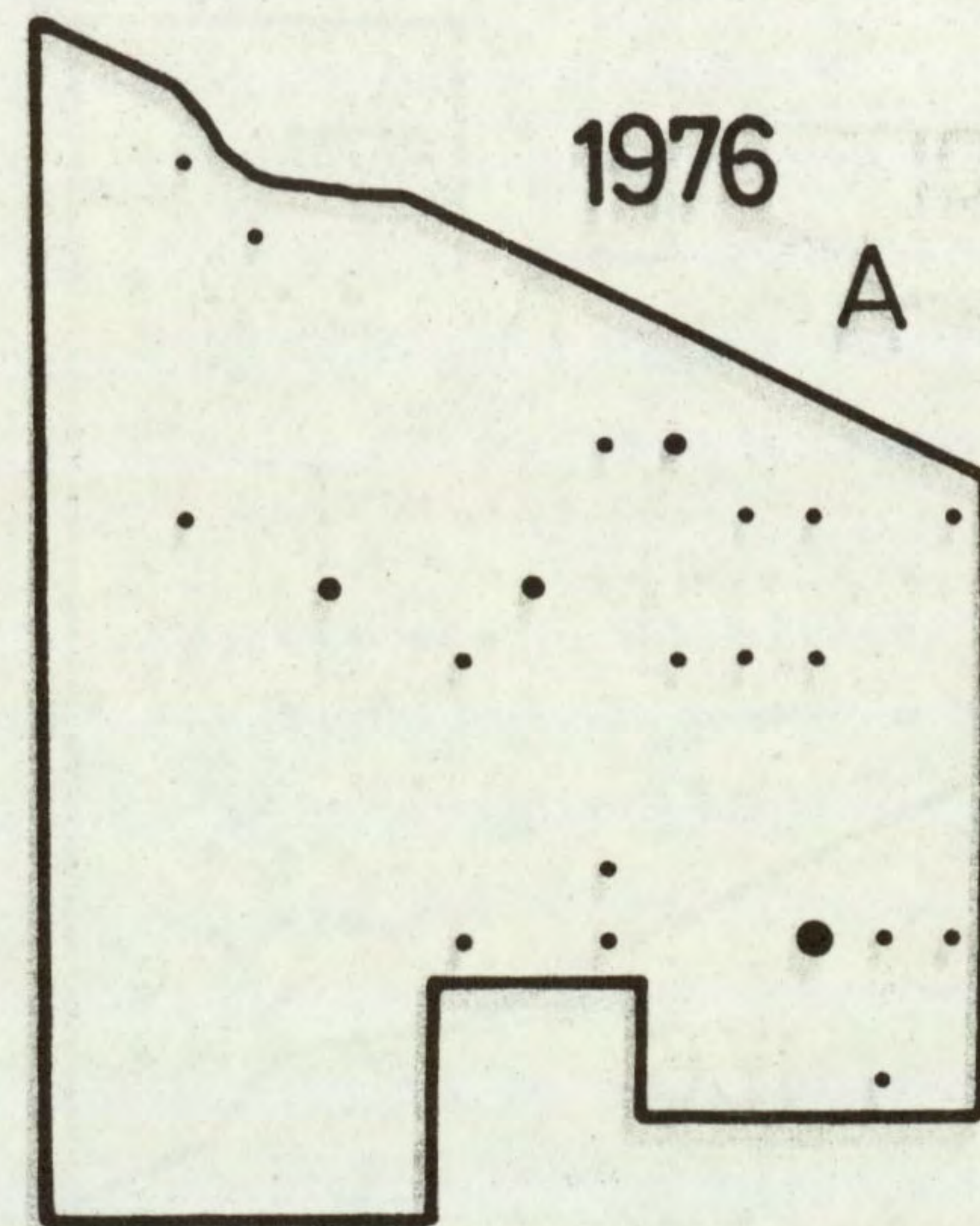
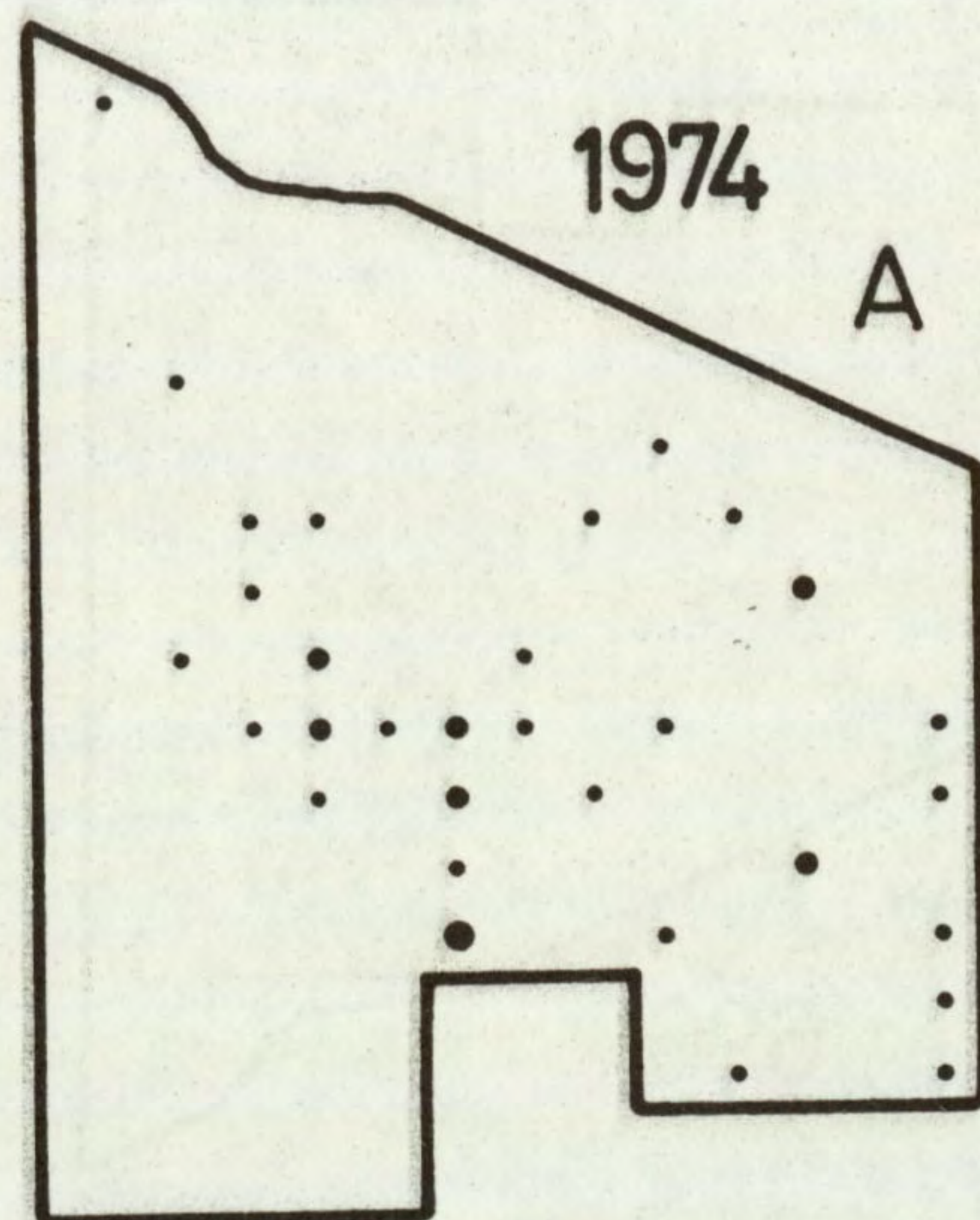
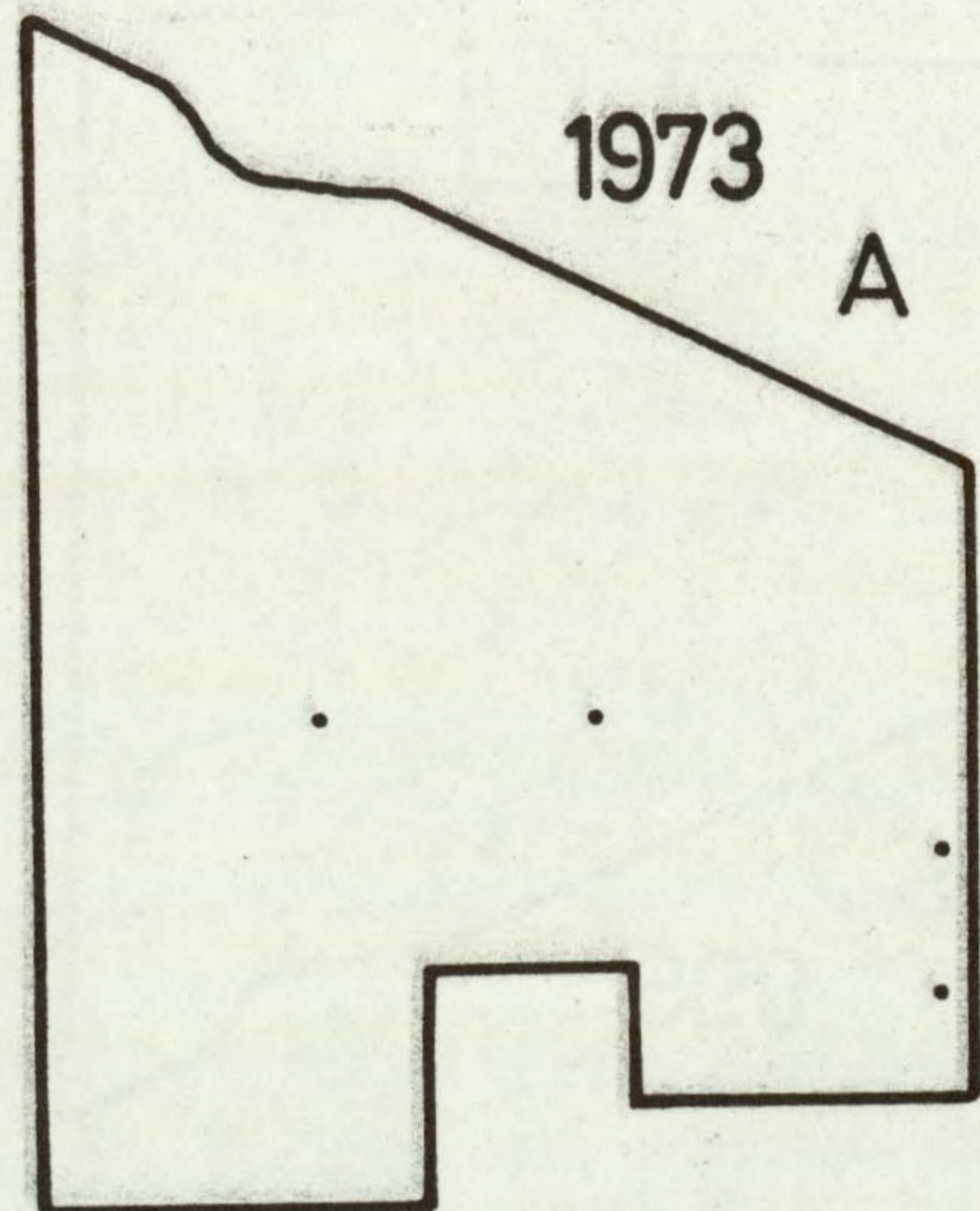
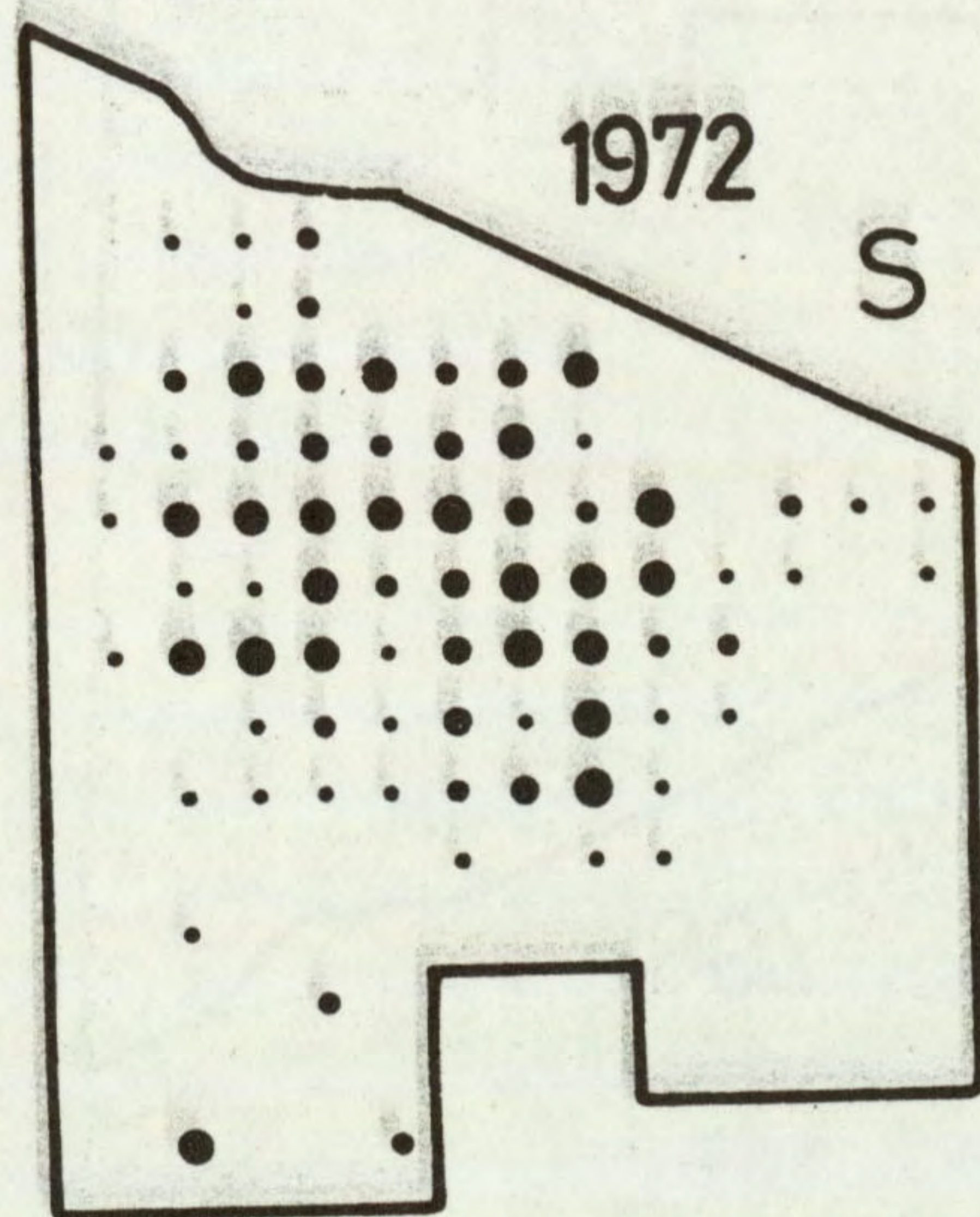




Veronica spp.

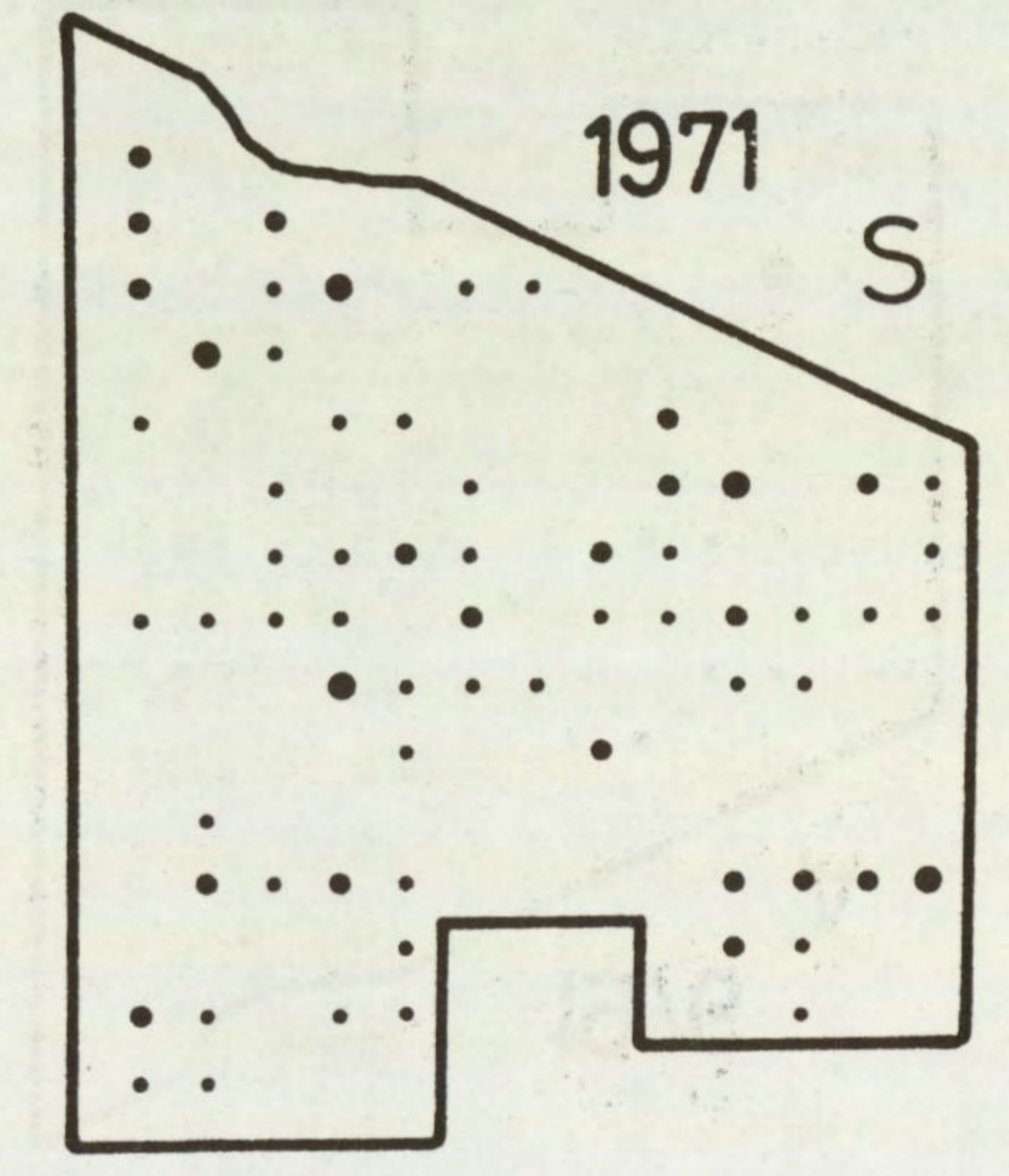
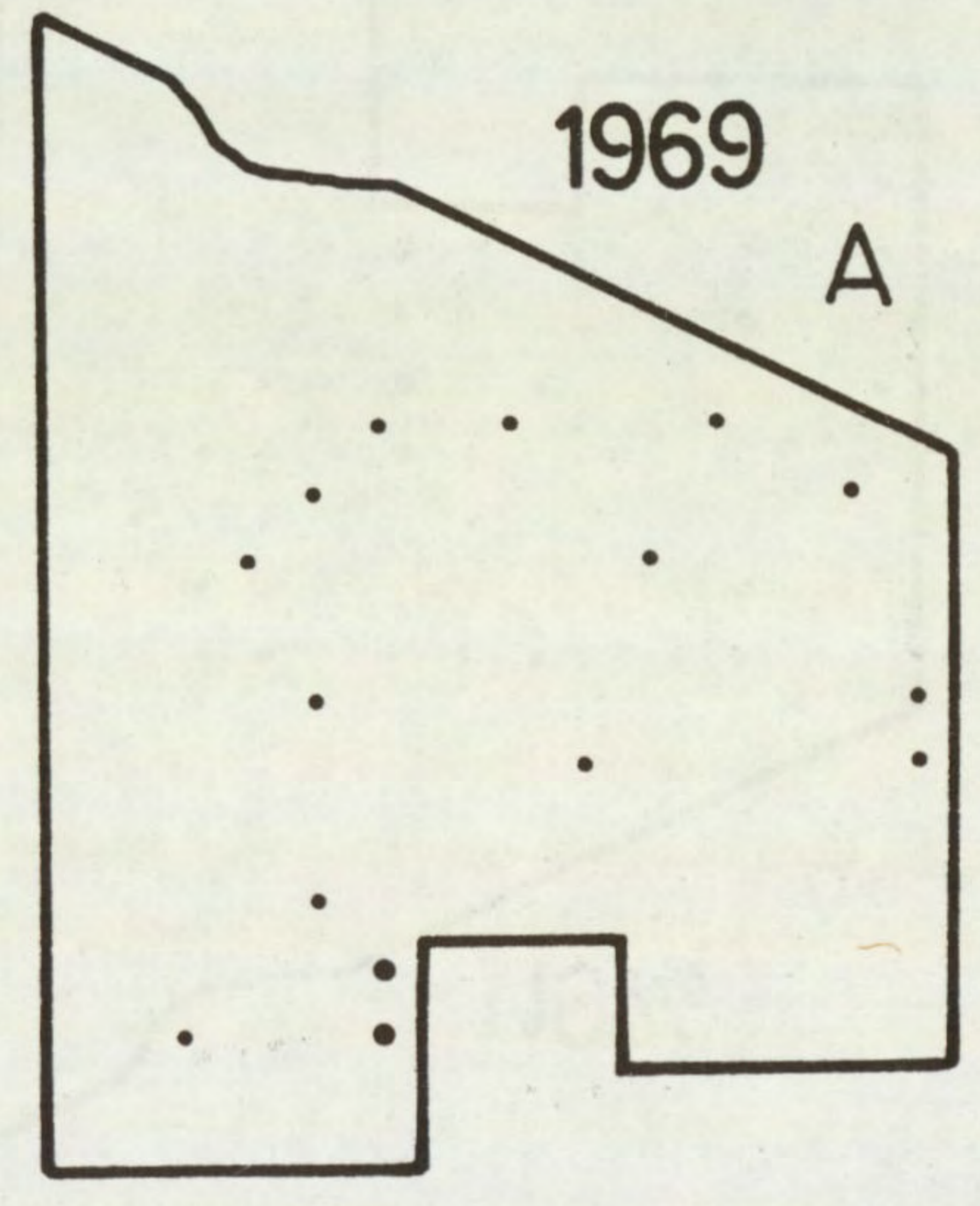
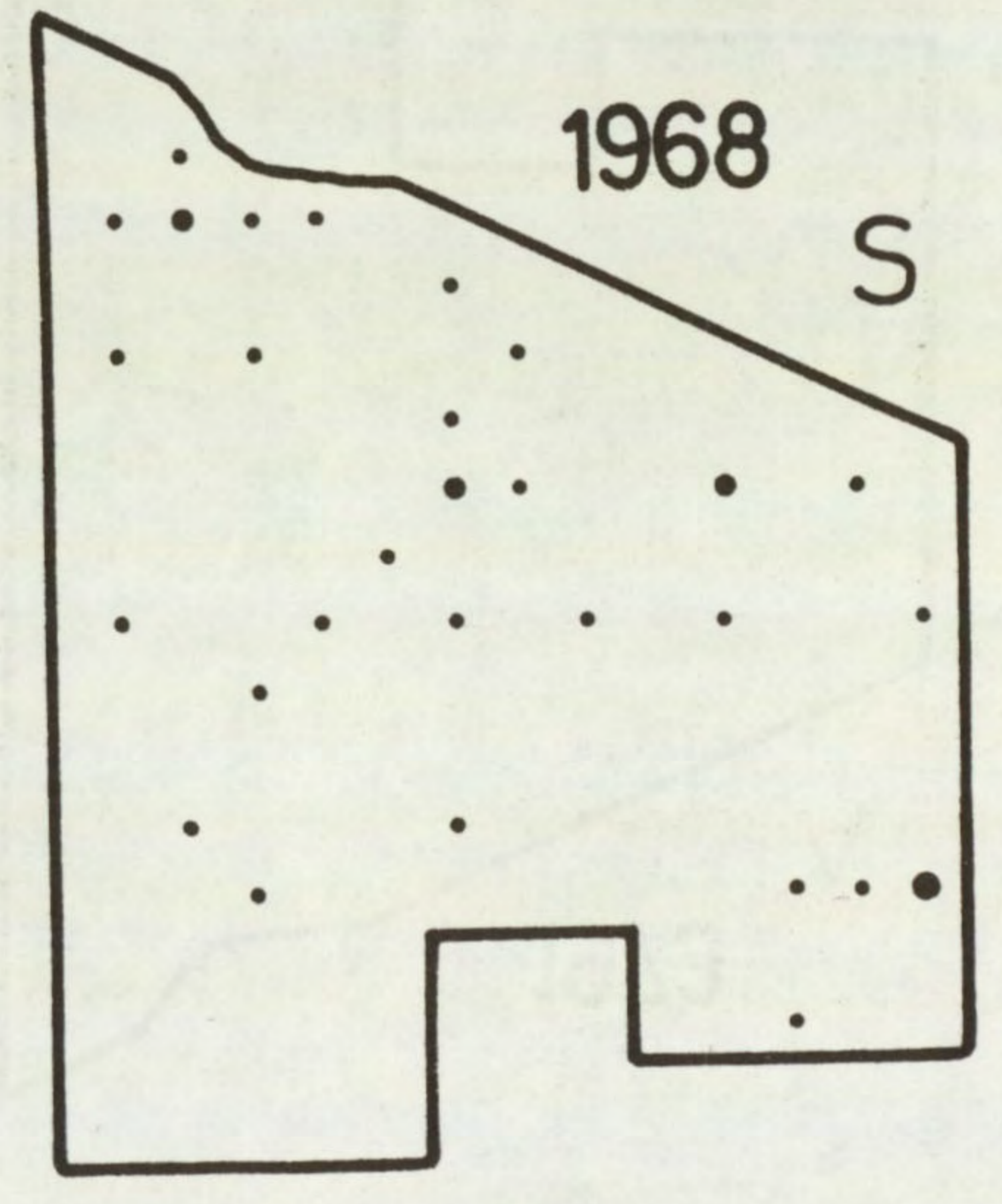
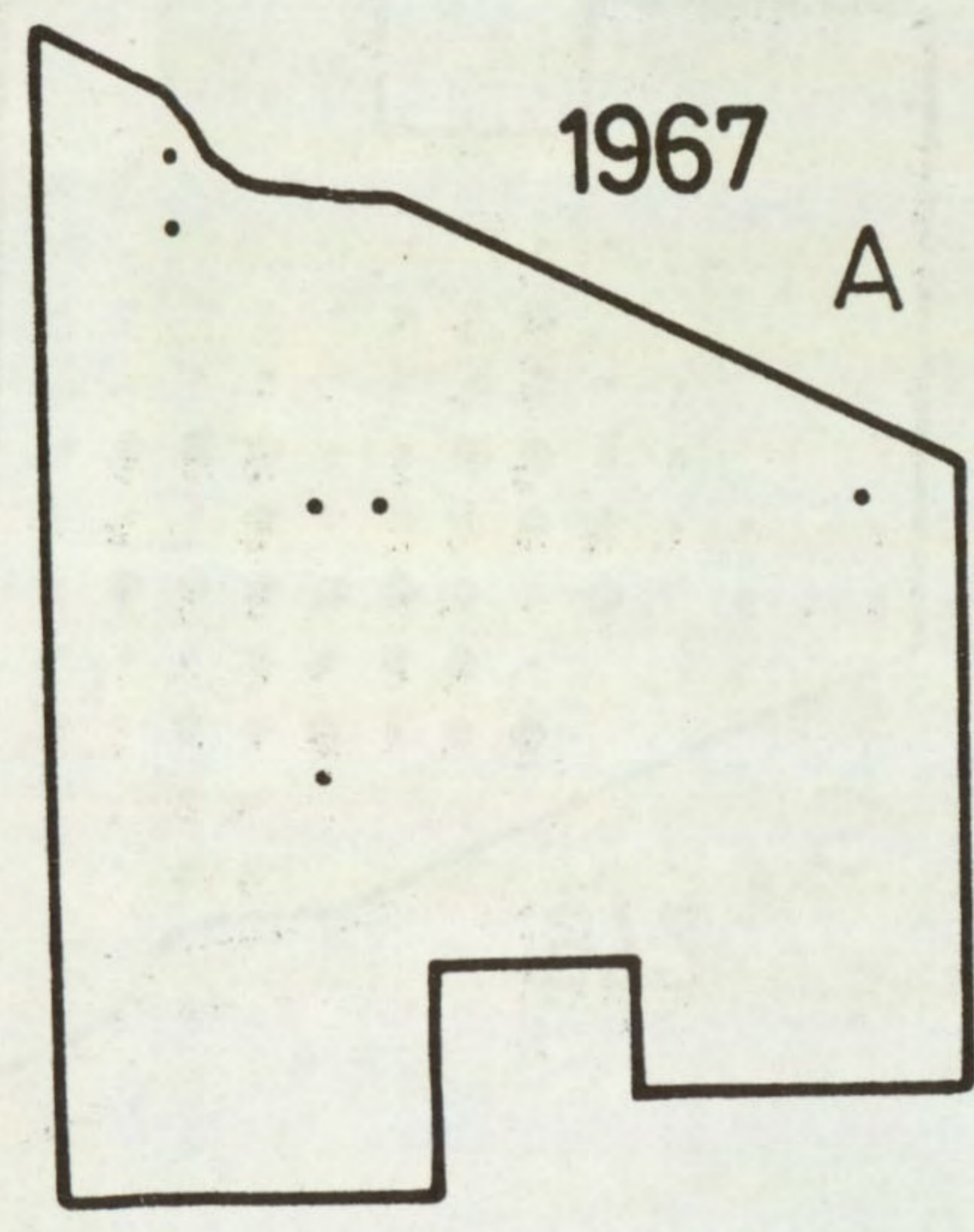
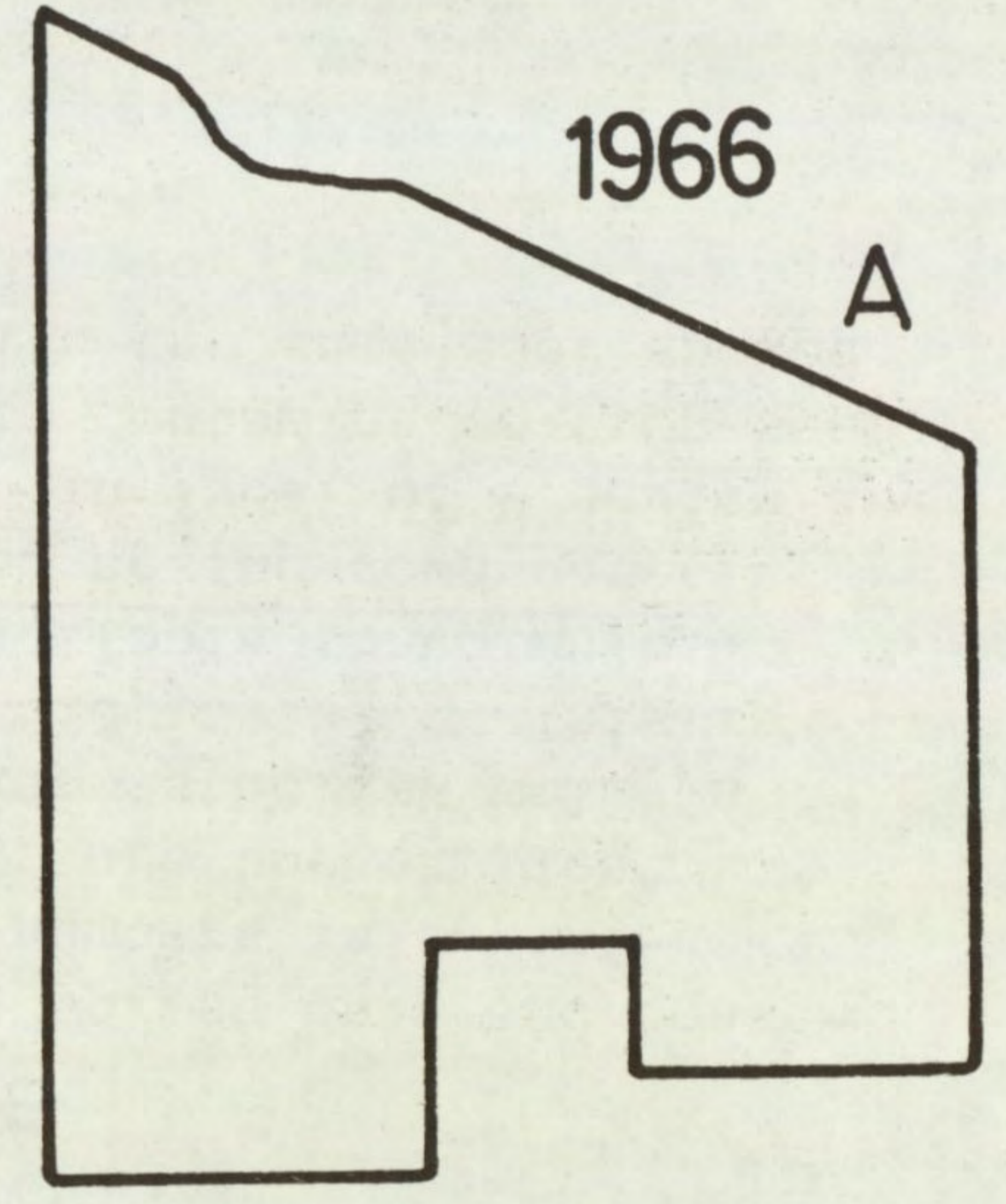
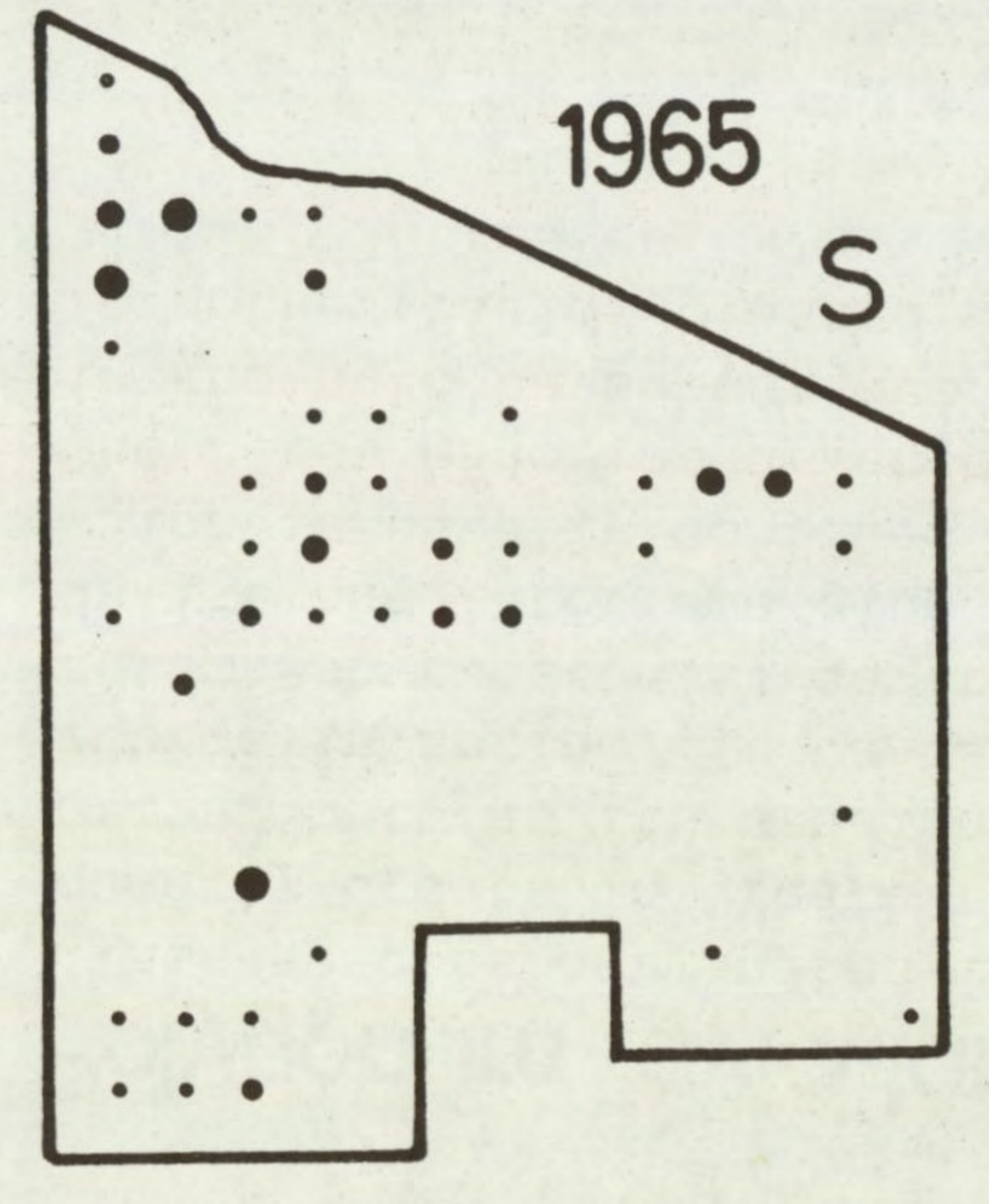
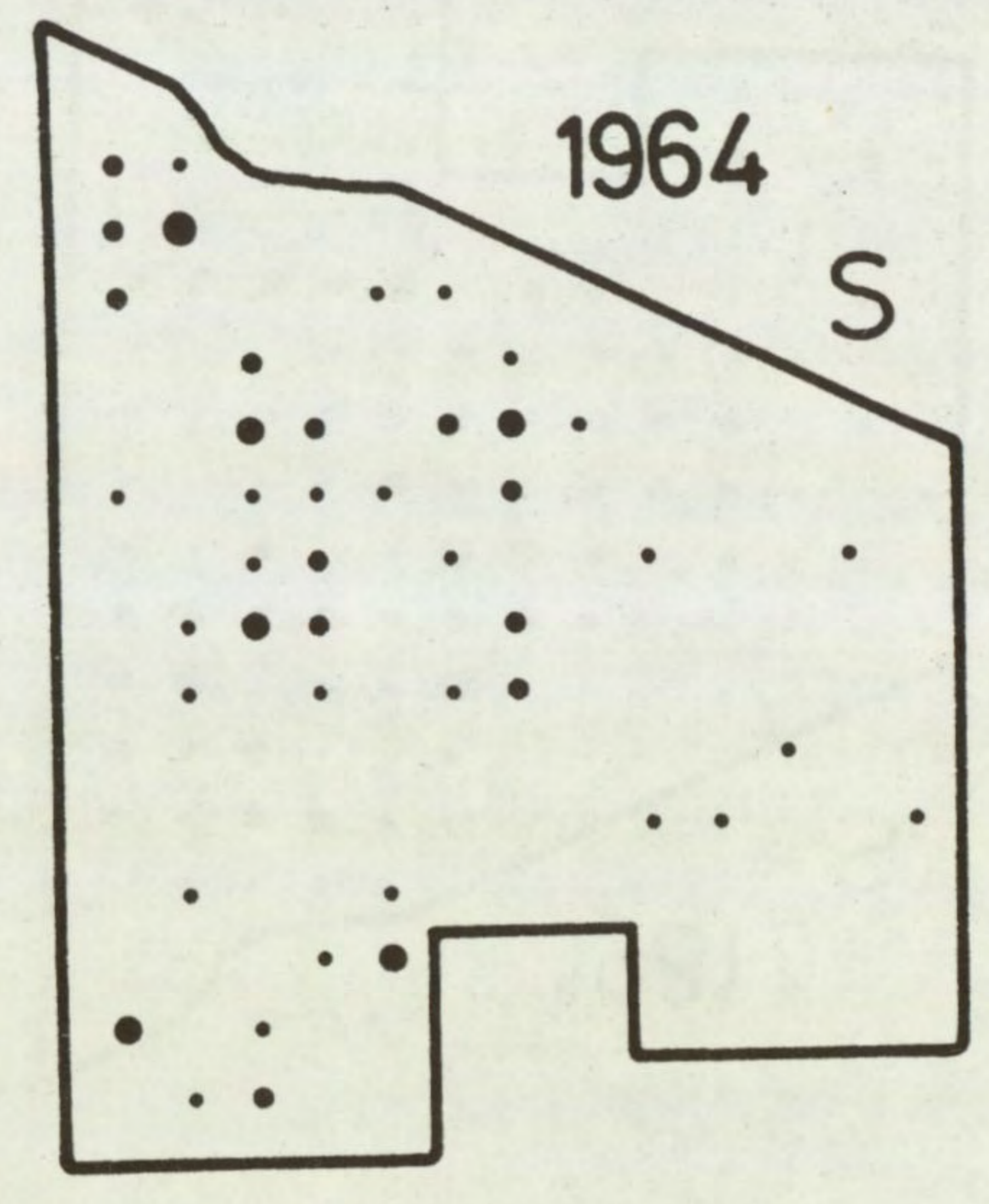
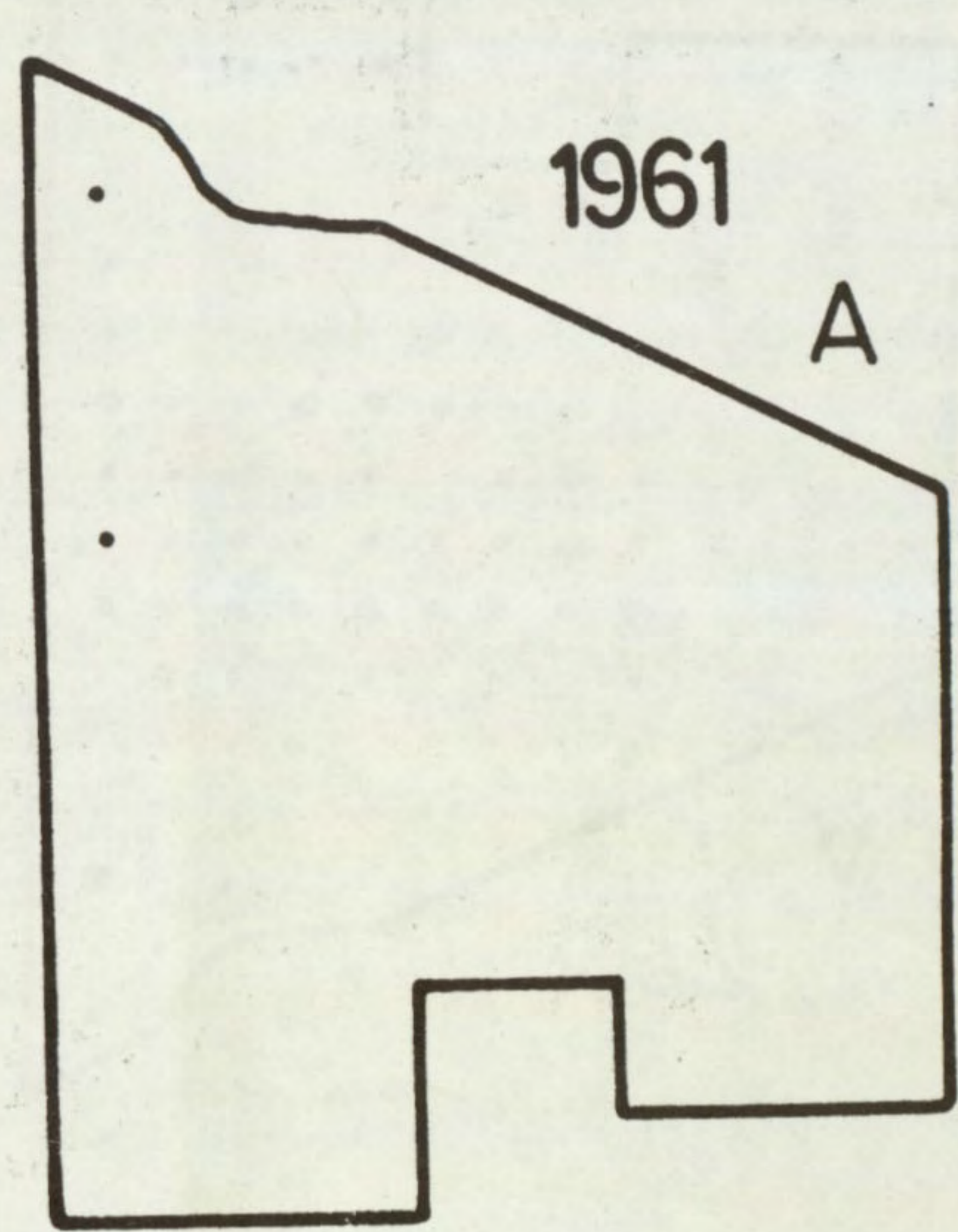
V. arvensis and *V. persica* have been grouped together because they cannot always be distinguished at the earliest stages. These two species appear to have been introduced in the same earlier cultivation as *Papaver rhoeas*, for they were confined to the same area in 1961. However, they have subsequently followed a different pattern of distribution and behaviour. Between 1964 and 1973, the few plants recorded were scattered throughout the field and did not appear to be derived from seeds persisting from the earlier cultivation. From 1974 onwards their numbers increased noticeably throughout the field and presumably result from one or more introductions in crop seed. There were fewer in 1981 than in 1976 and 1977, for they germinate more in autumn than in spring.

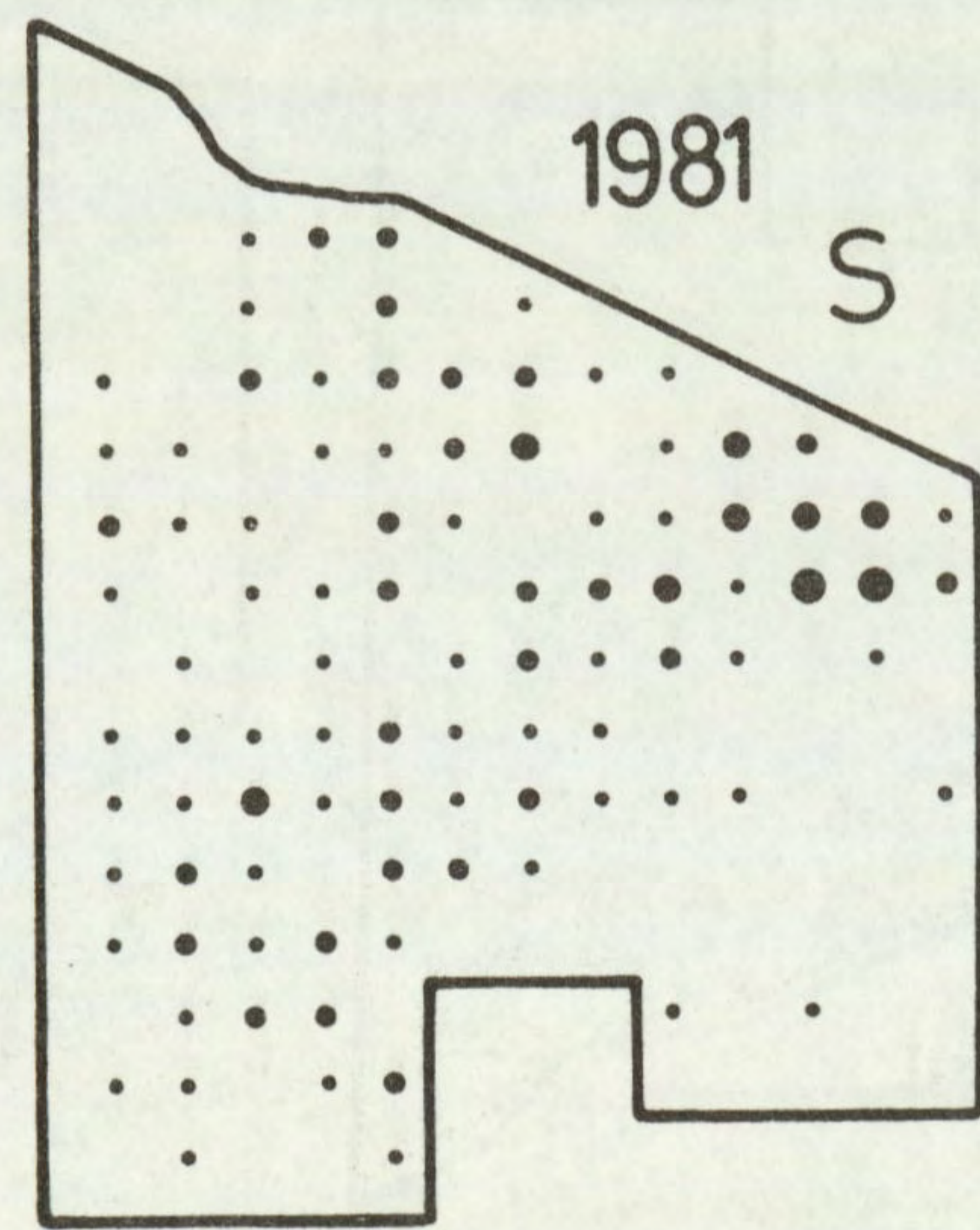
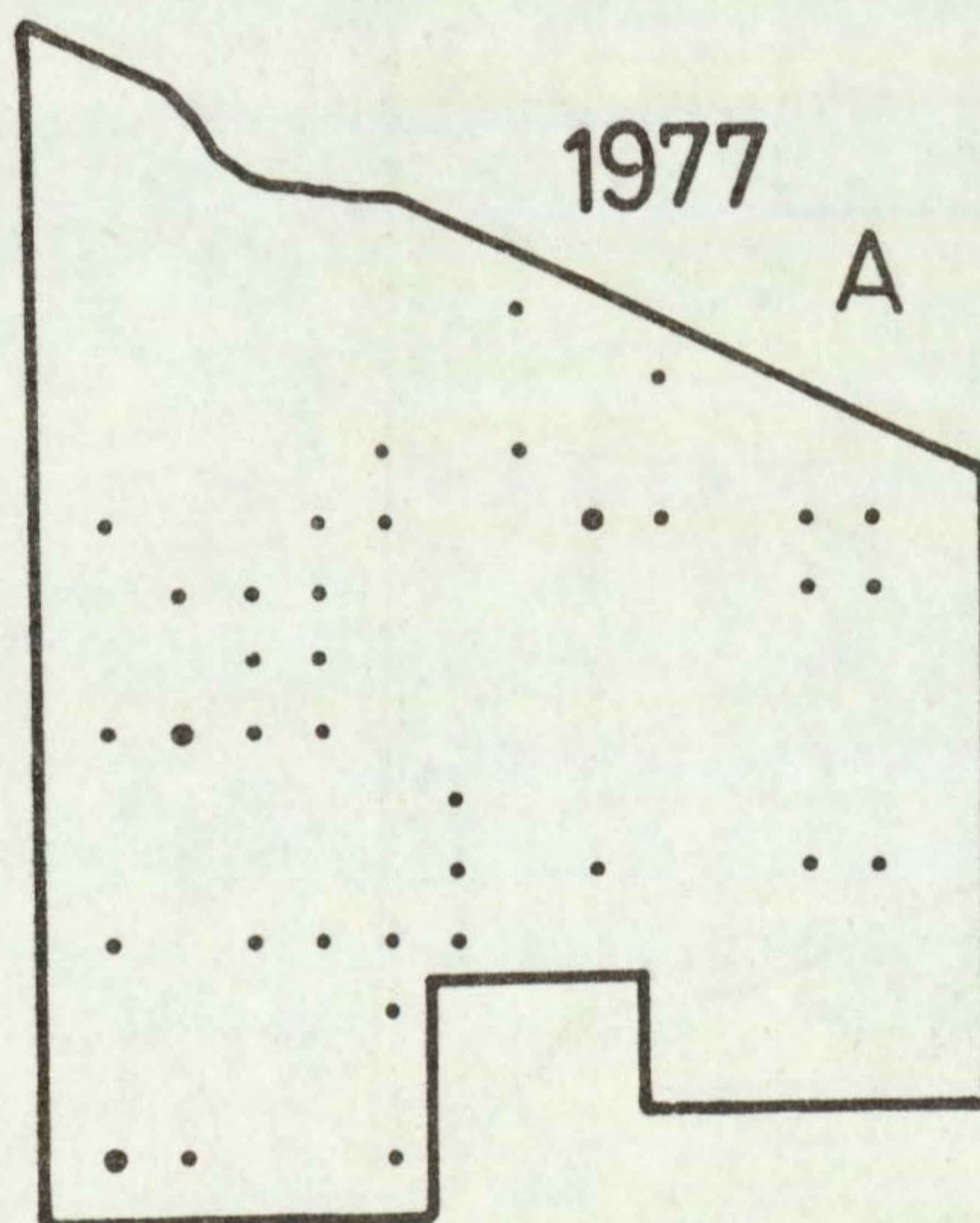
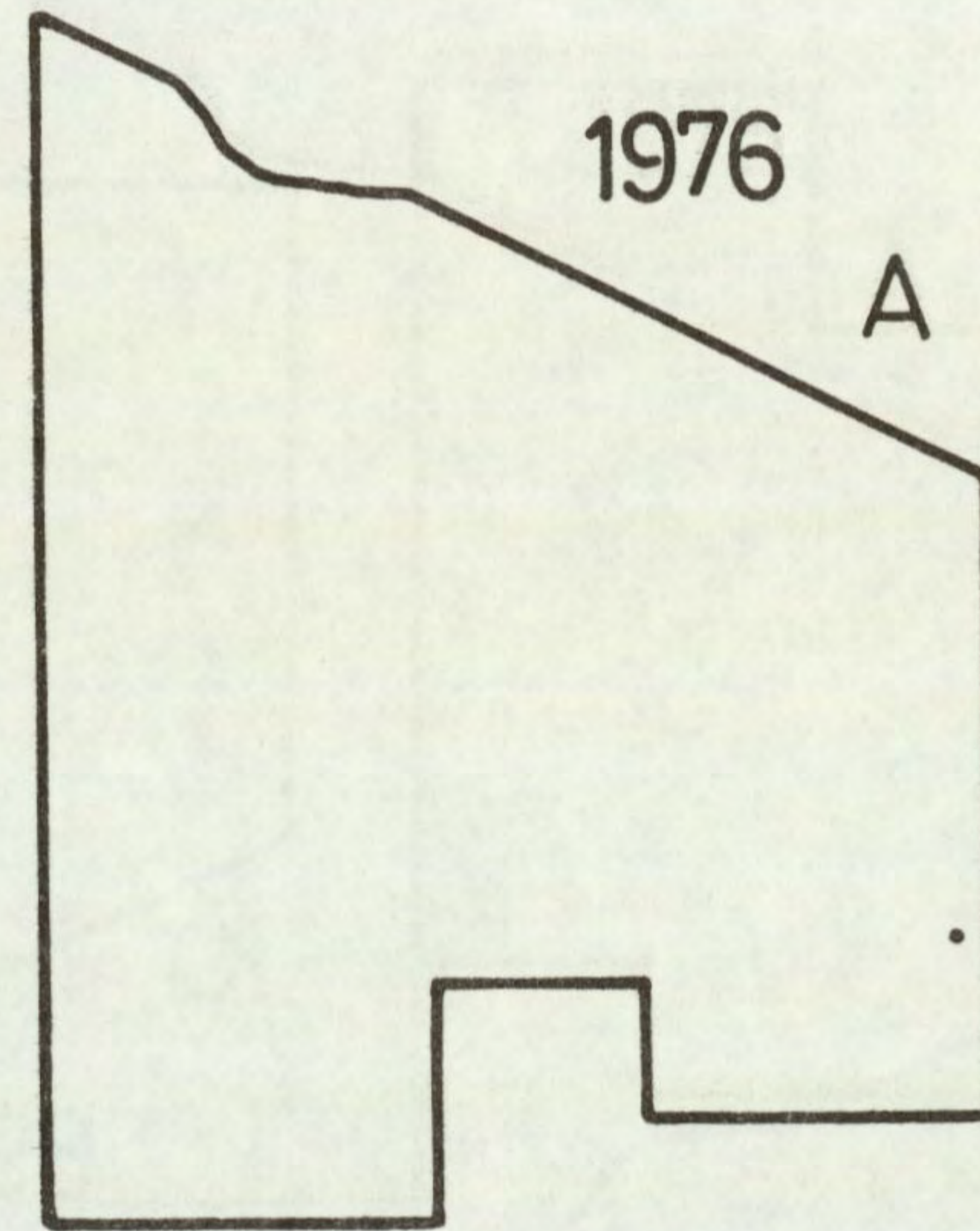
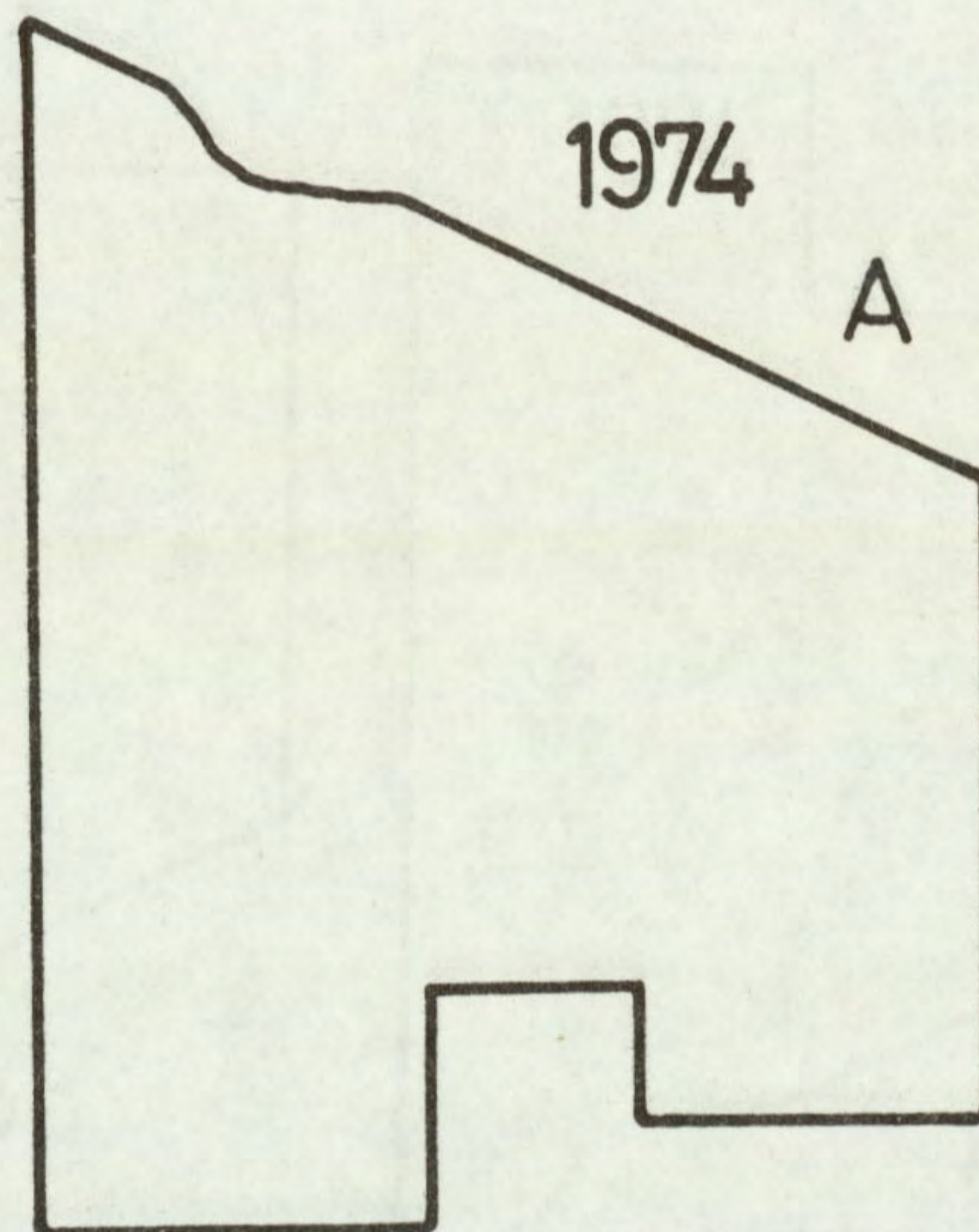
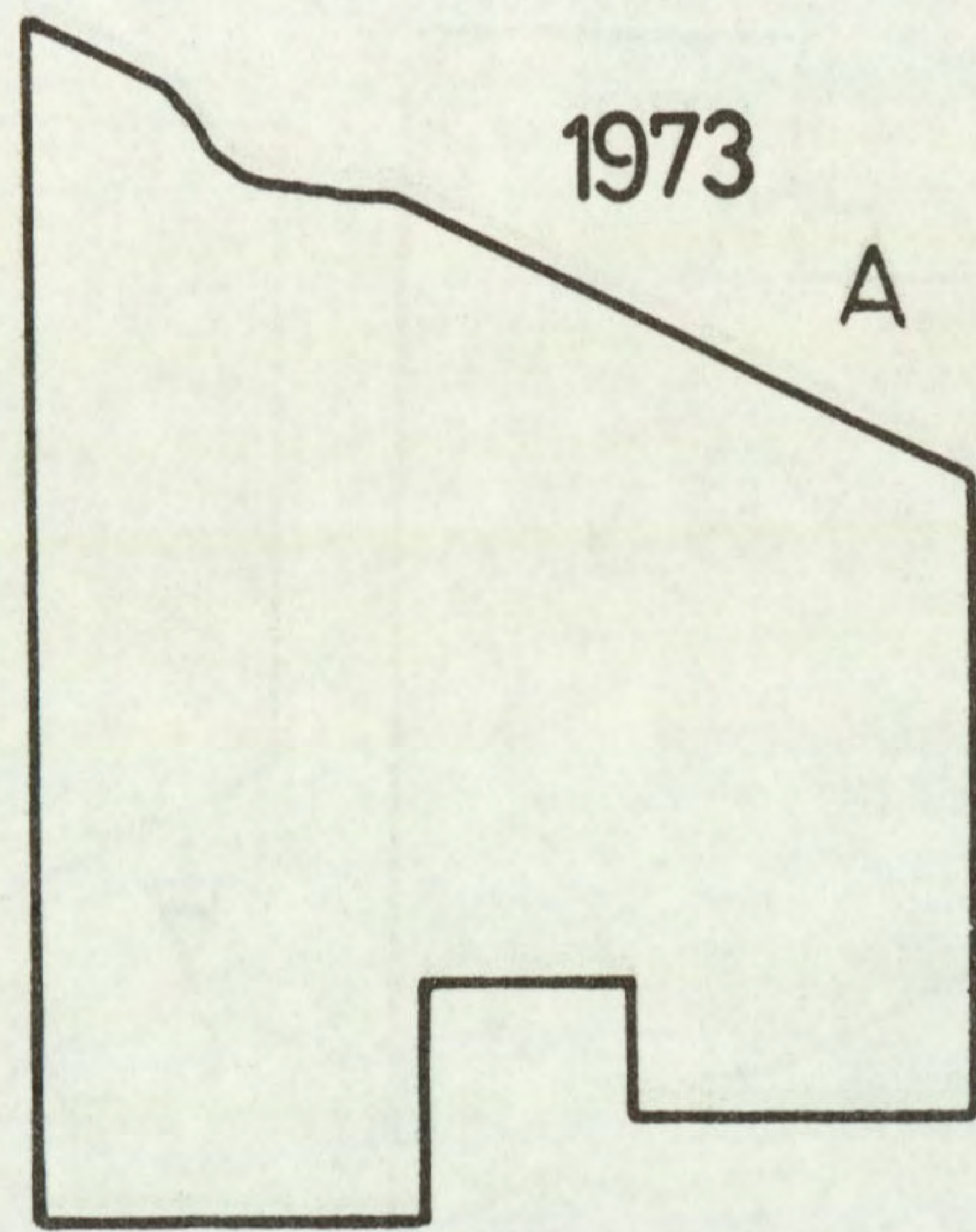
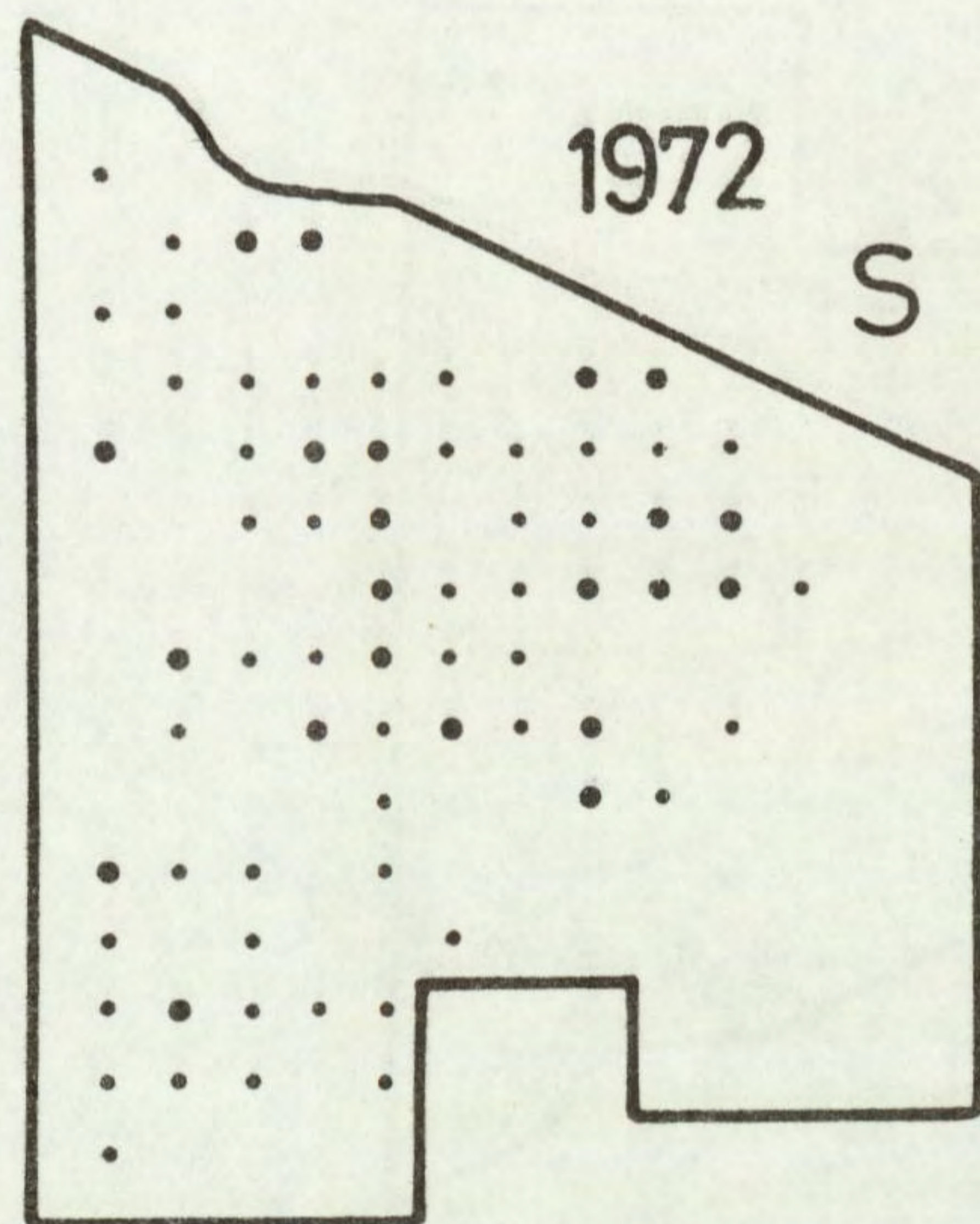




Polygonum aviculare

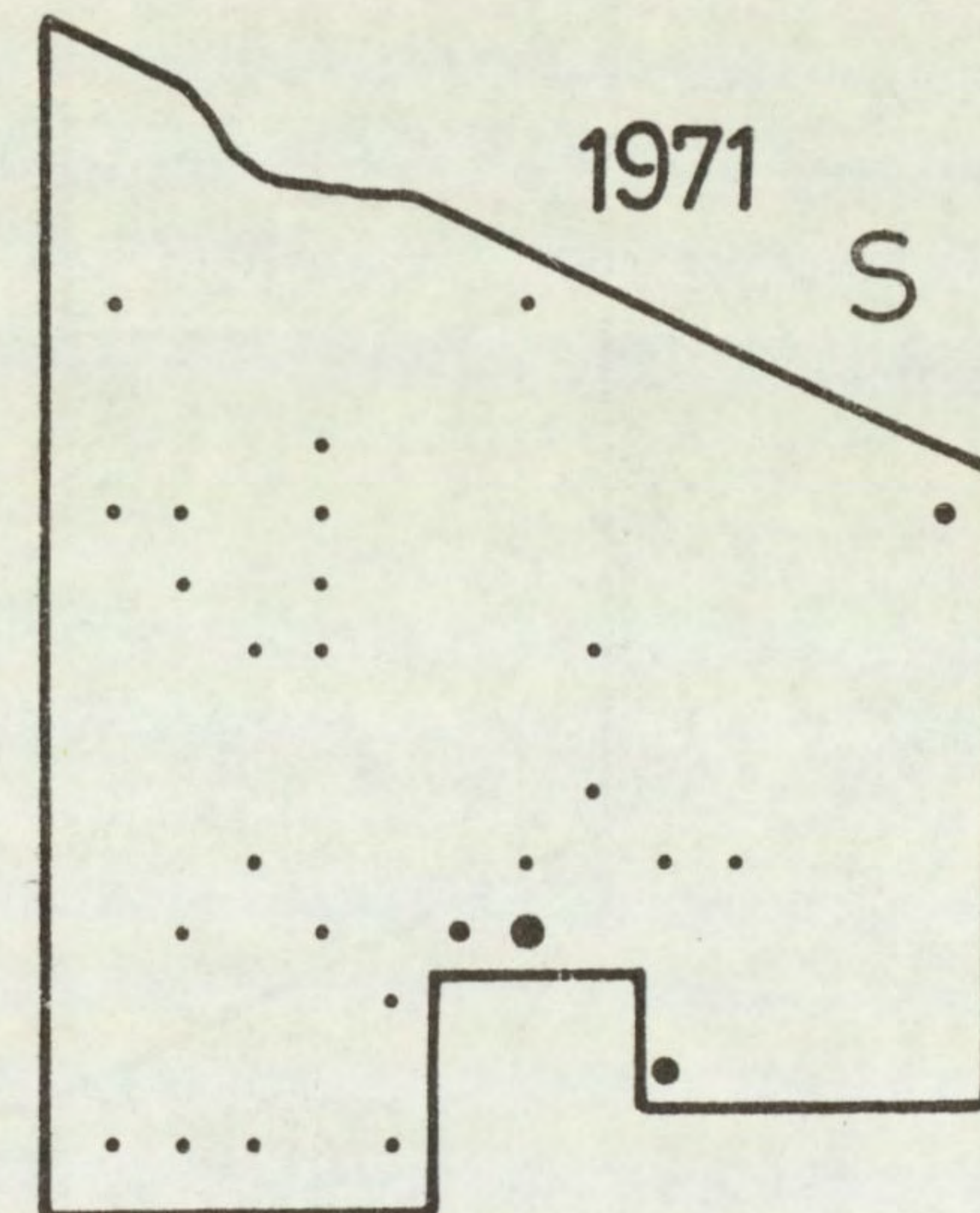
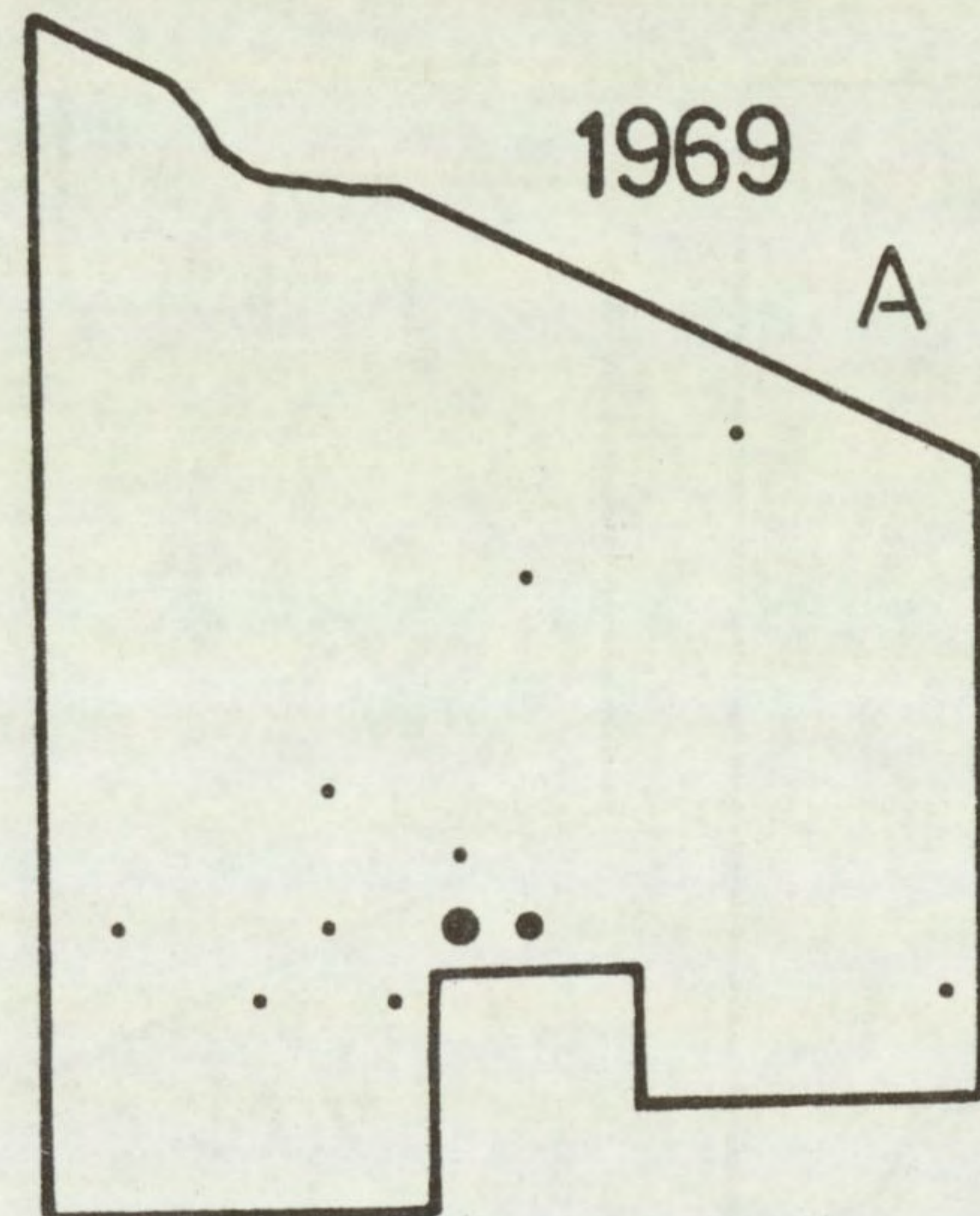
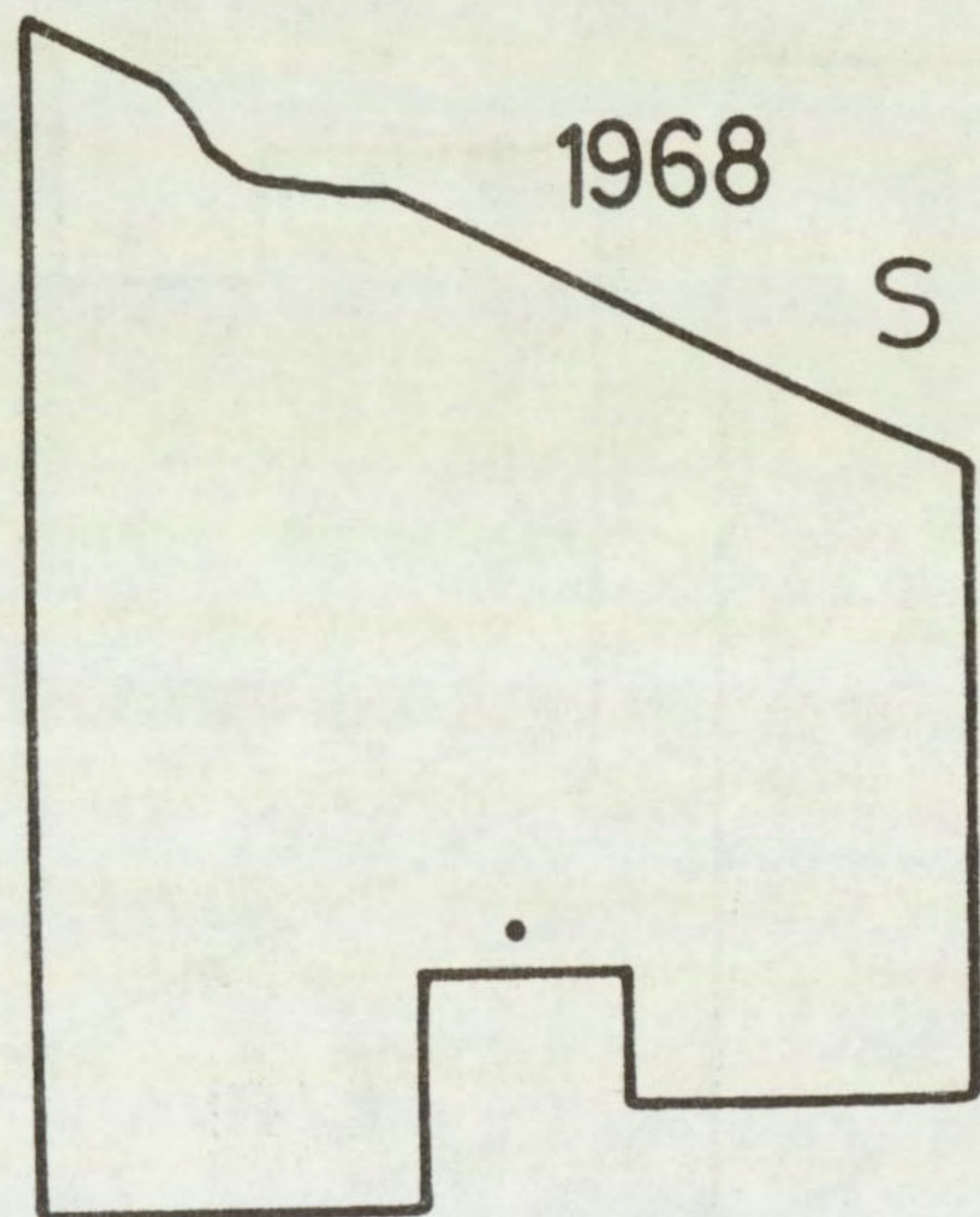
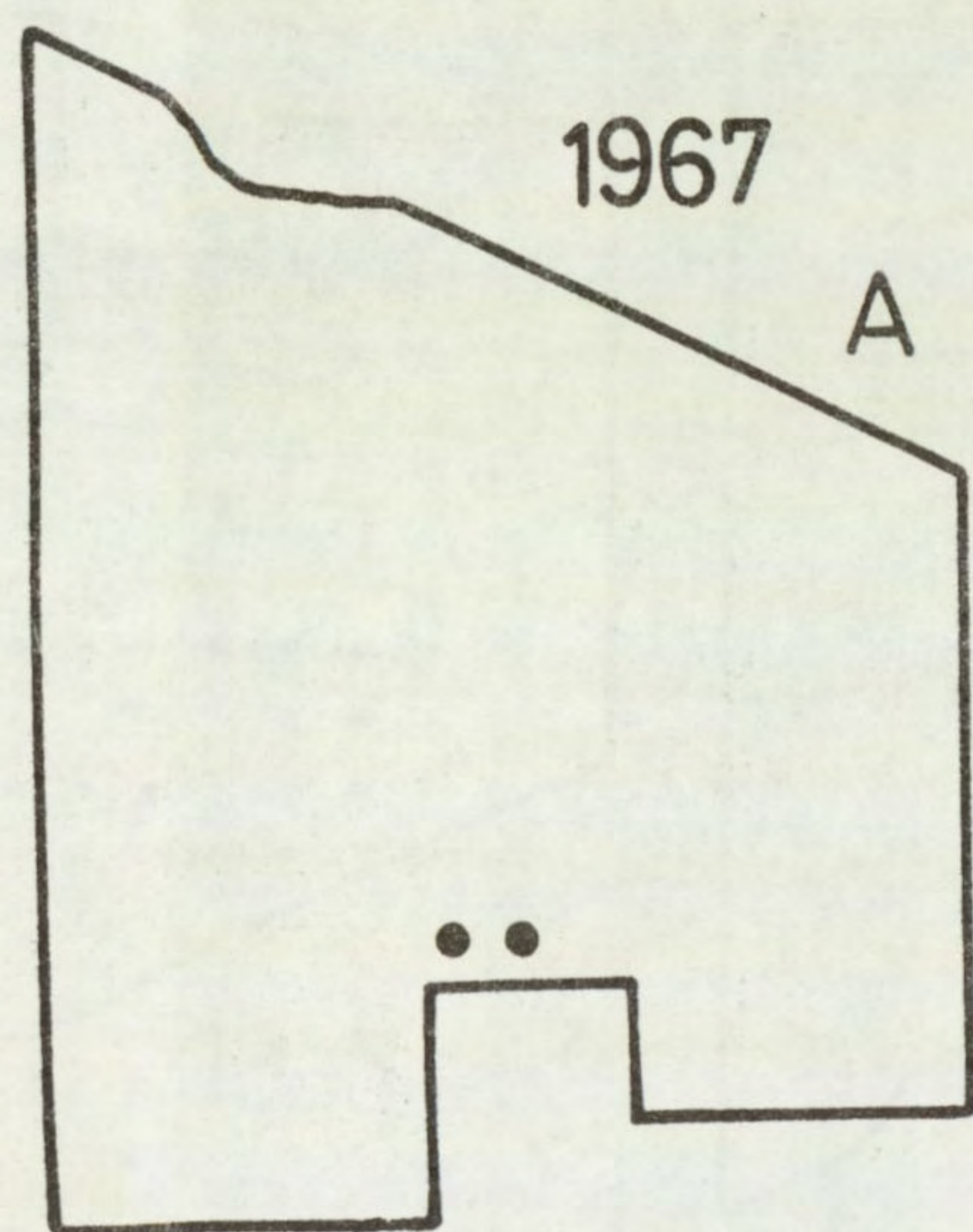
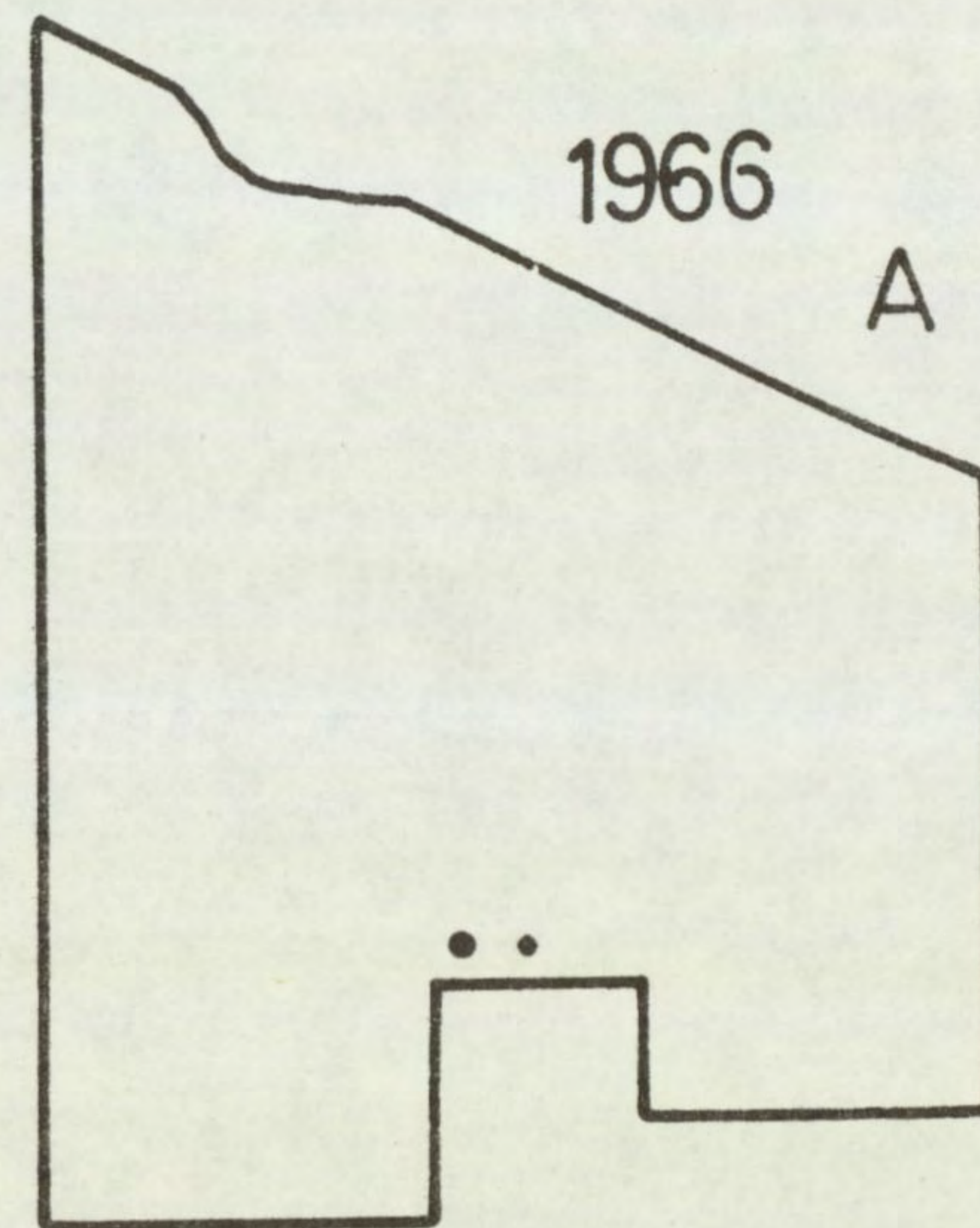
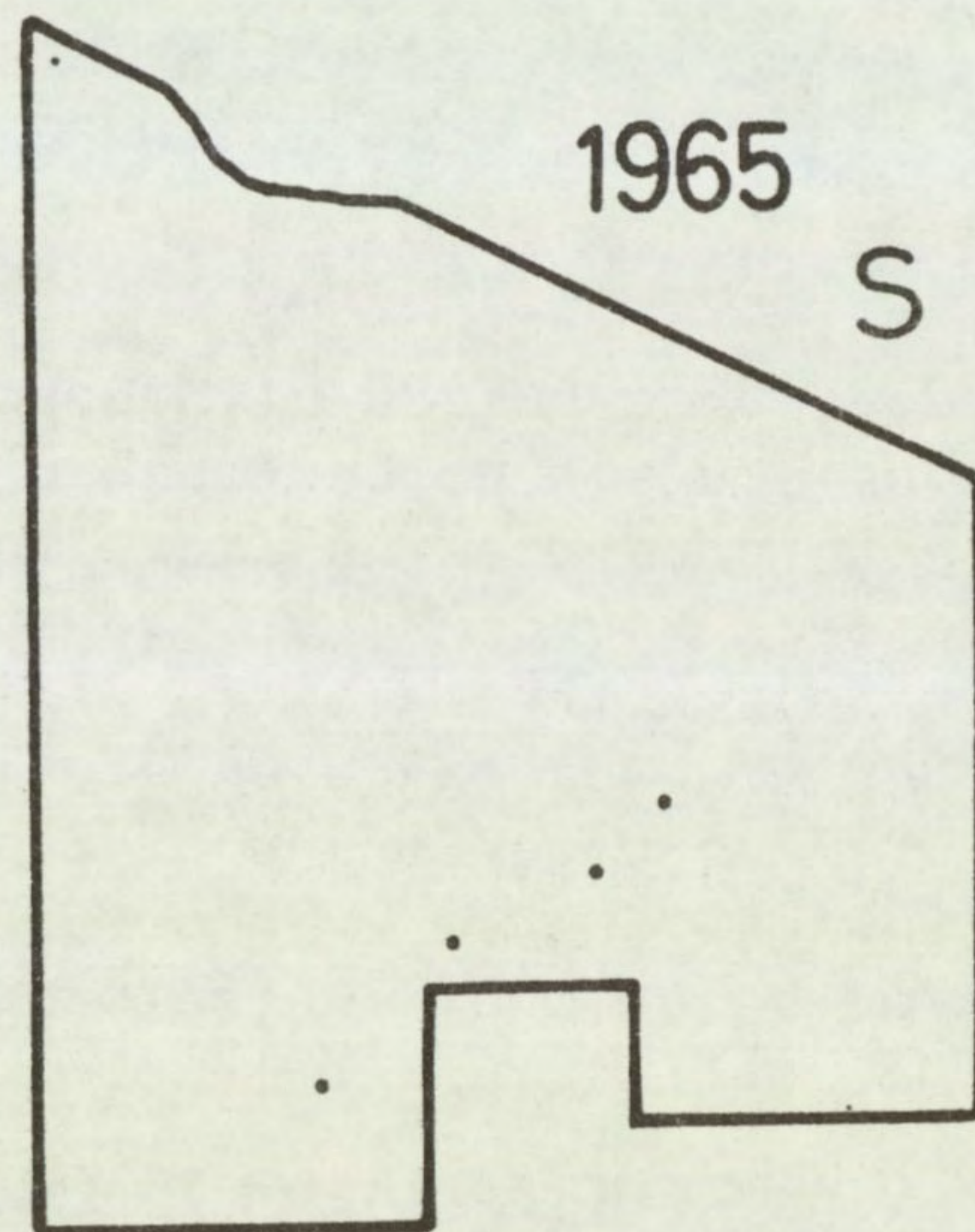
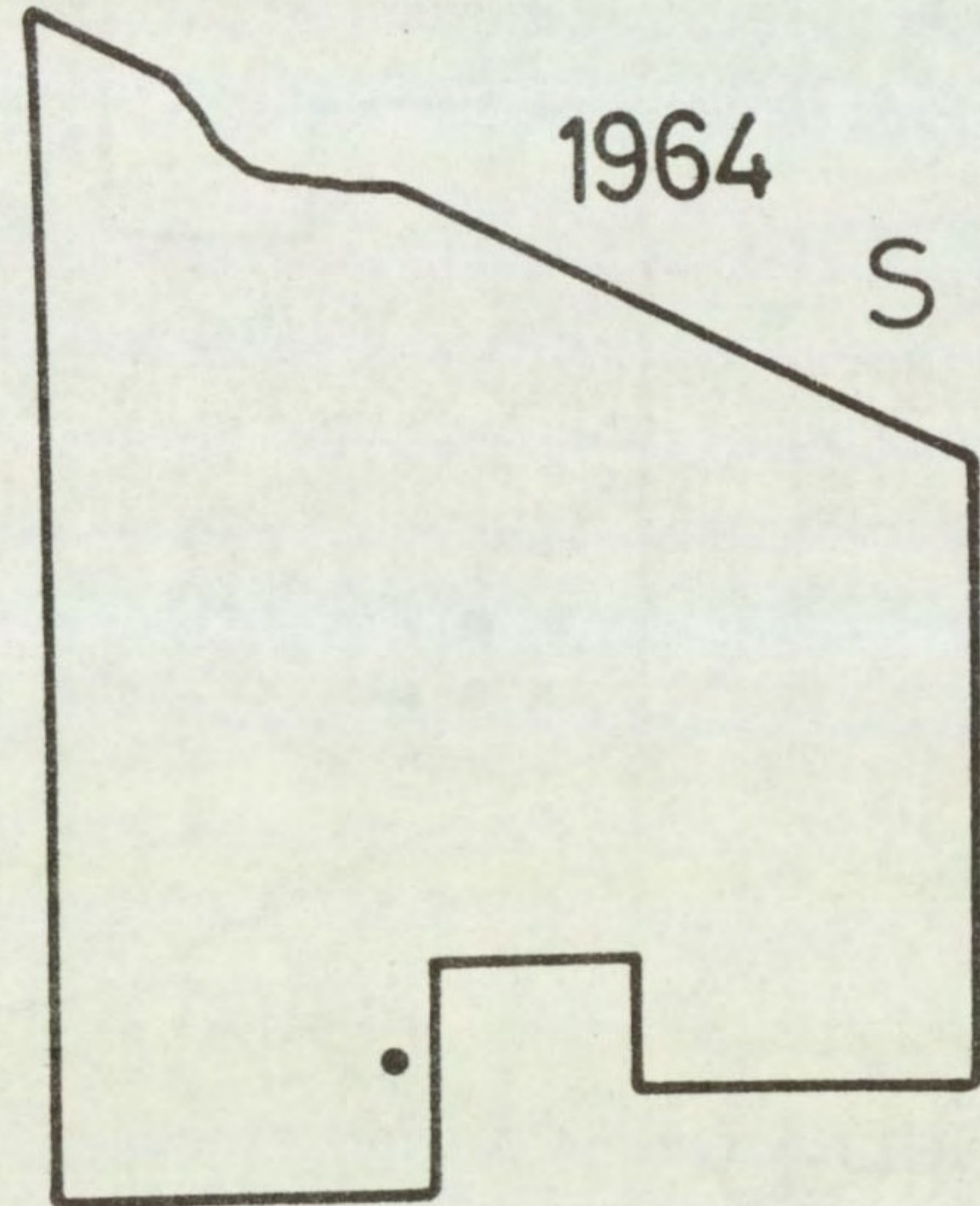
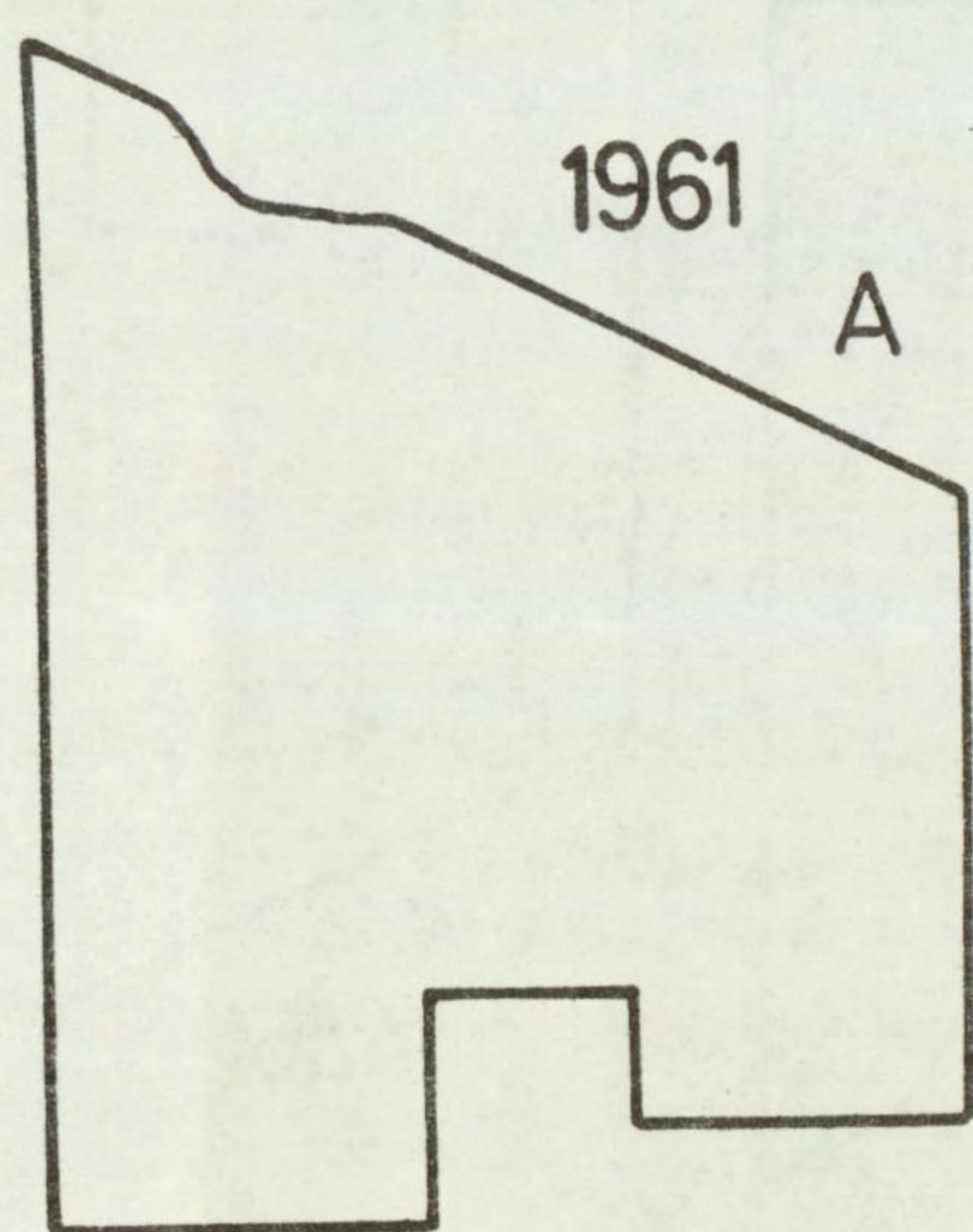
This species germinates in spring only and consequently occurs in greatest numbers in spring-sown crops, but, as its seedlings are the earliest to emerge in spring, it can also establish well in autumn-sown cereals, as it did in 1977. This is unlike the later emerging Fallopia convolvulus, which is usually confined to spring-sown cereals. The first major occurrence (in 1964) of P. aviculare is known to have been due to contaminated crop seed, for other fields planted with the same seed showed similar increases.

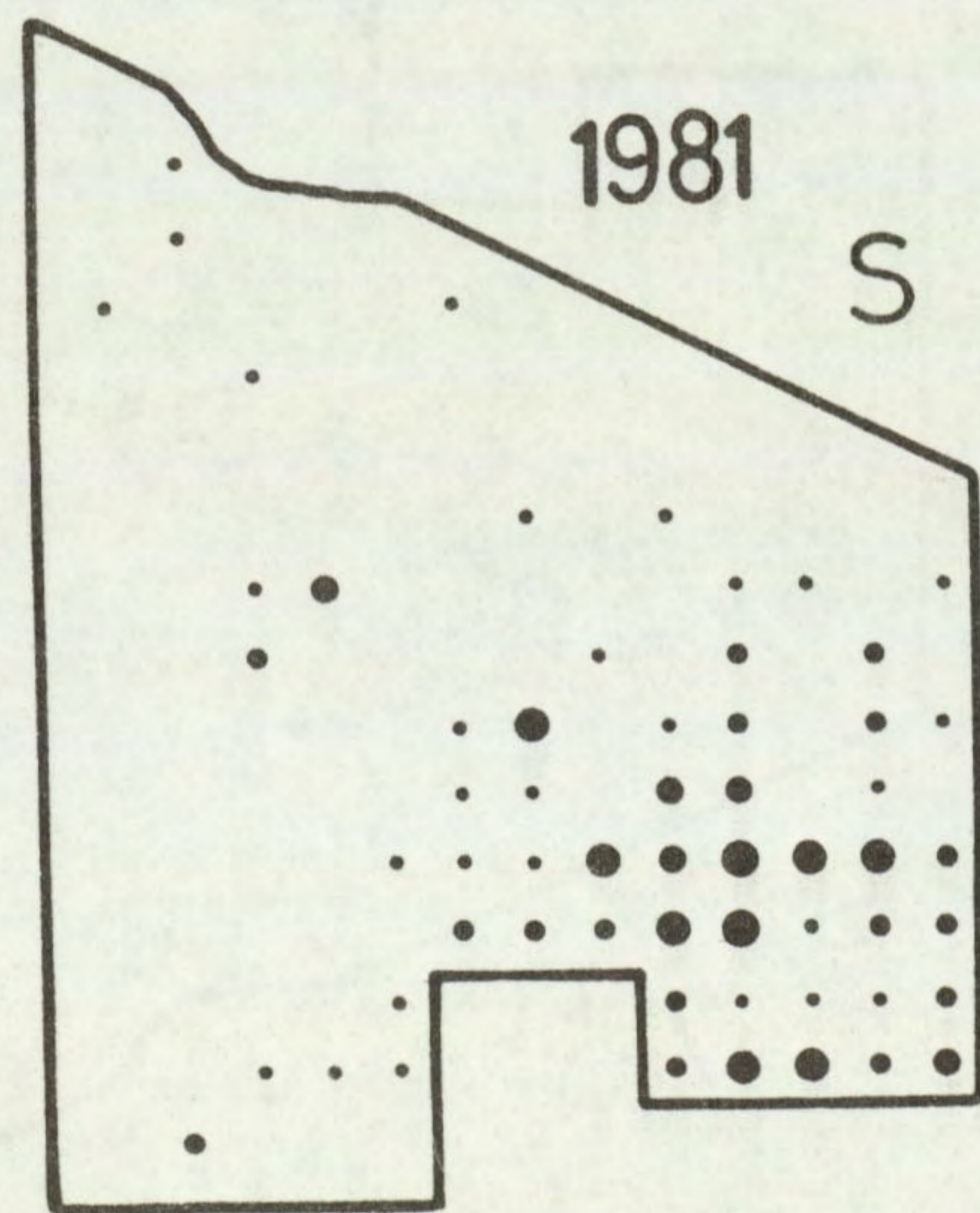
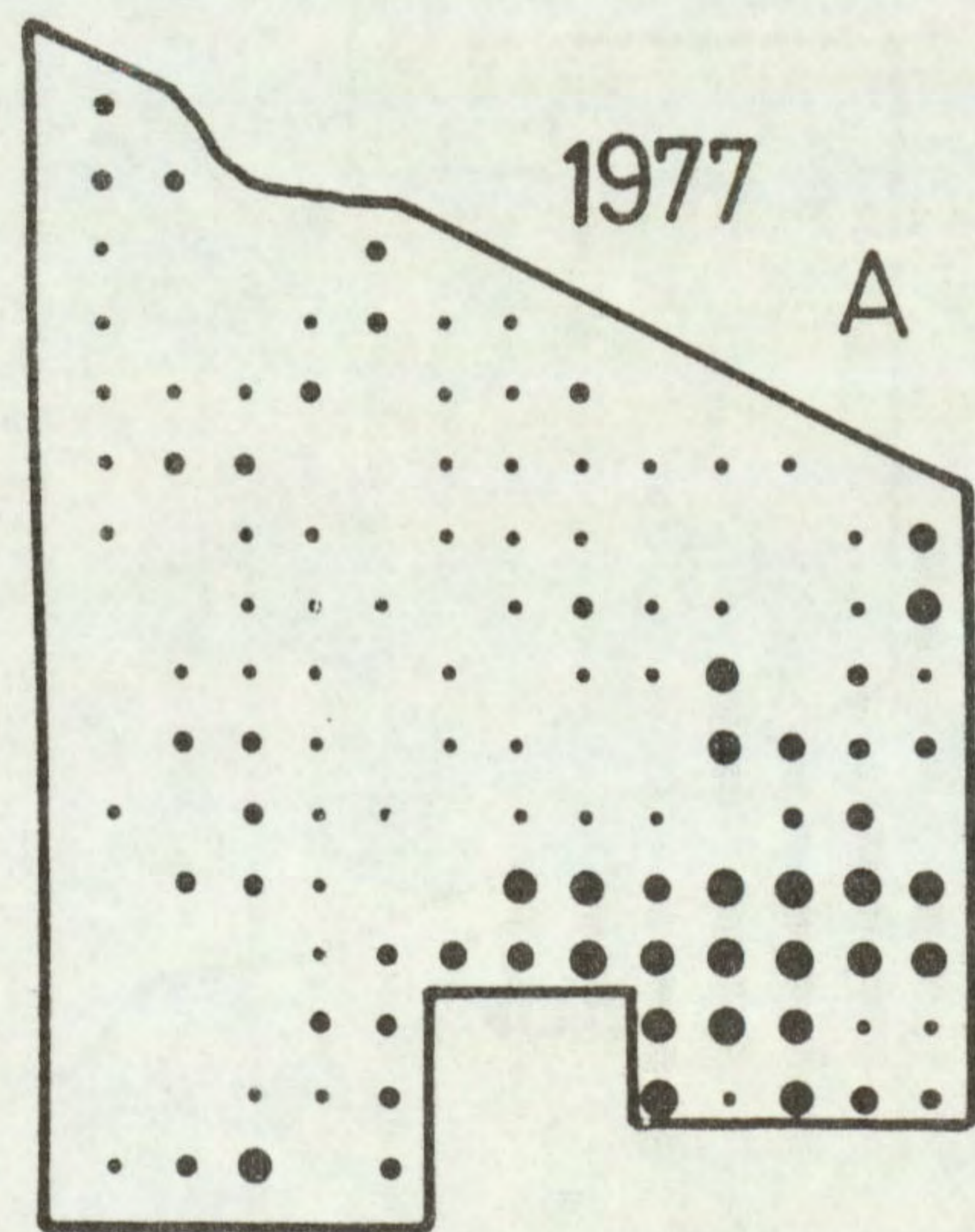
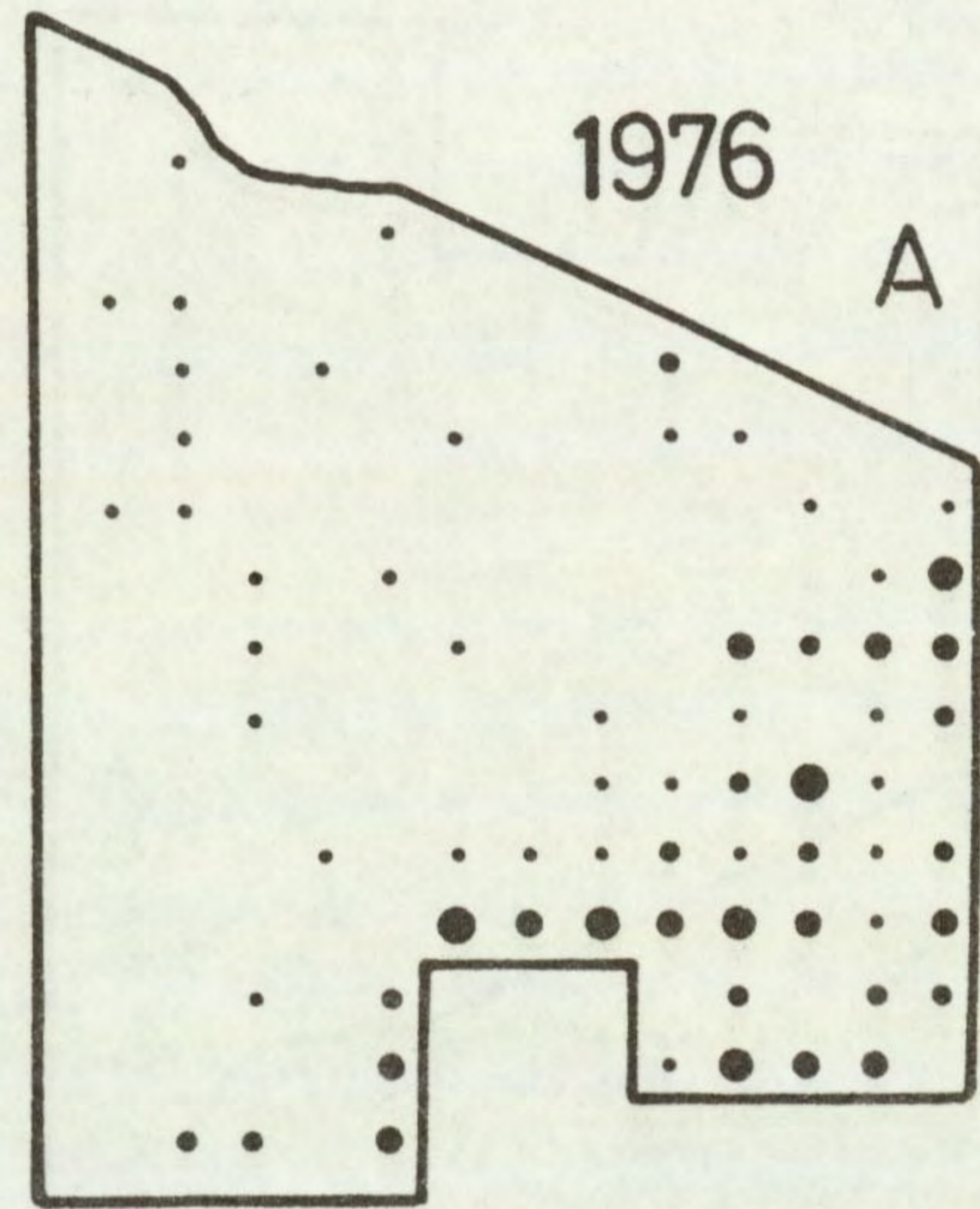
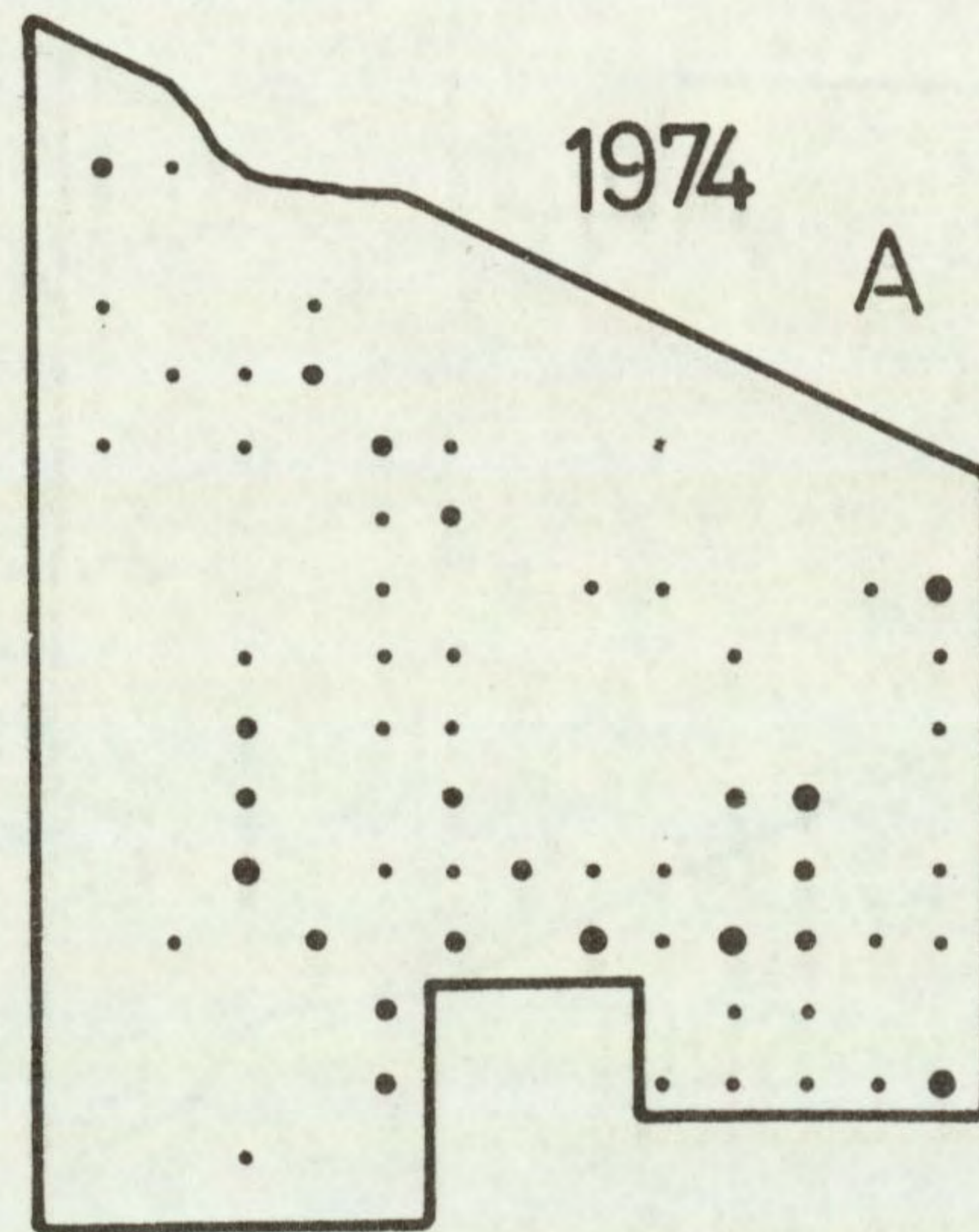
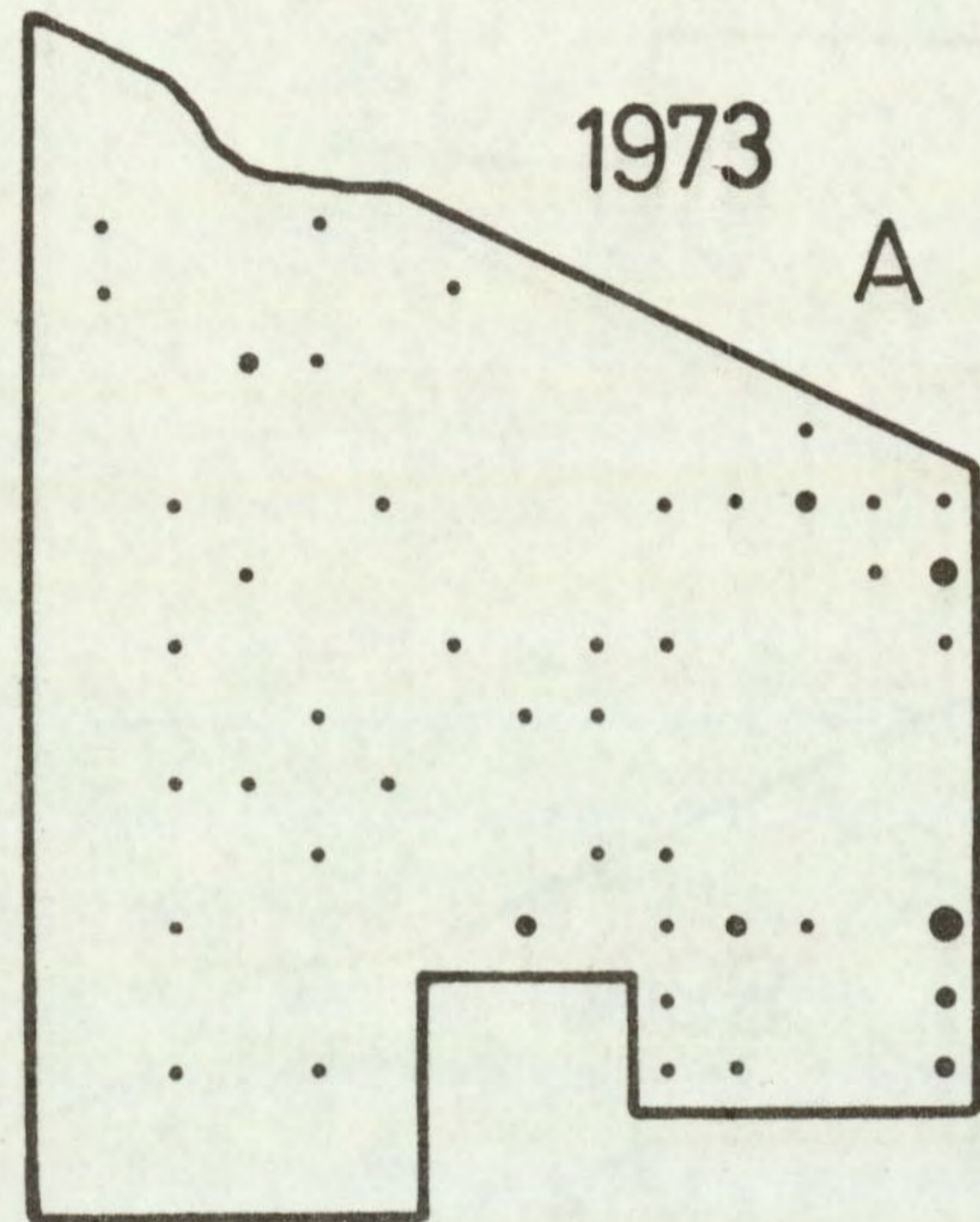
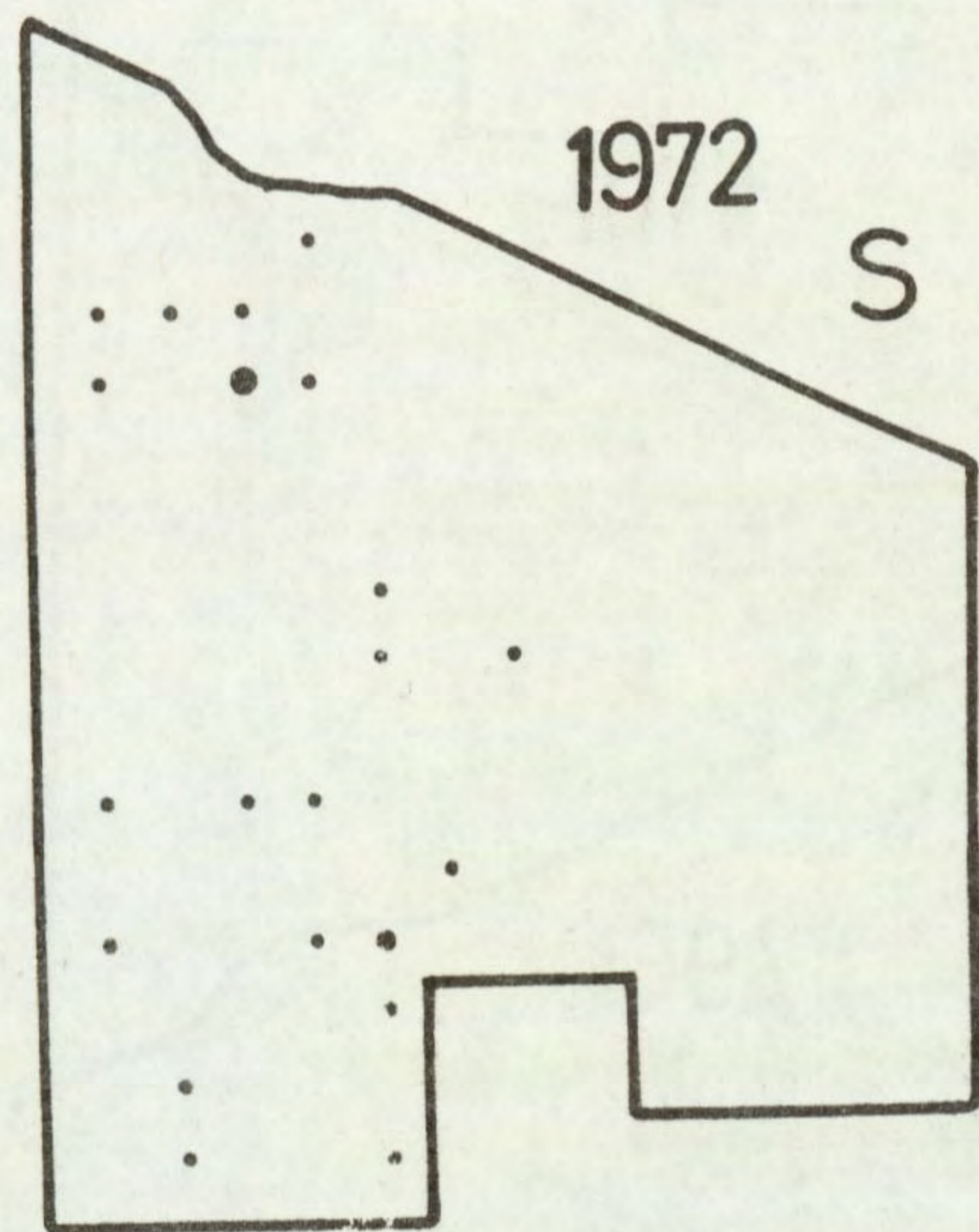




Fallopia convolvulus

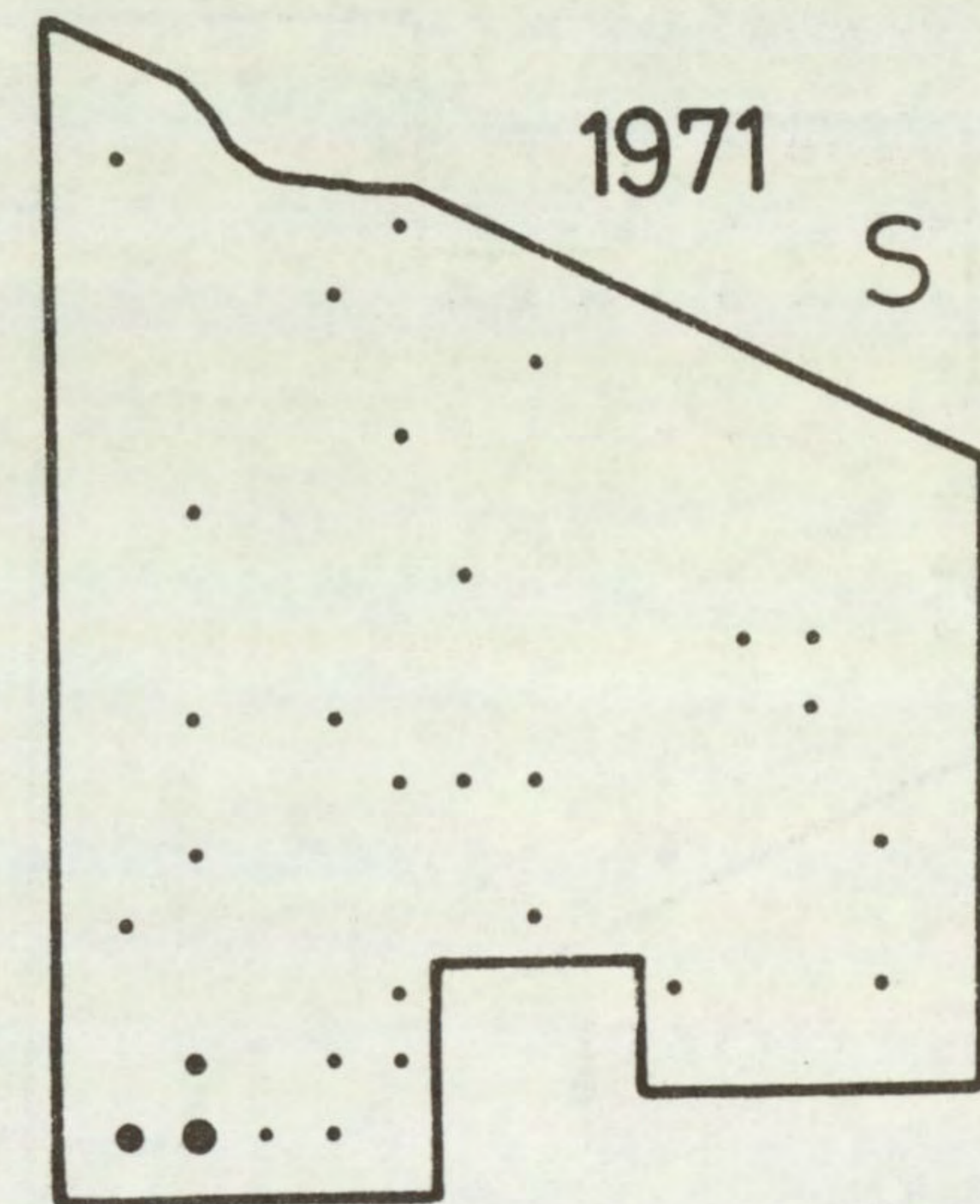
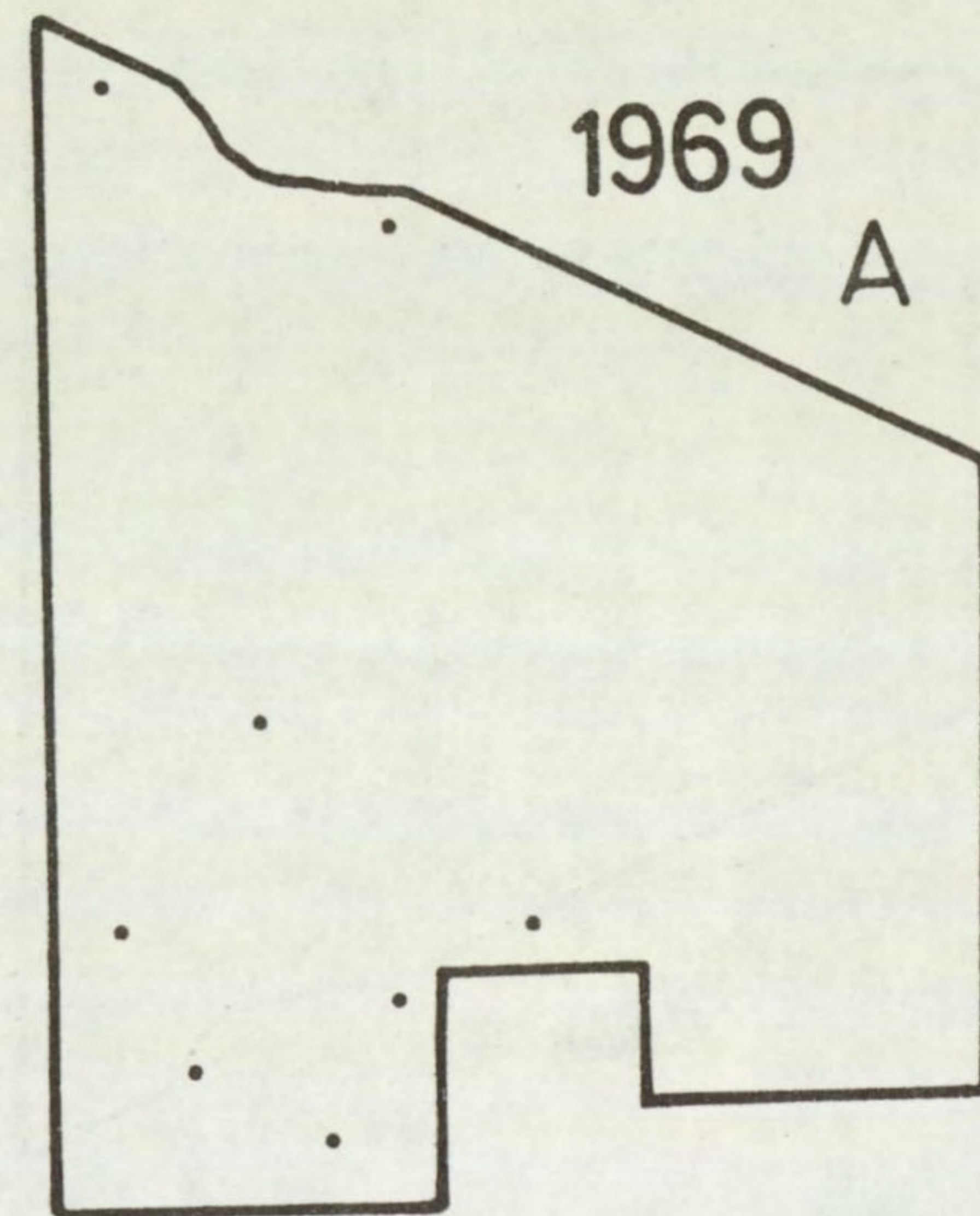
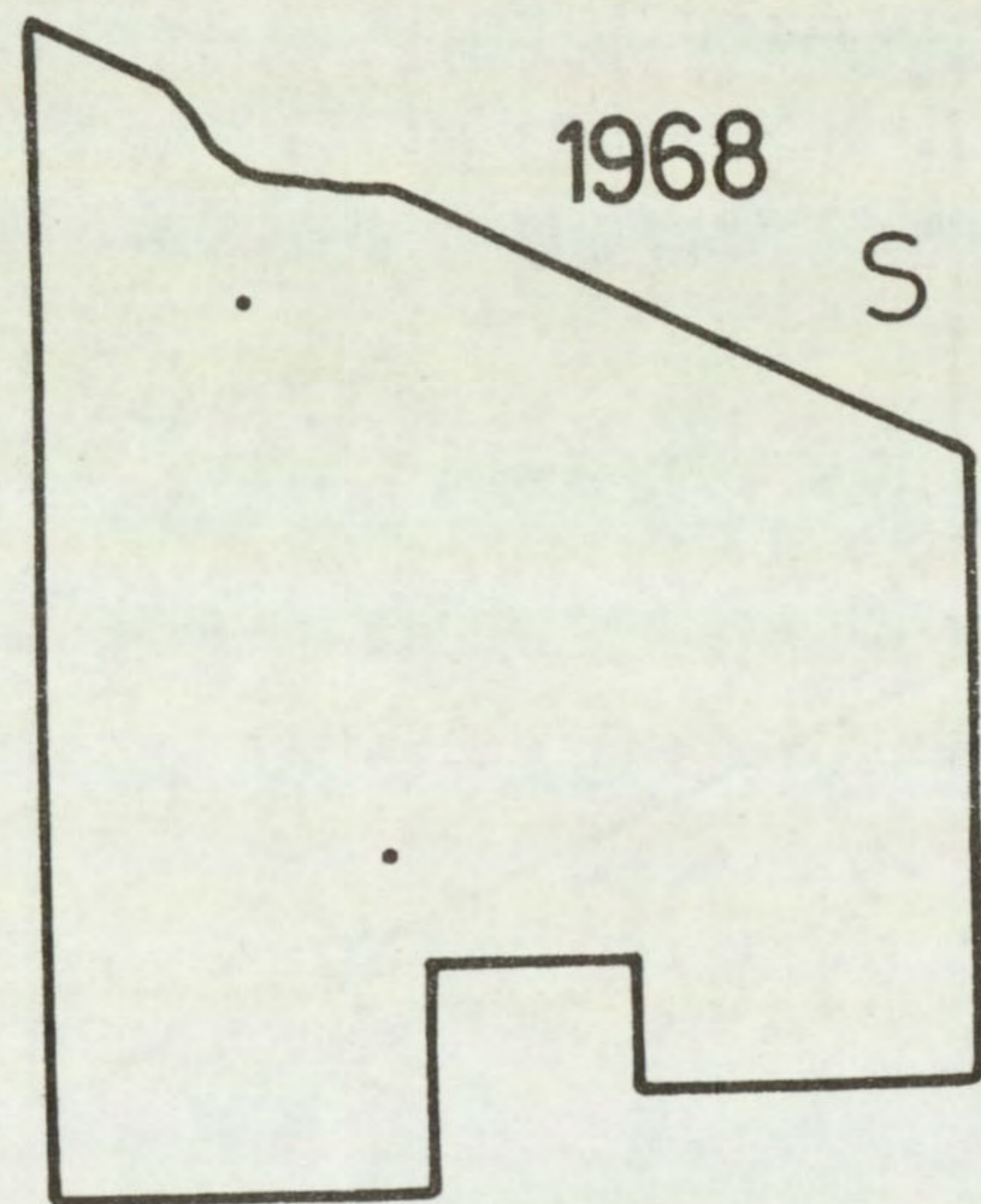
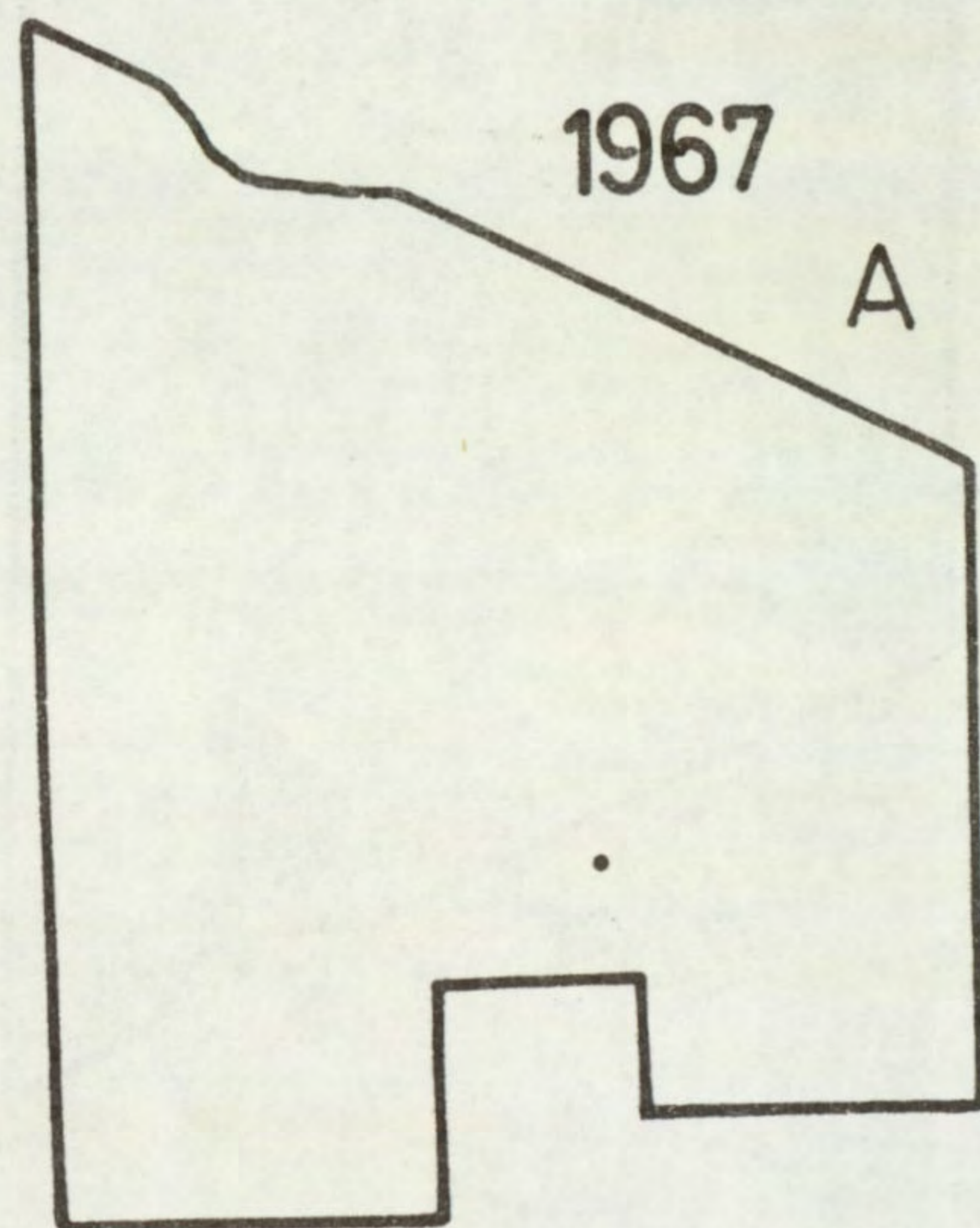
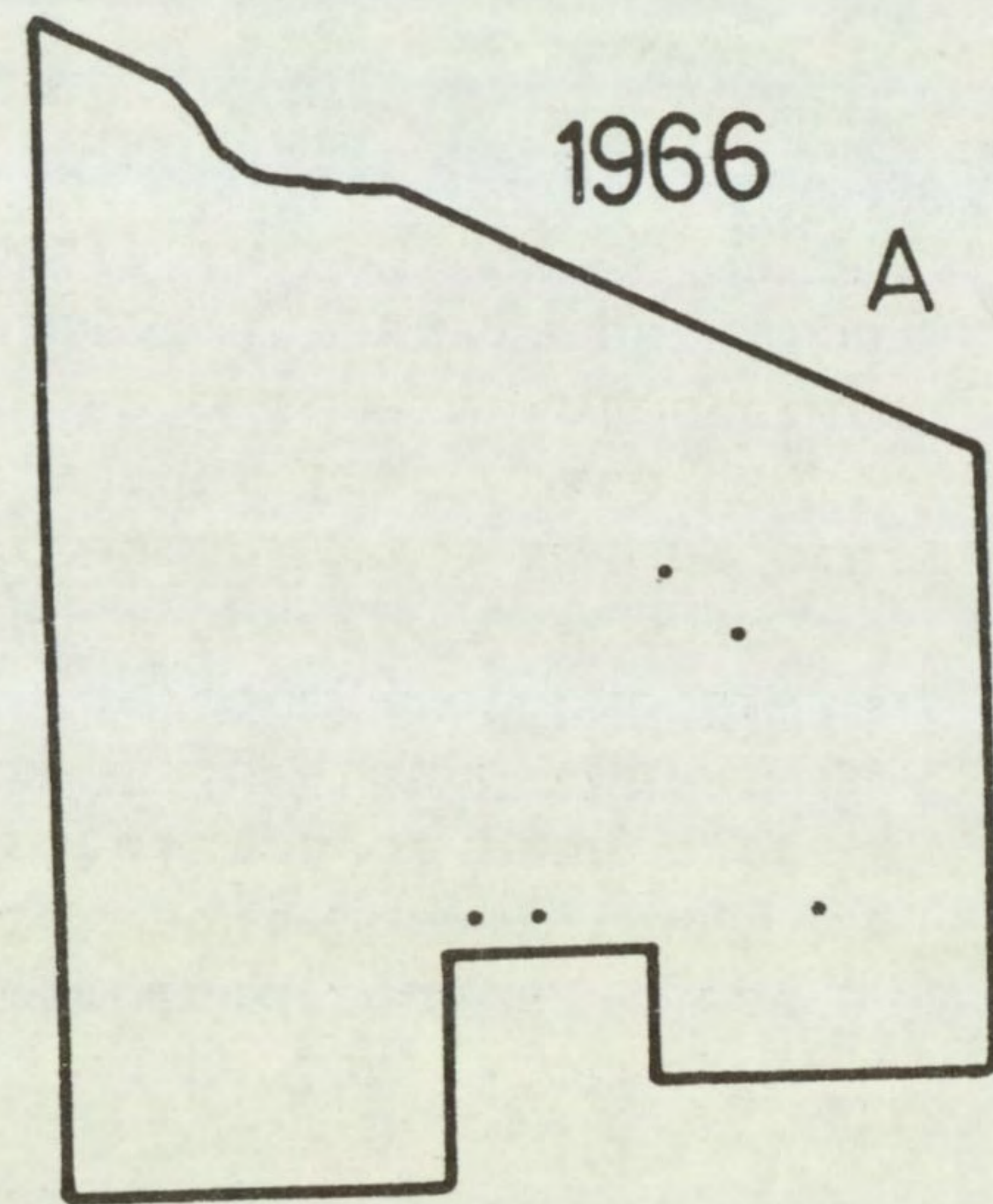
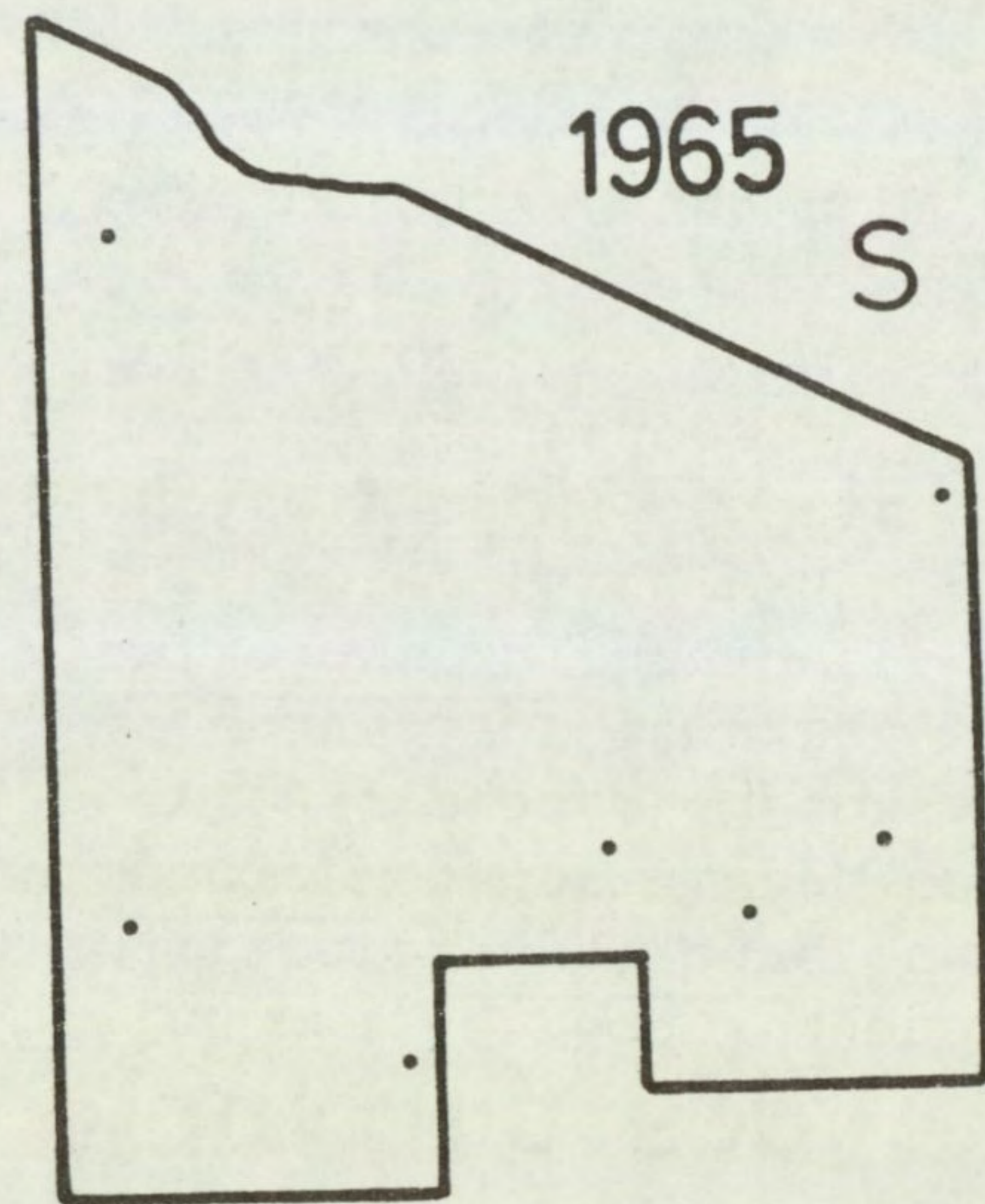
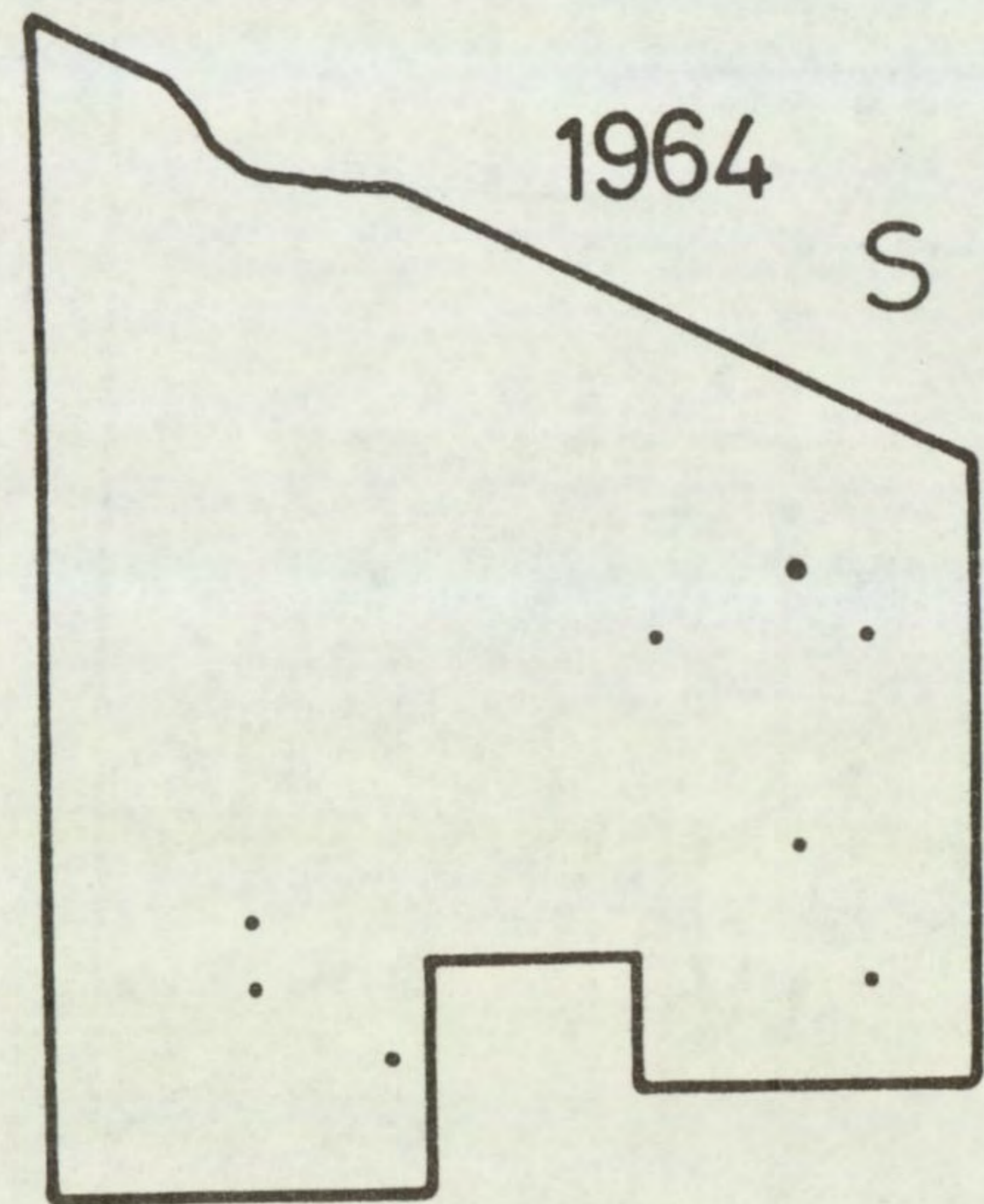
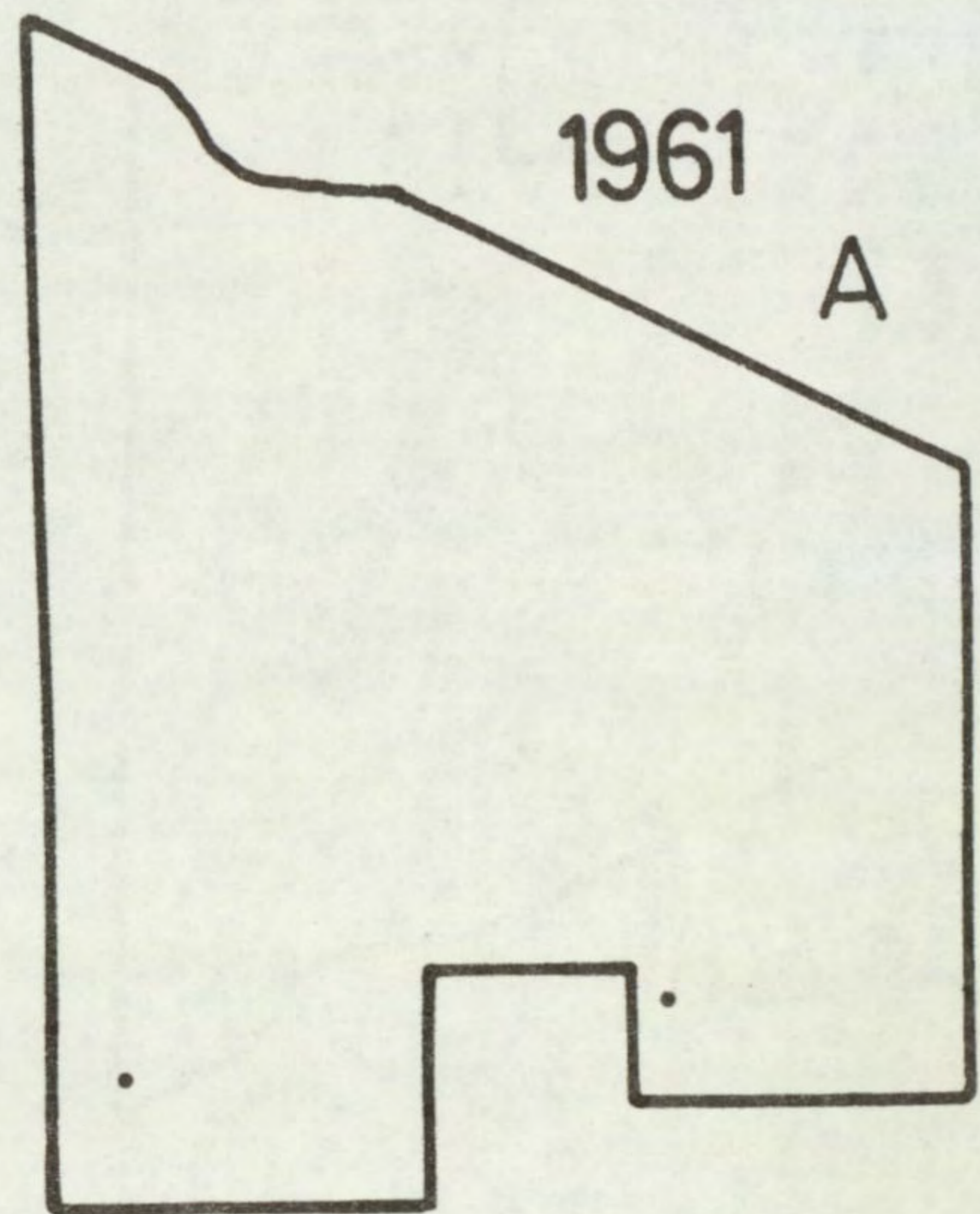
Like Polygonum aviculare, Fallopia convolvulus (= P. convolvulus) germinates only in spring, but as it emerges about a month later, it occurs less frequently in autumn-sown crops. In several years no seedlings were recorded in autumn-sown cereals, but in 1977, like P. aviculare, a moderate number were present. A few other species germinating in spring or early summer, such as P. lapathifolium and Solanum nigrum, which are not shown in this report, occurred only in spring-sown crops.





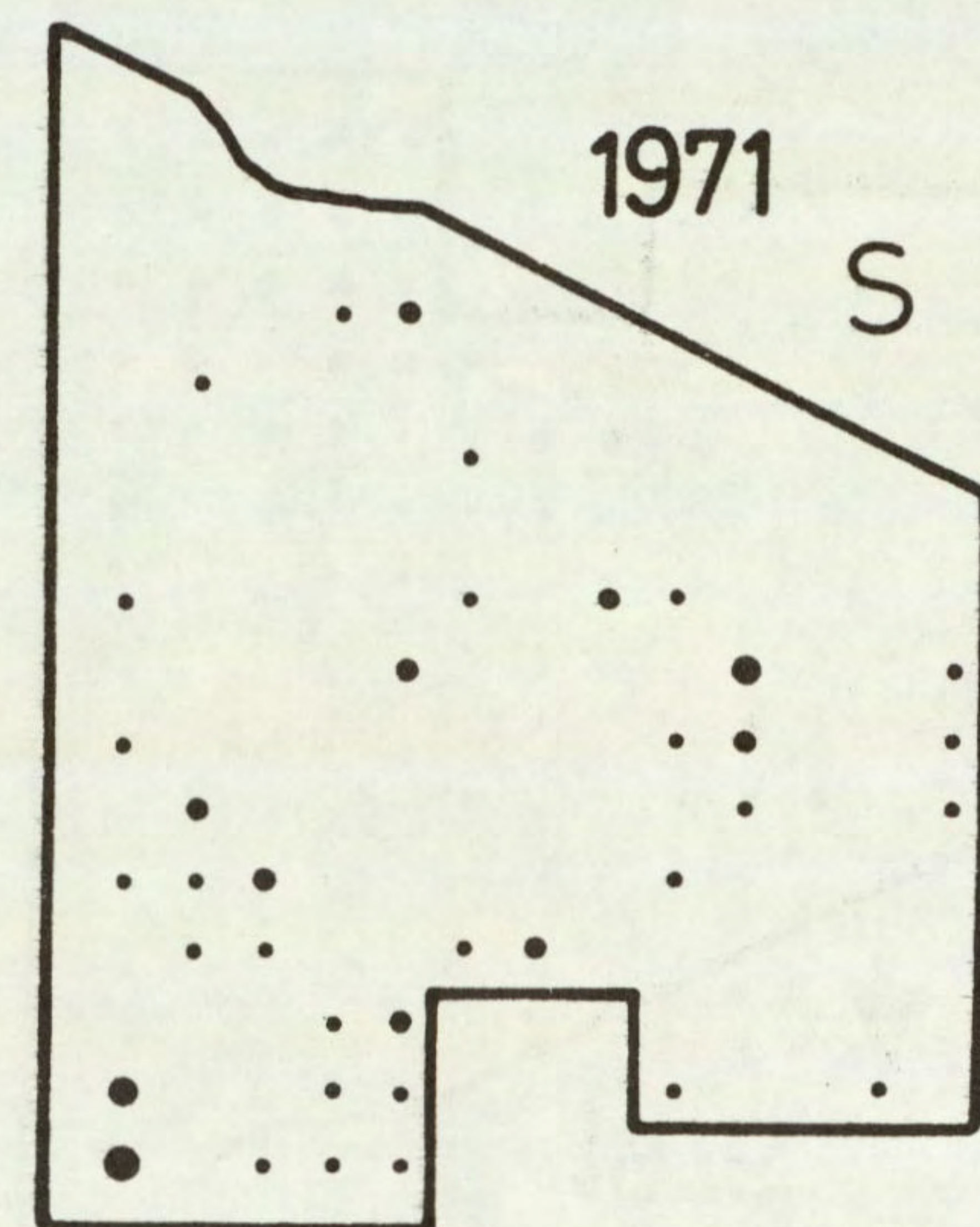
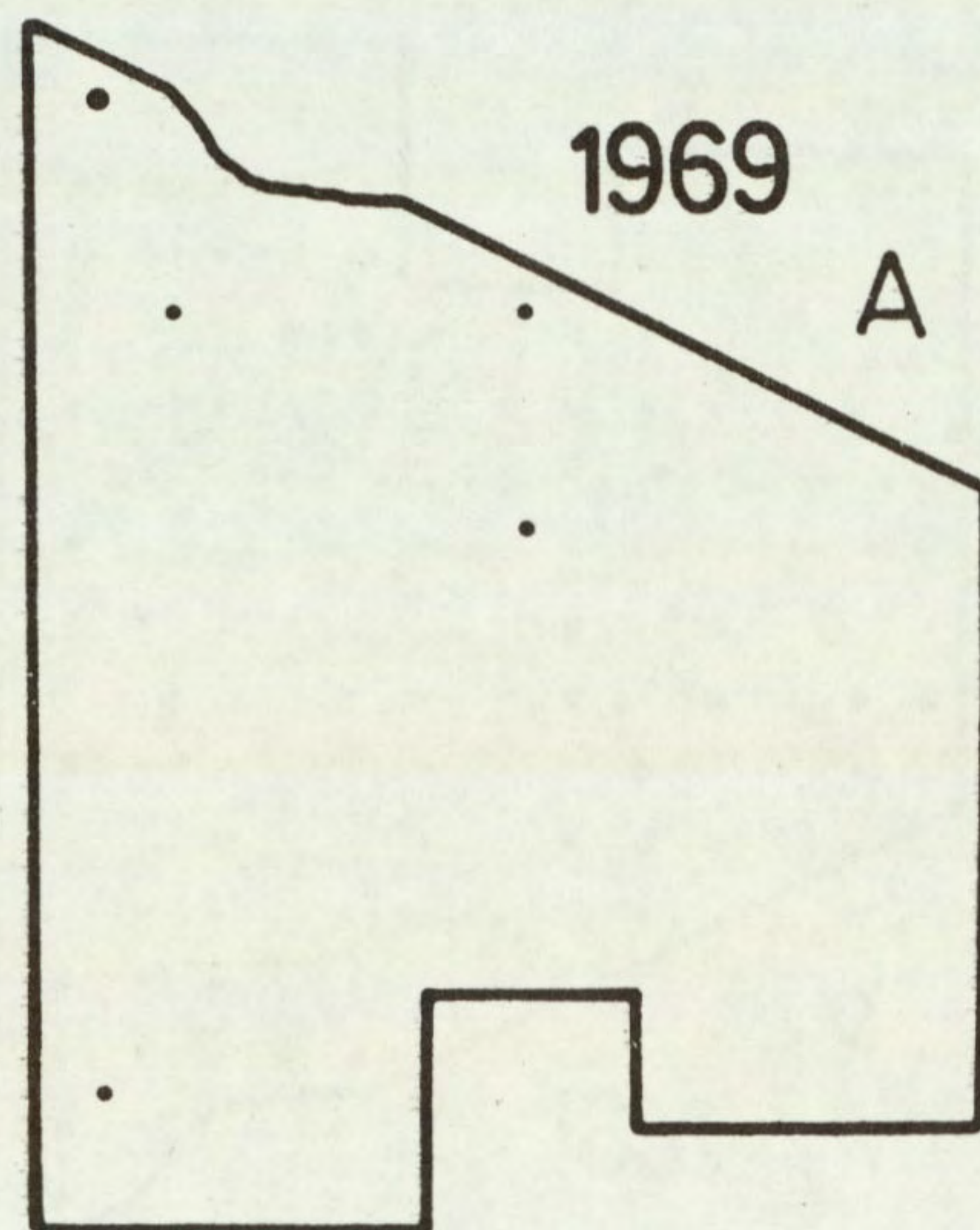
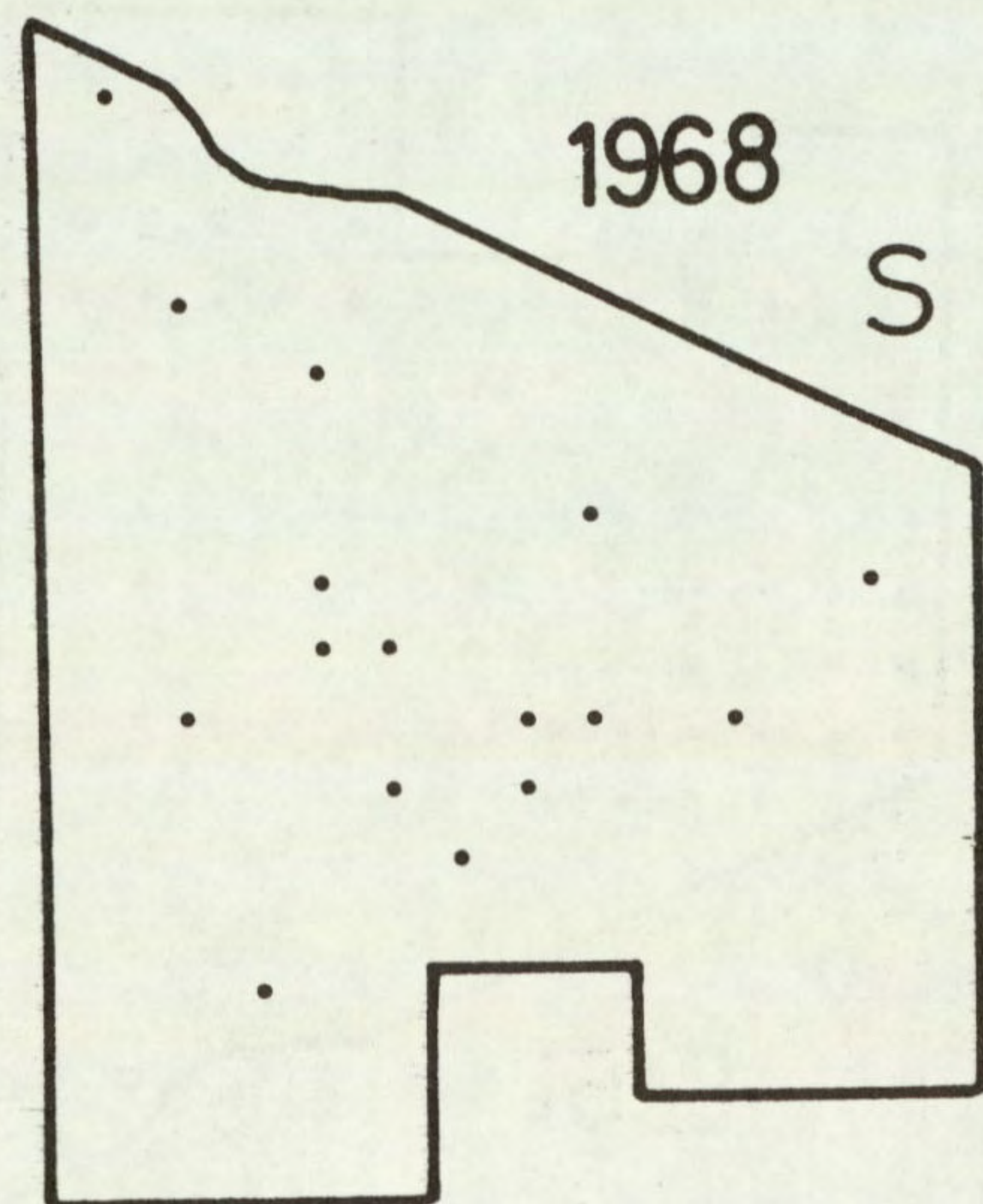
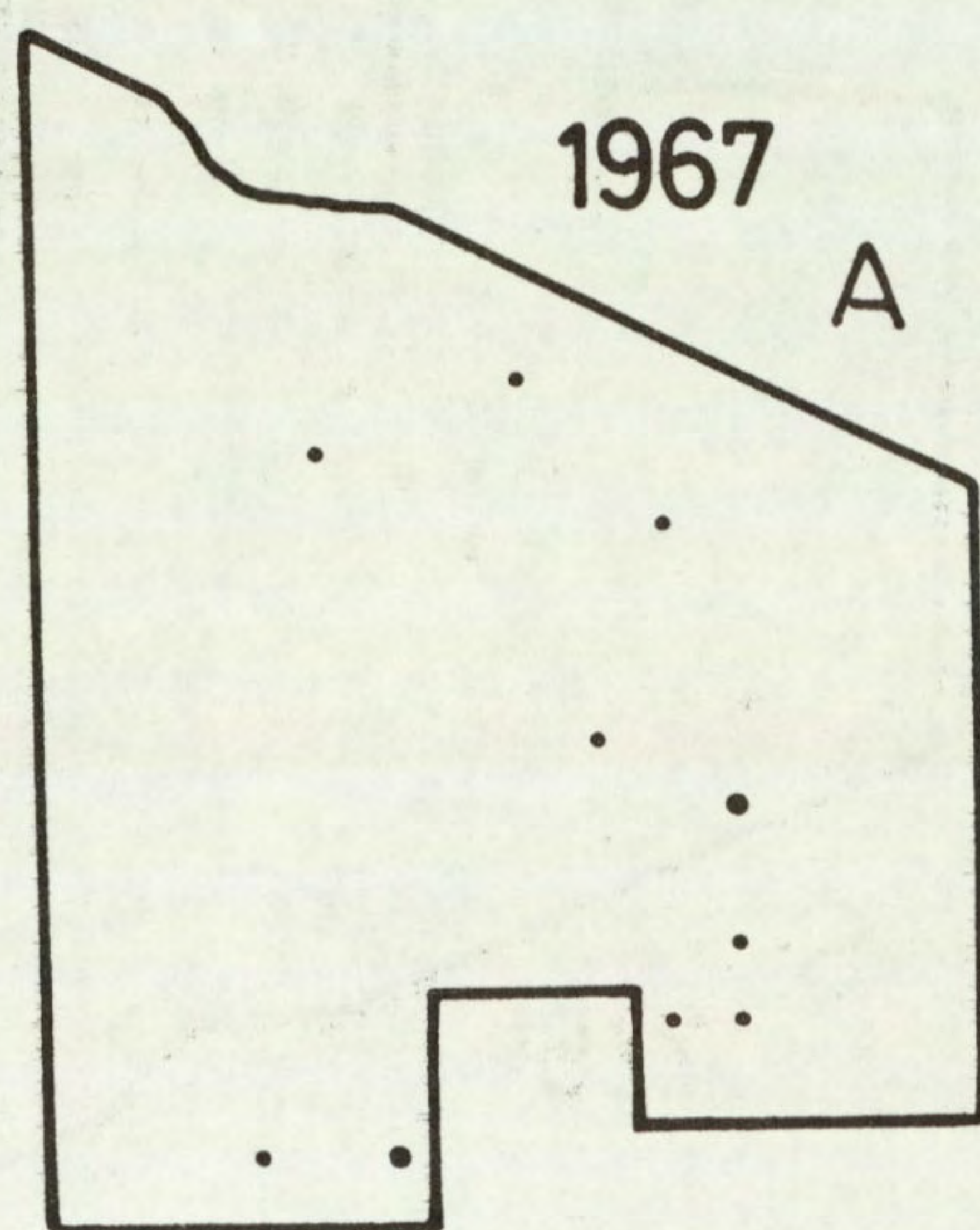
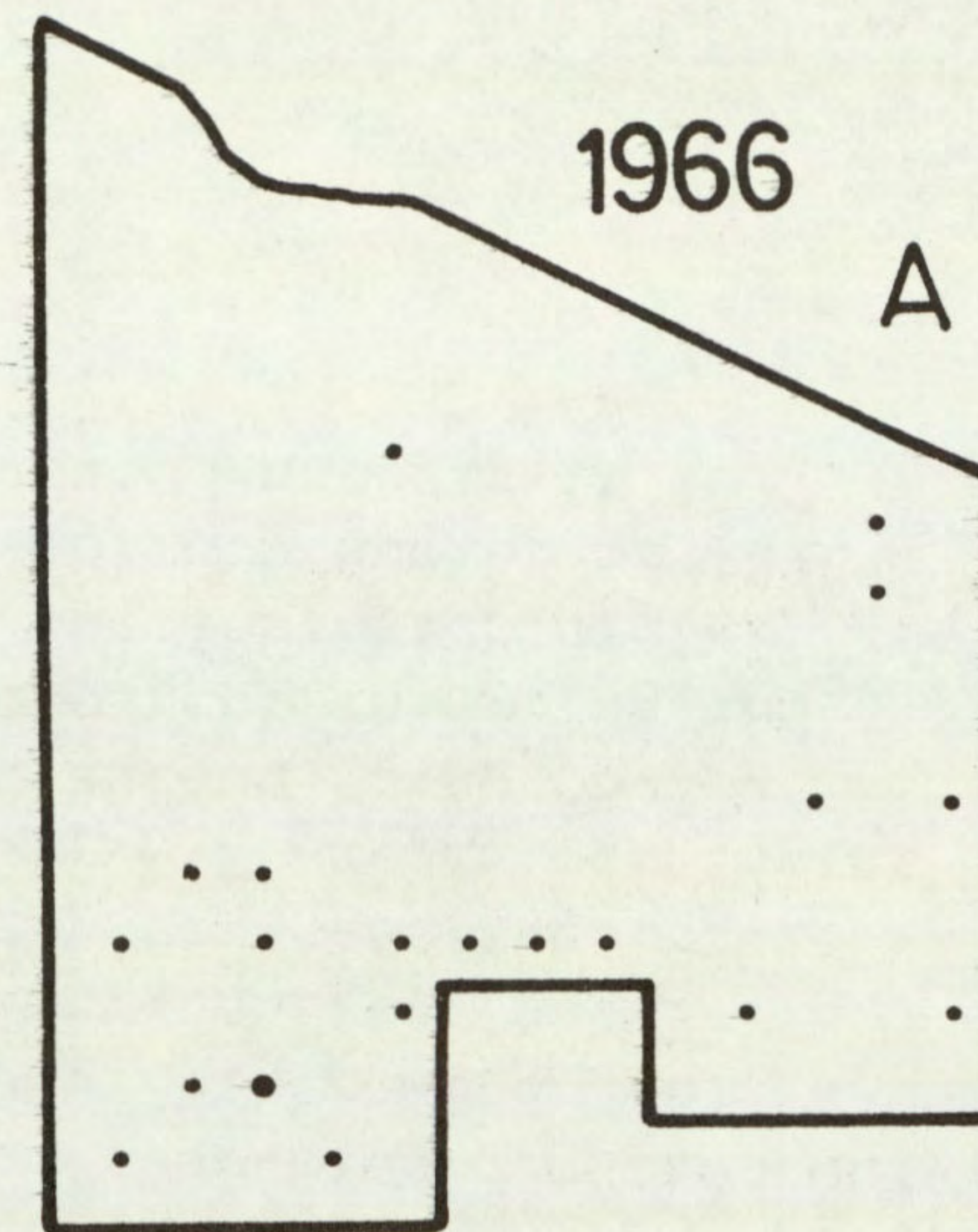
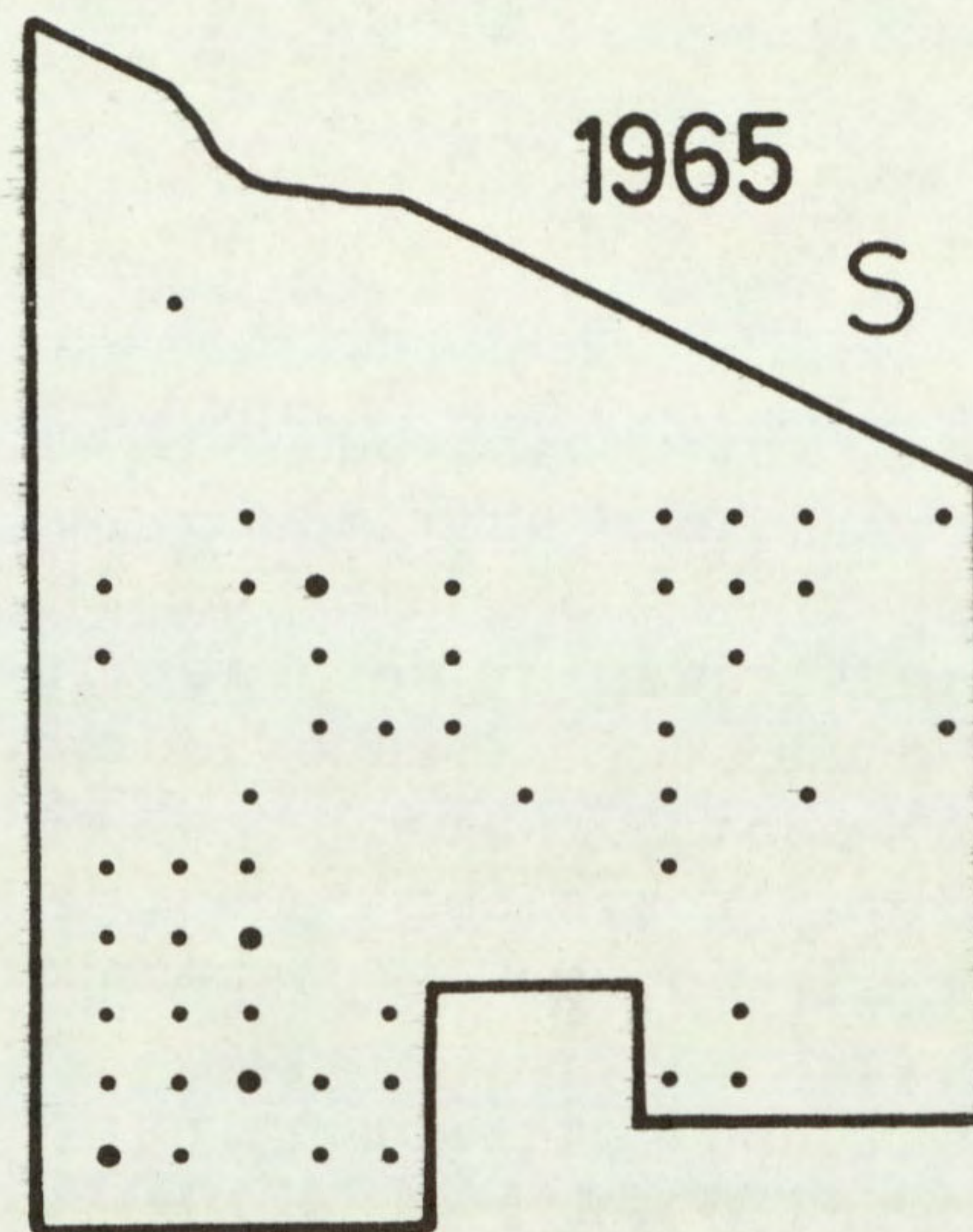
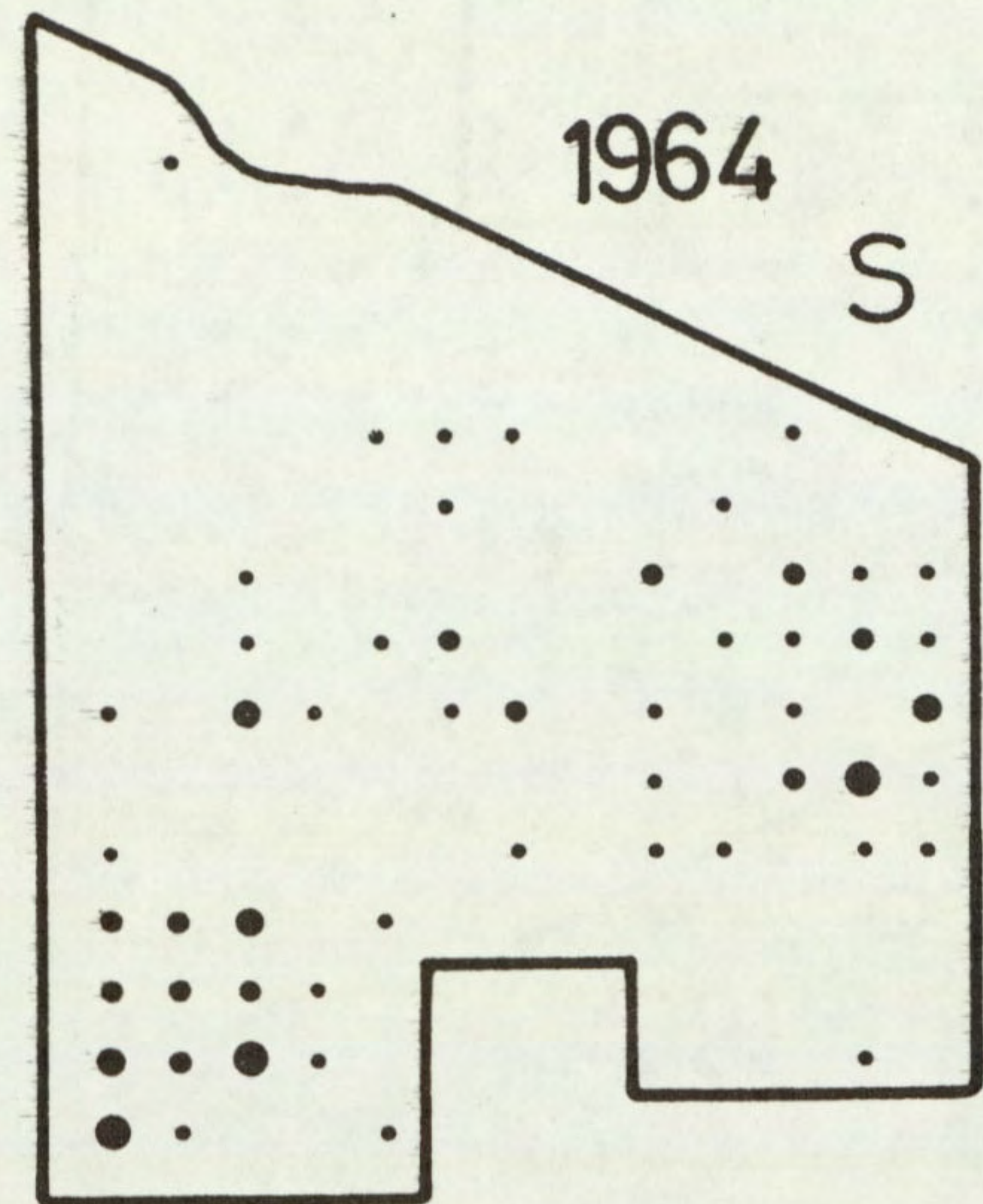
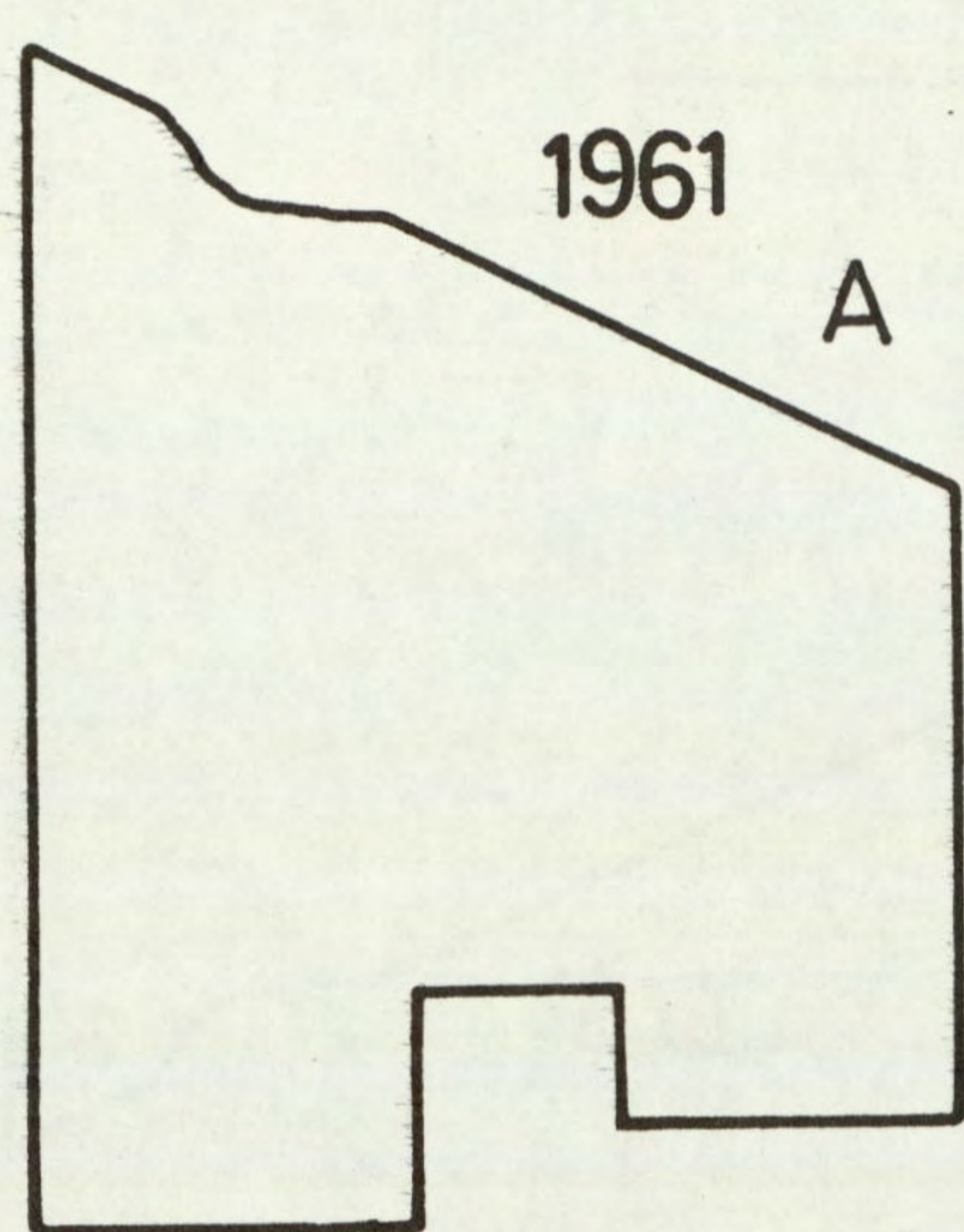
Matricaria spp.

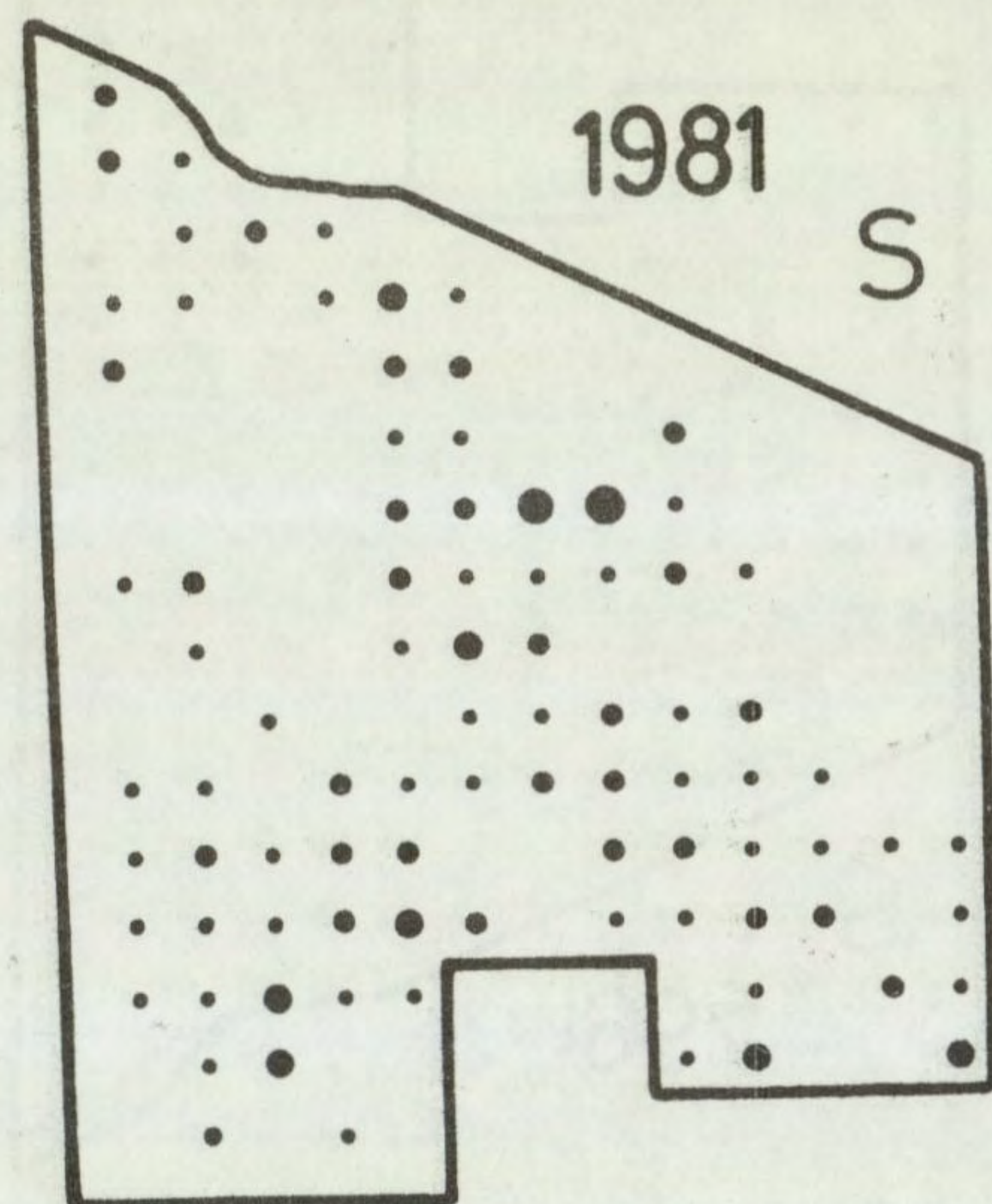
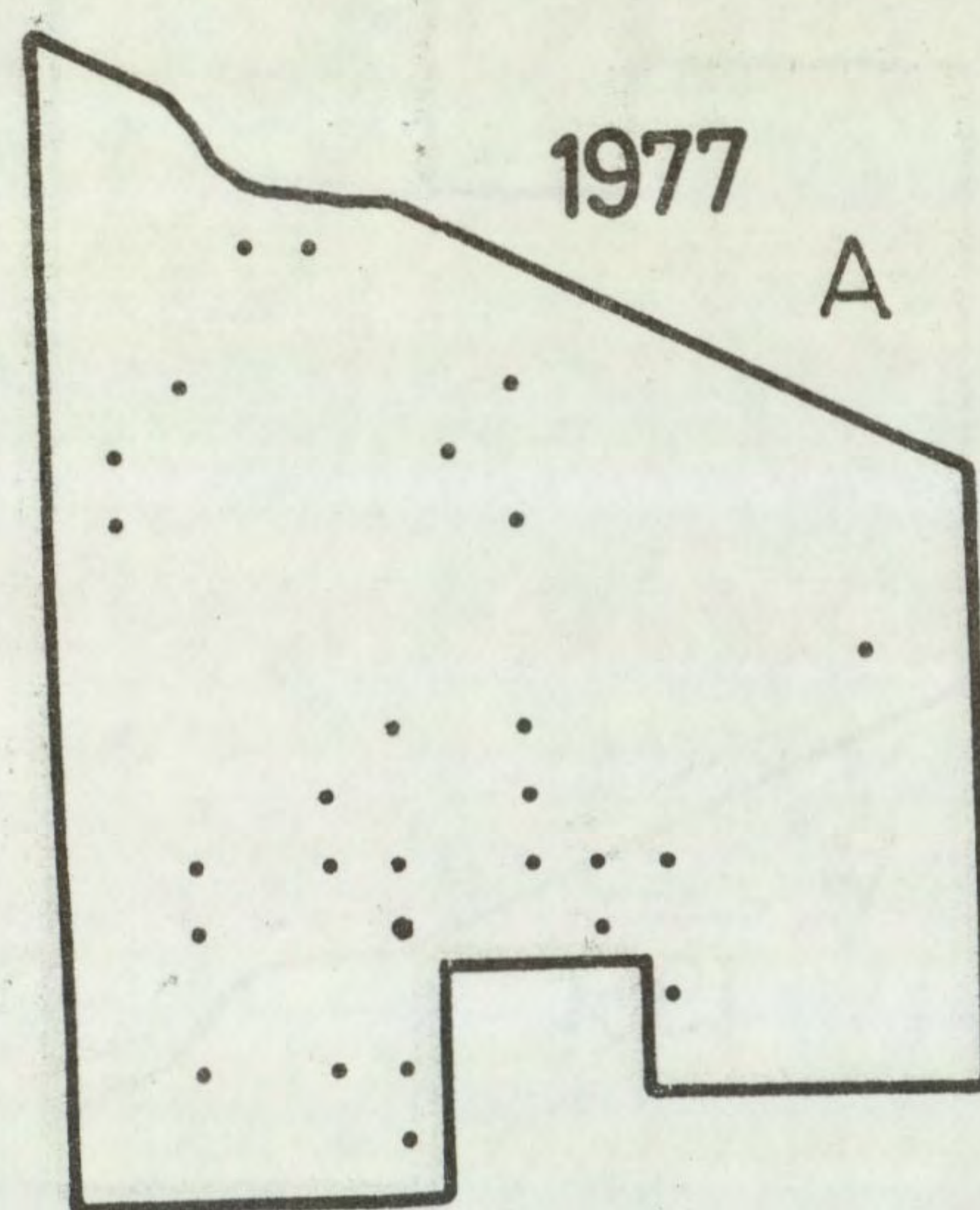
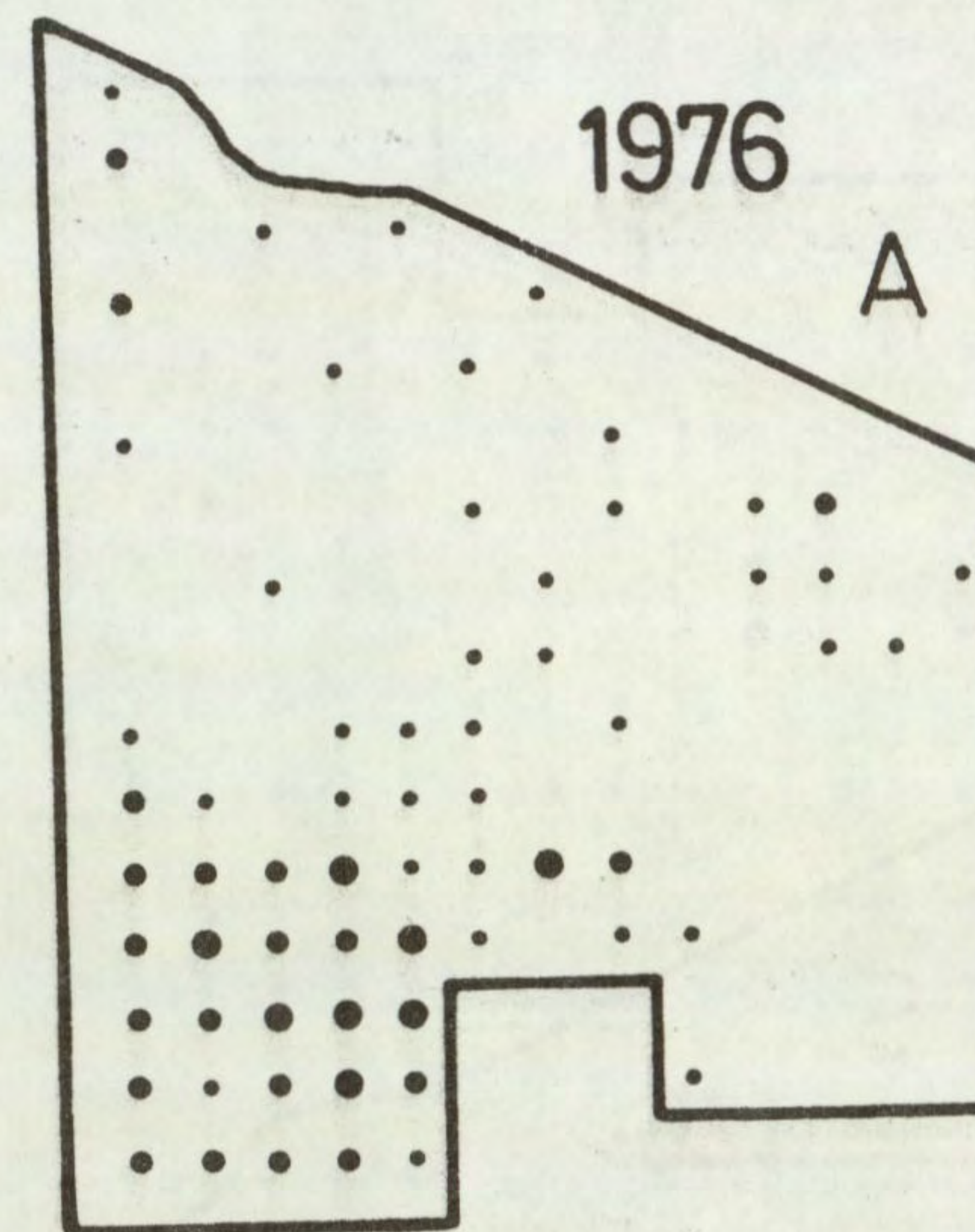
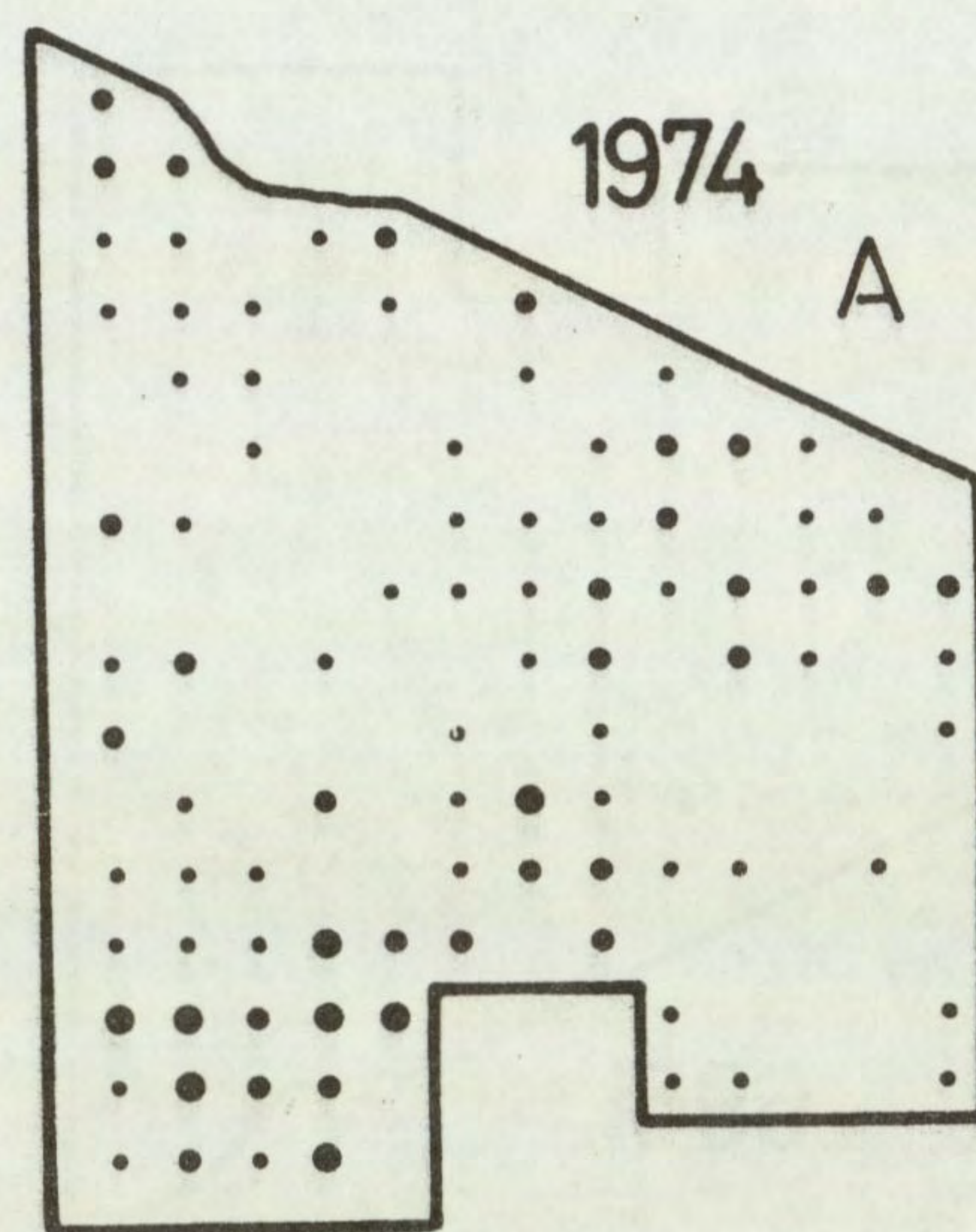
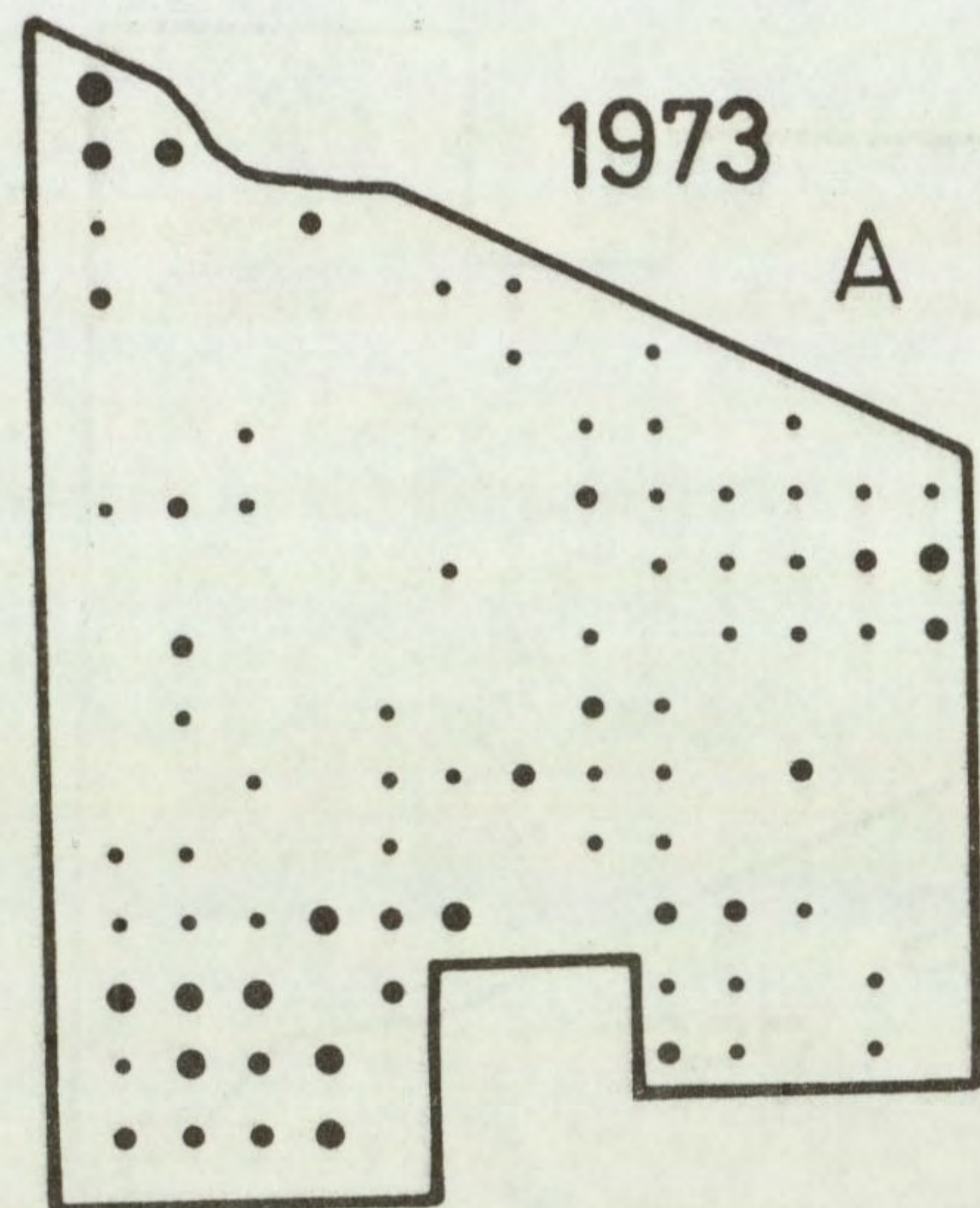
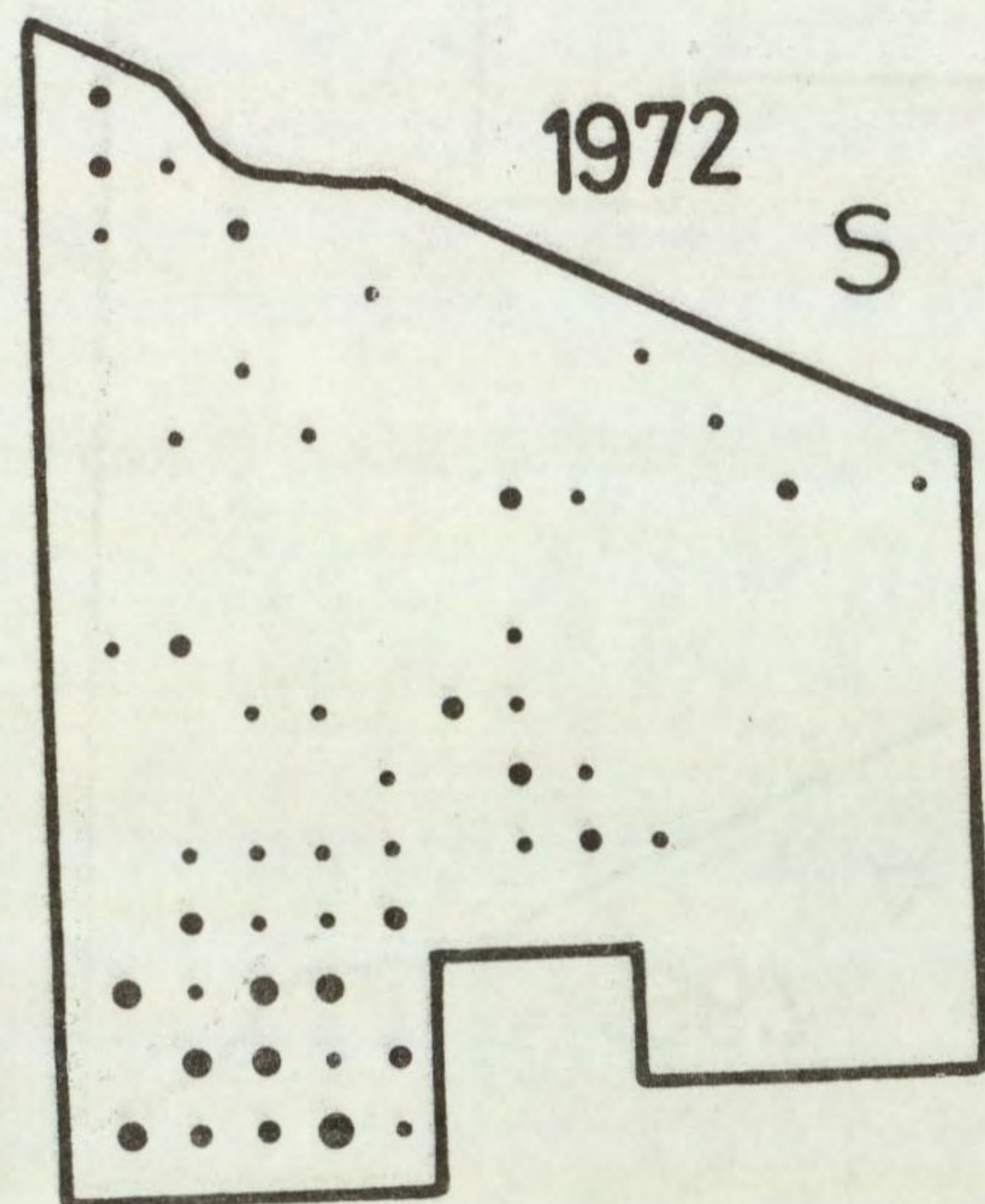
Chamomilla recutita and C. suaveolens (formerly Matricaria spp) have been combined because these species cannot always be distinguished at the earliest stages. Occasional clumps of plants of C. suaveolens occurred up to 1968 around the buildings in the indent at the bottom of the field. Thereafter there was a gradual increase, almost entirely of C. recutita, presumably due to one or more introductions in crop seed. Inadequate control of this weed led up to a severe infestation in 1977. A parallel example of a weed infestation developing was shown by Stellaria media.



568

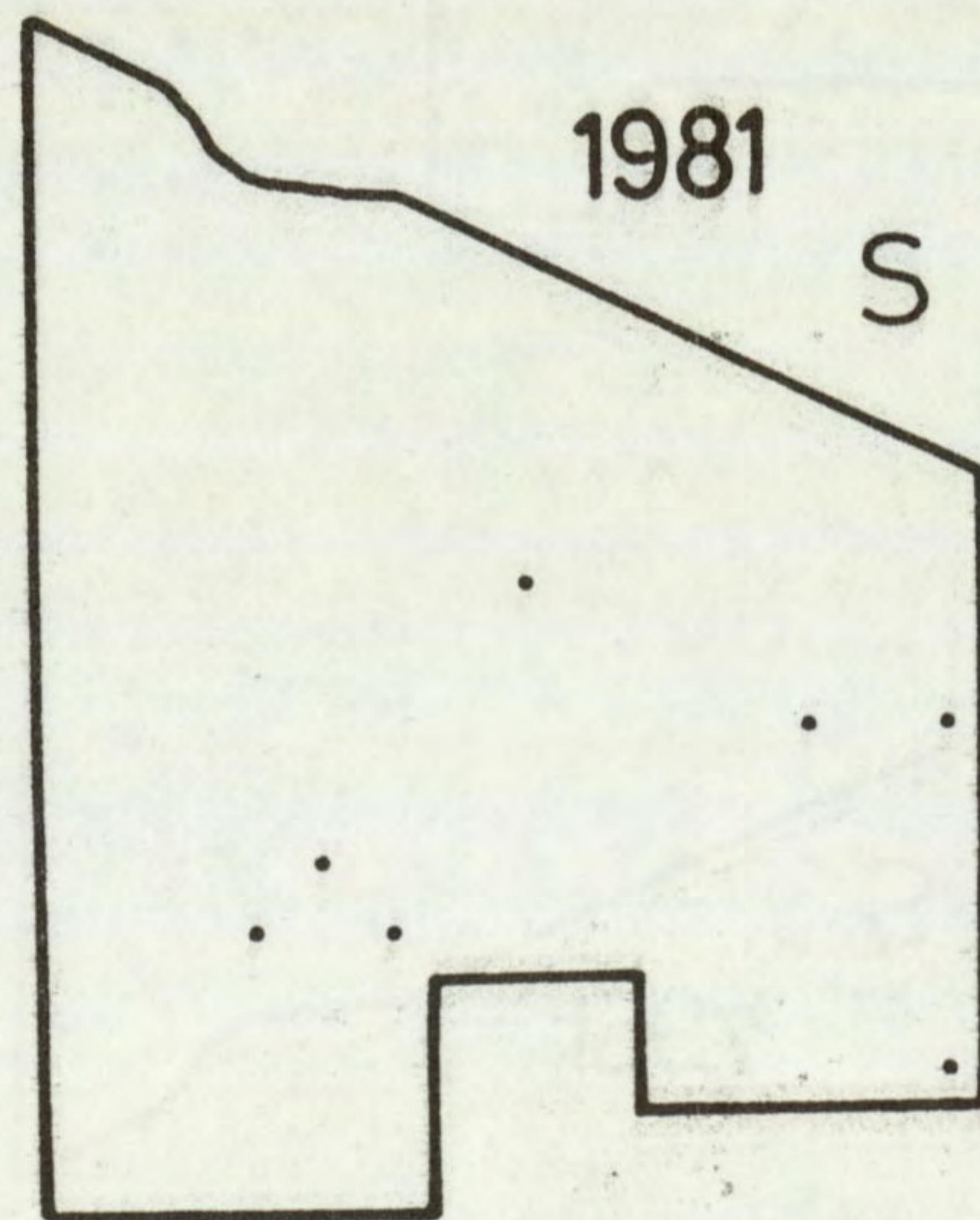
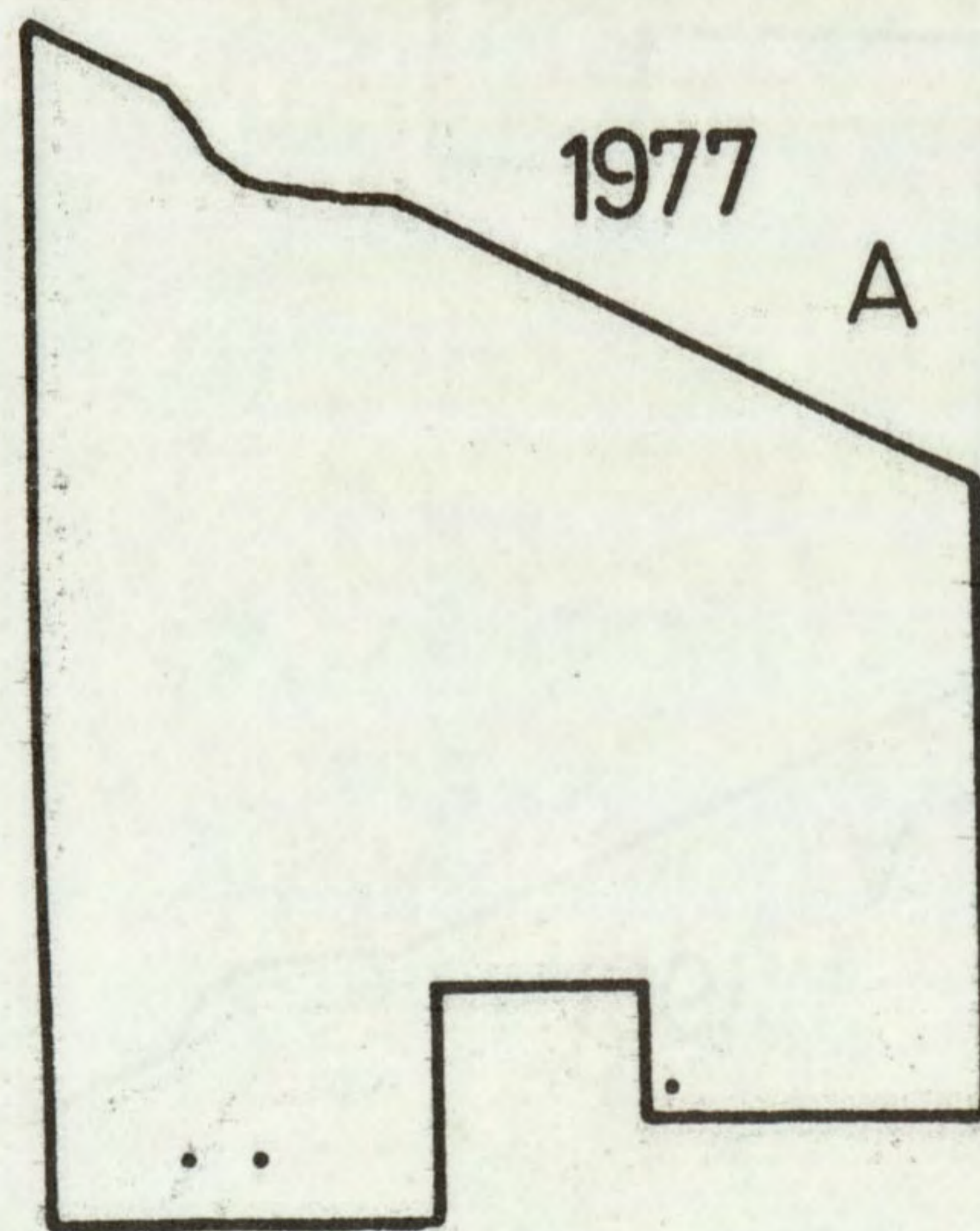
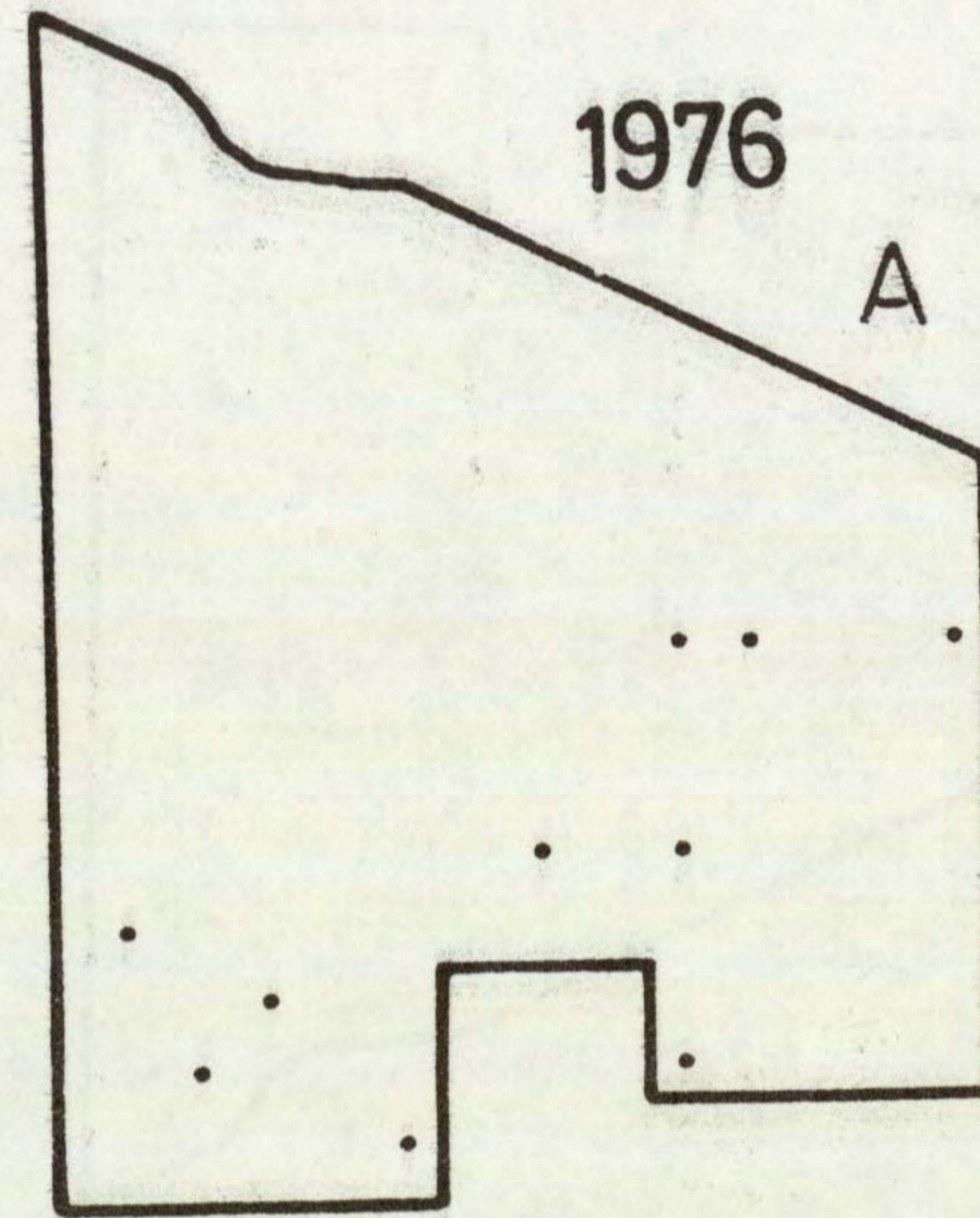
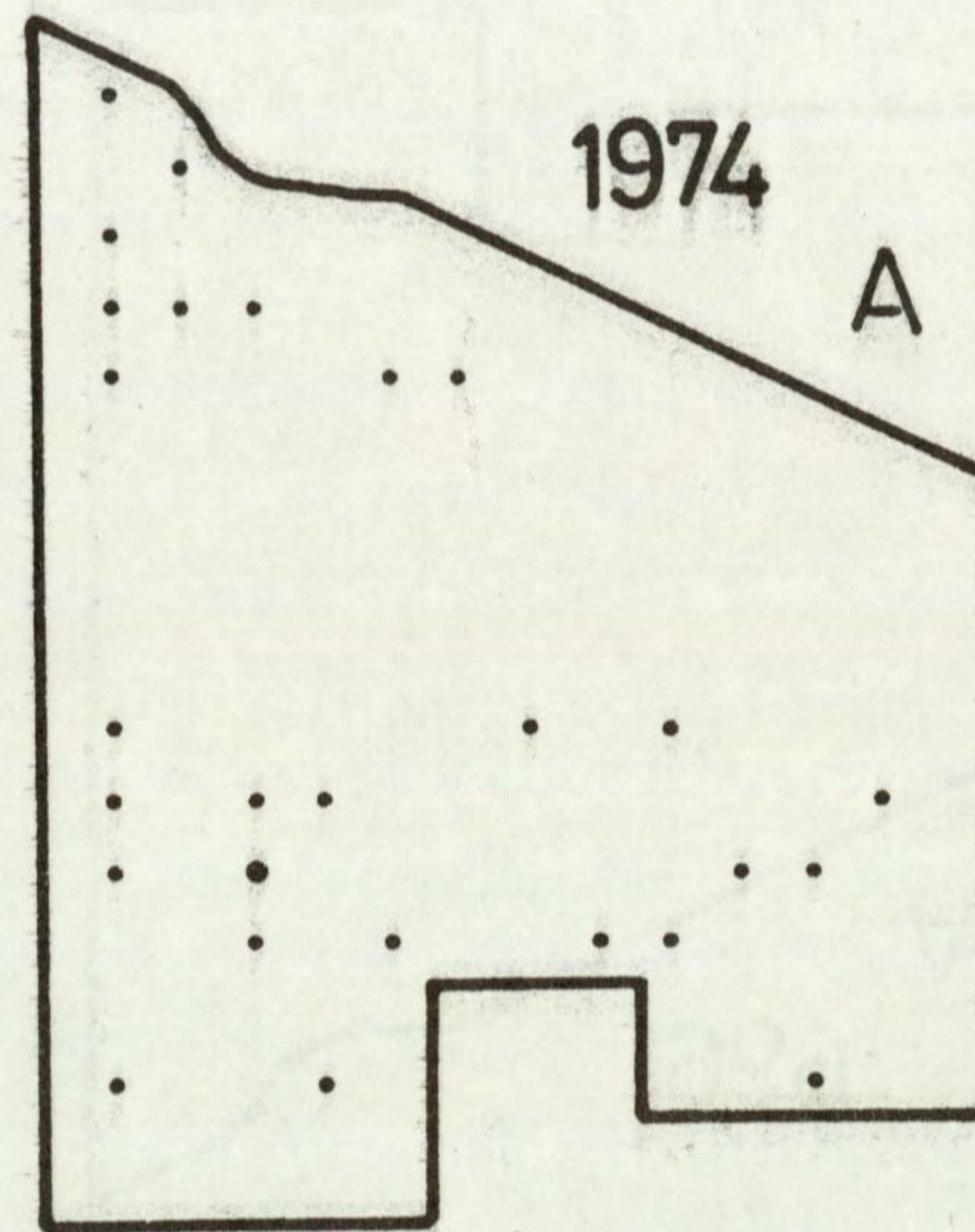
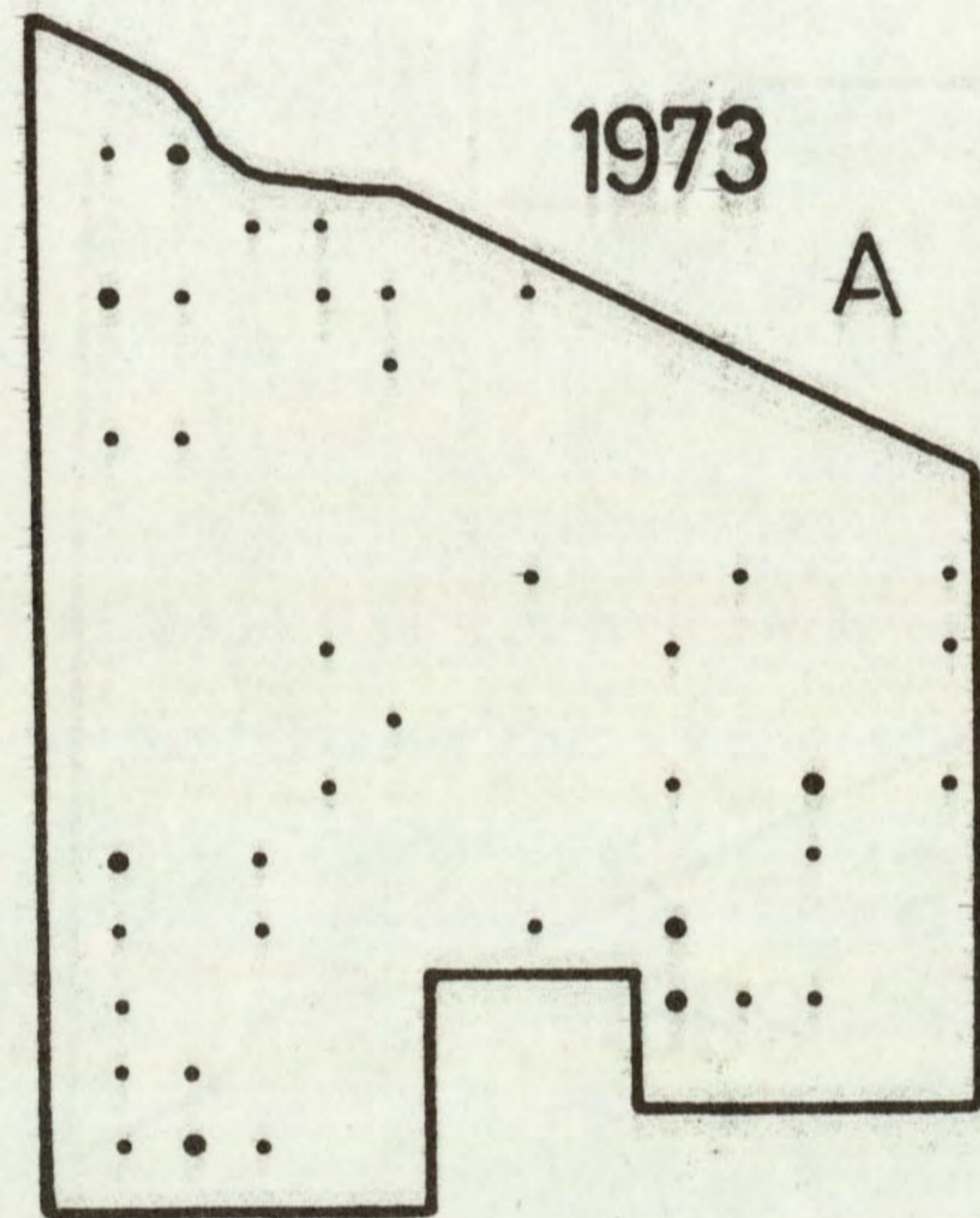
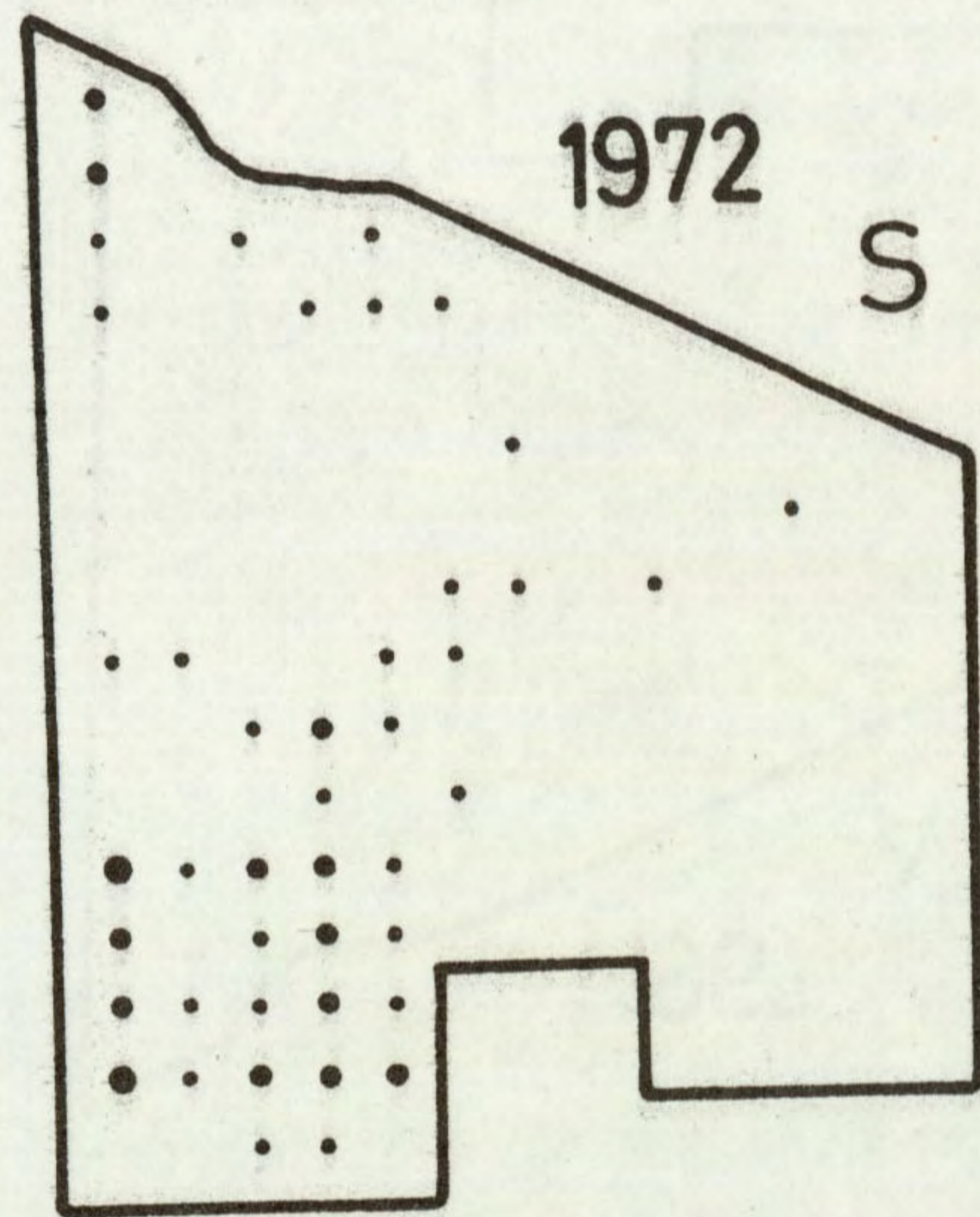
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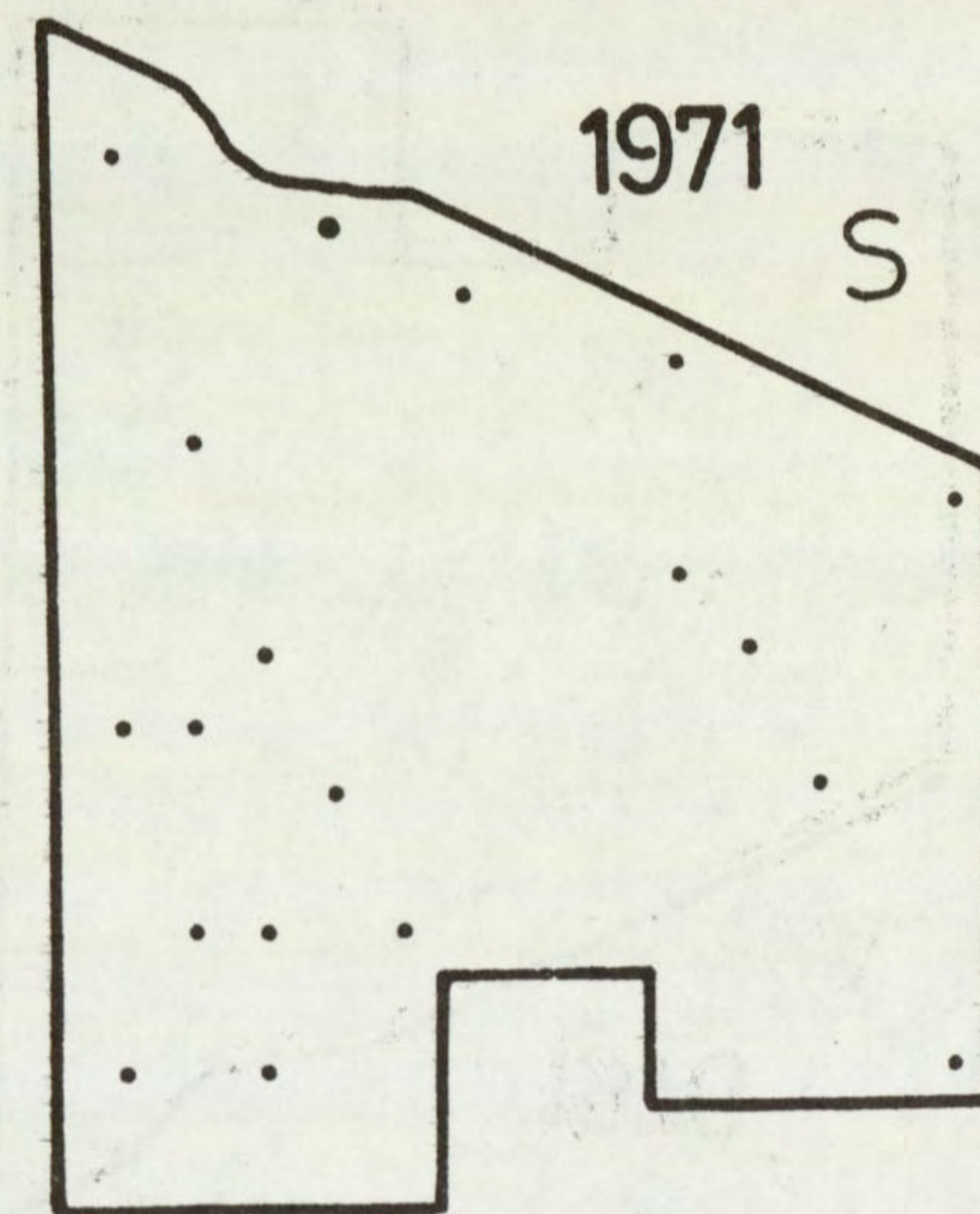
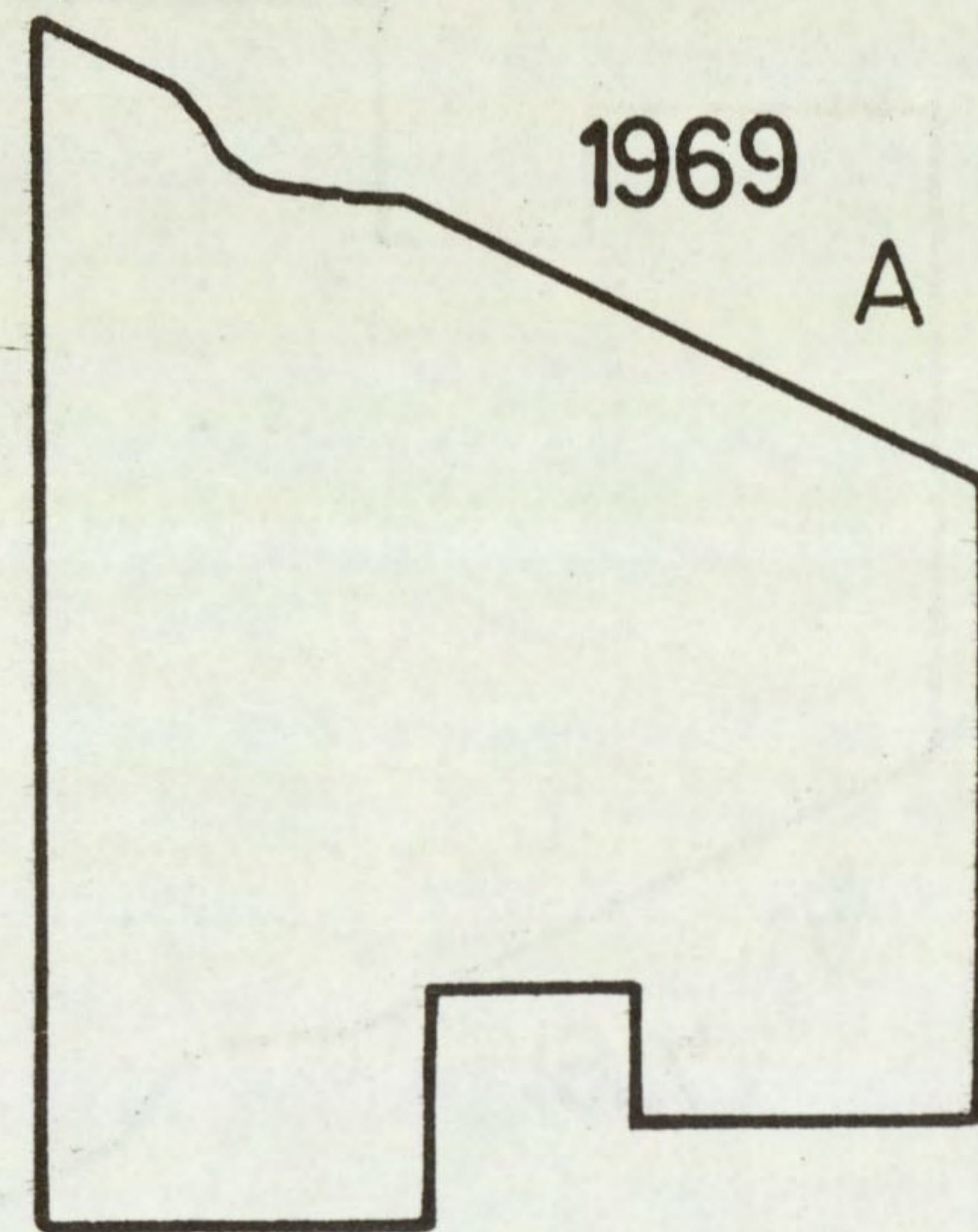
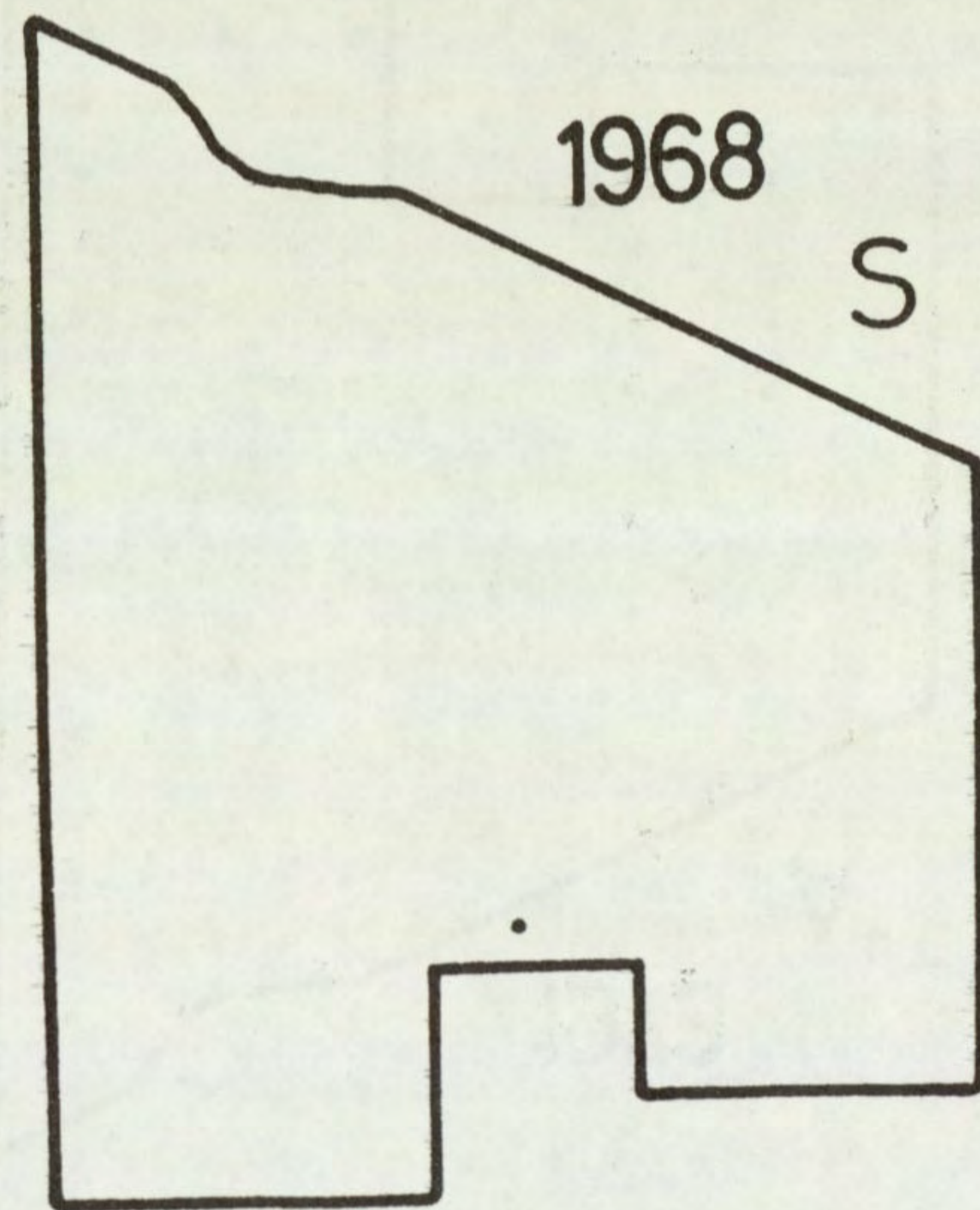
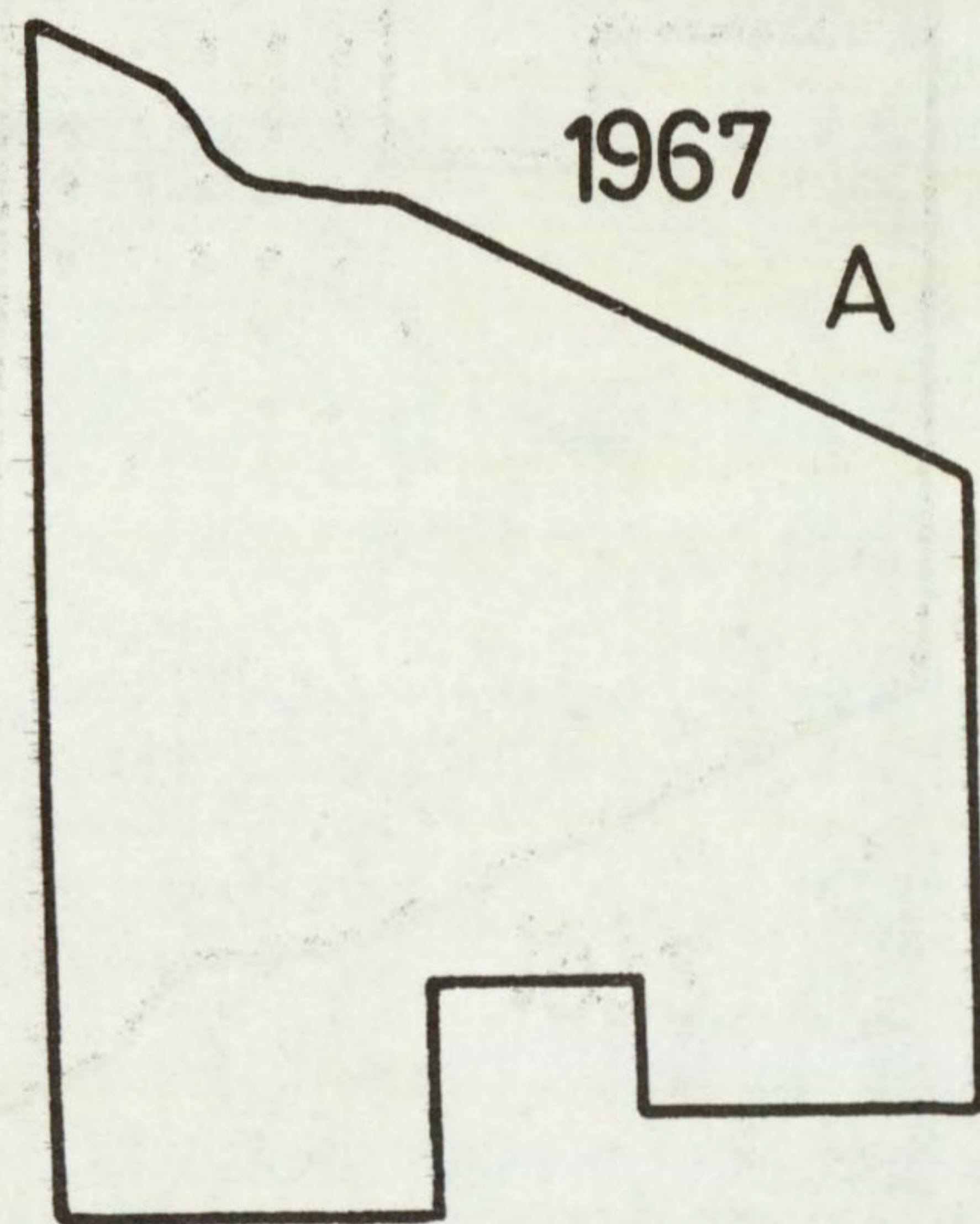
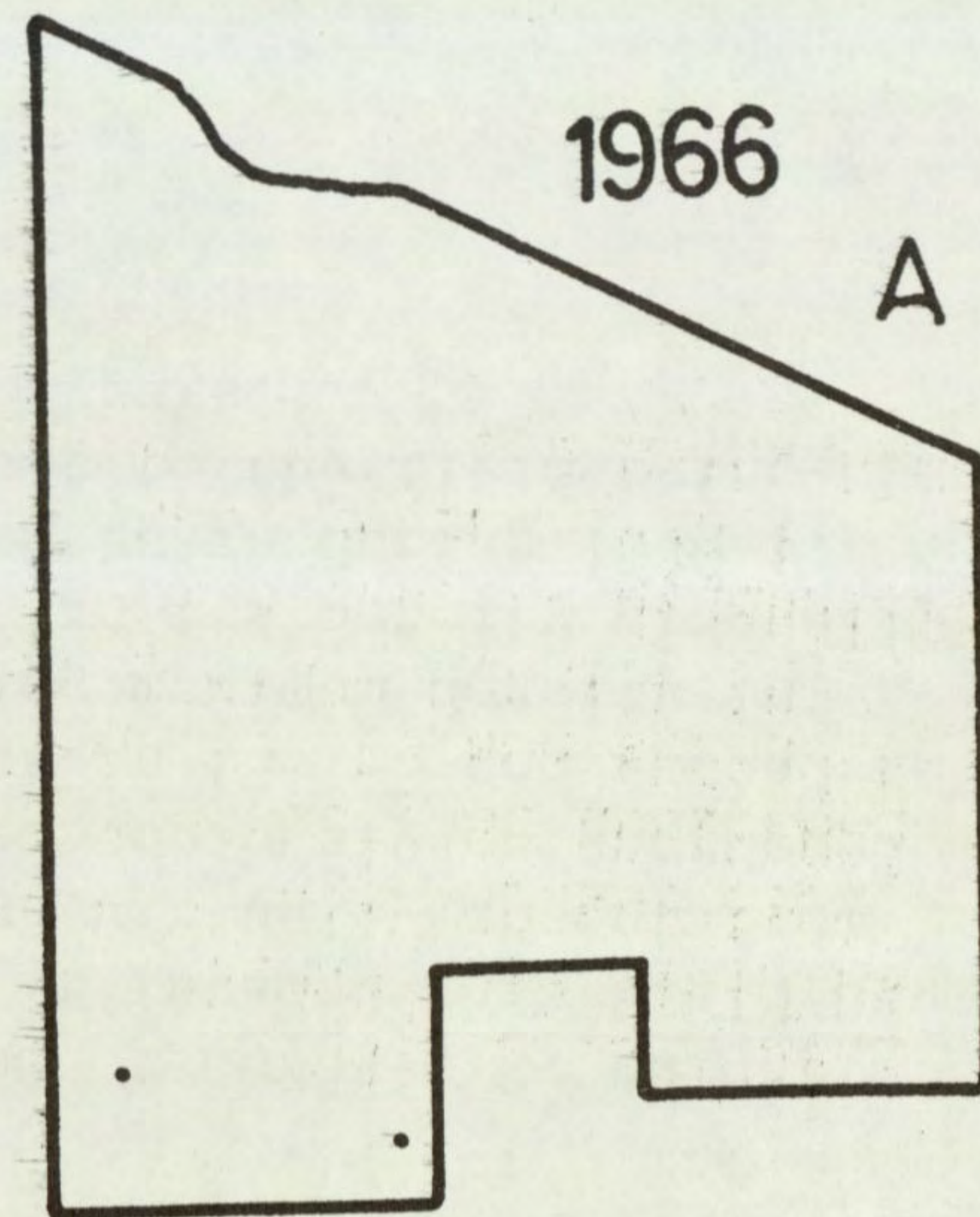
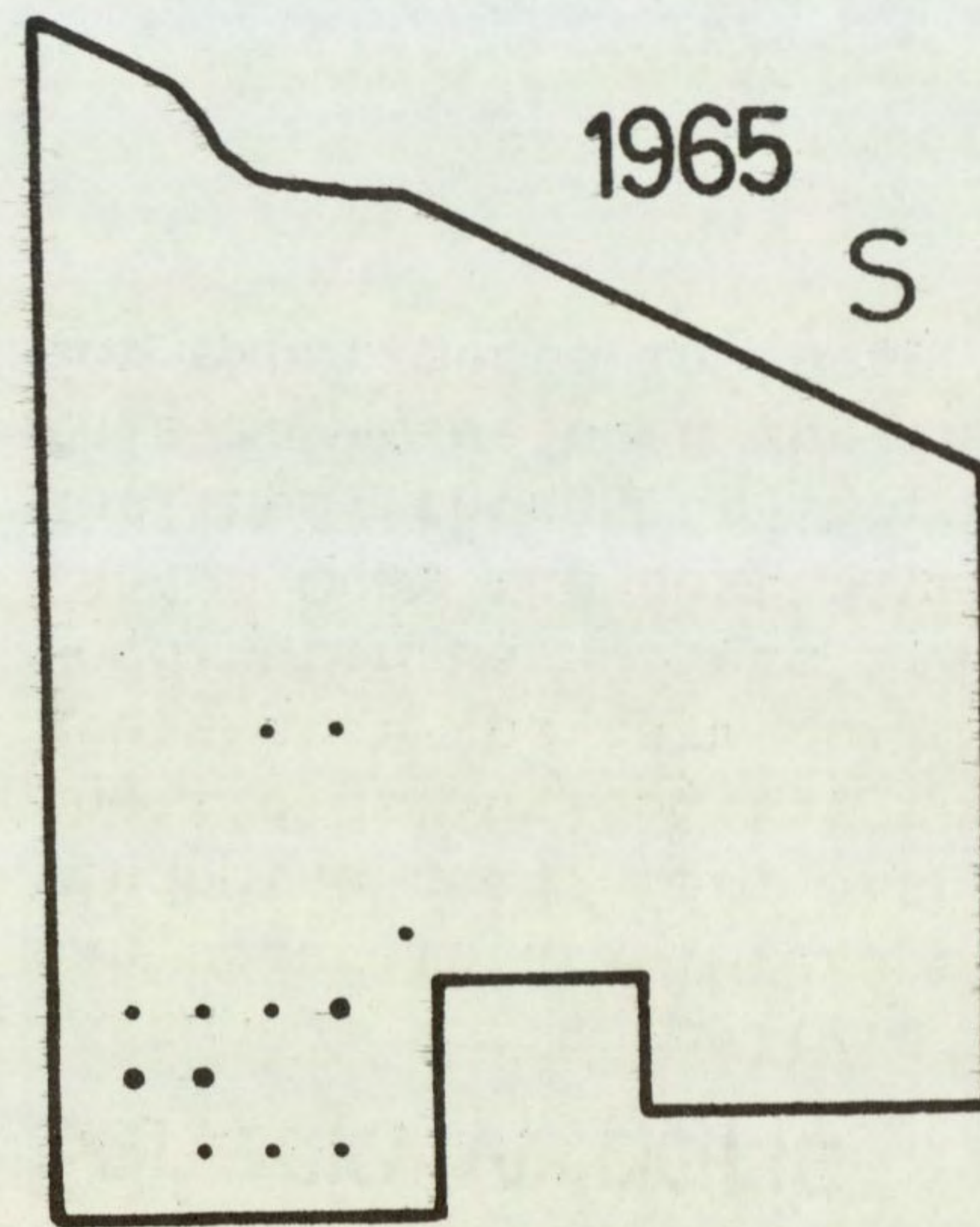
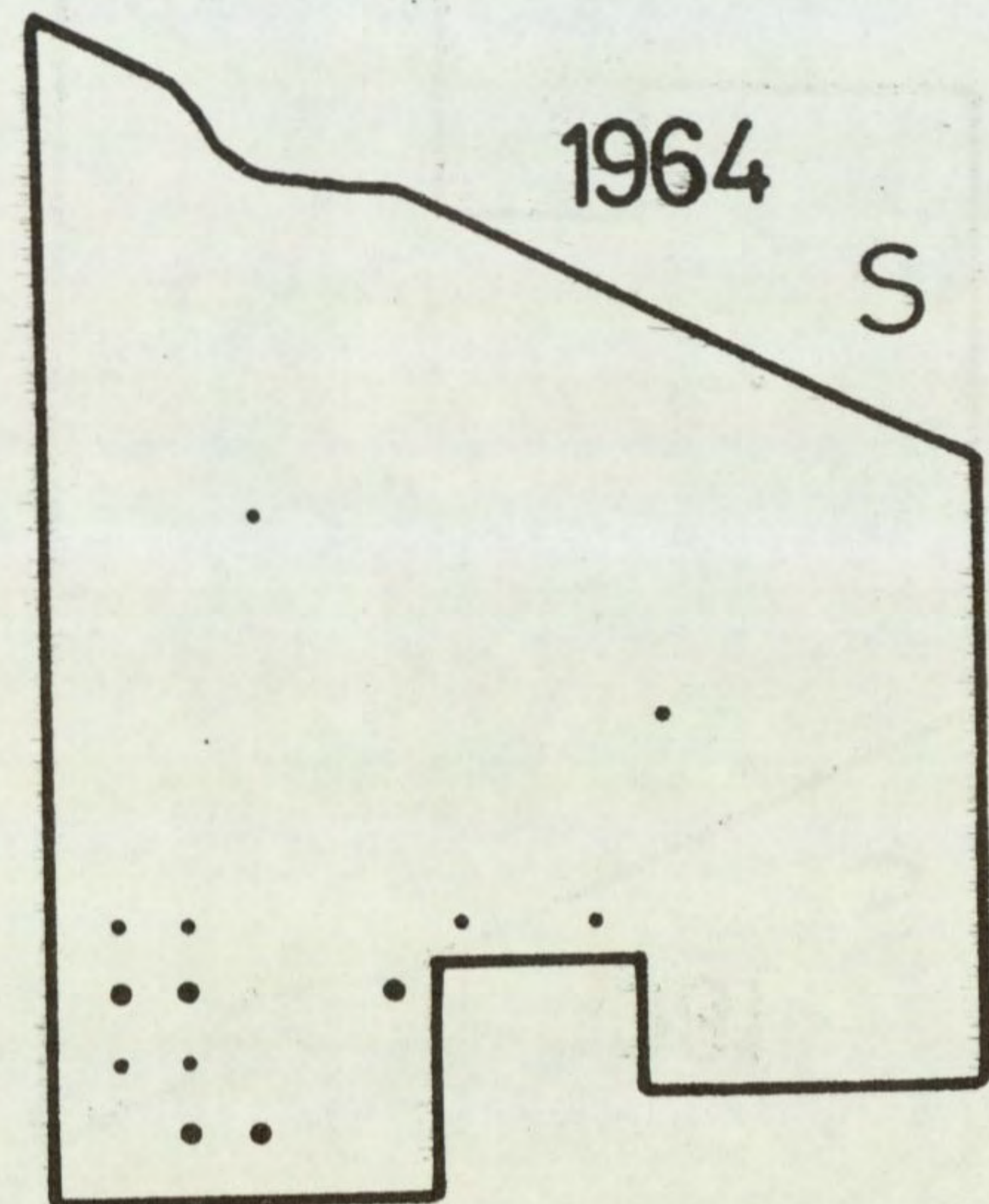
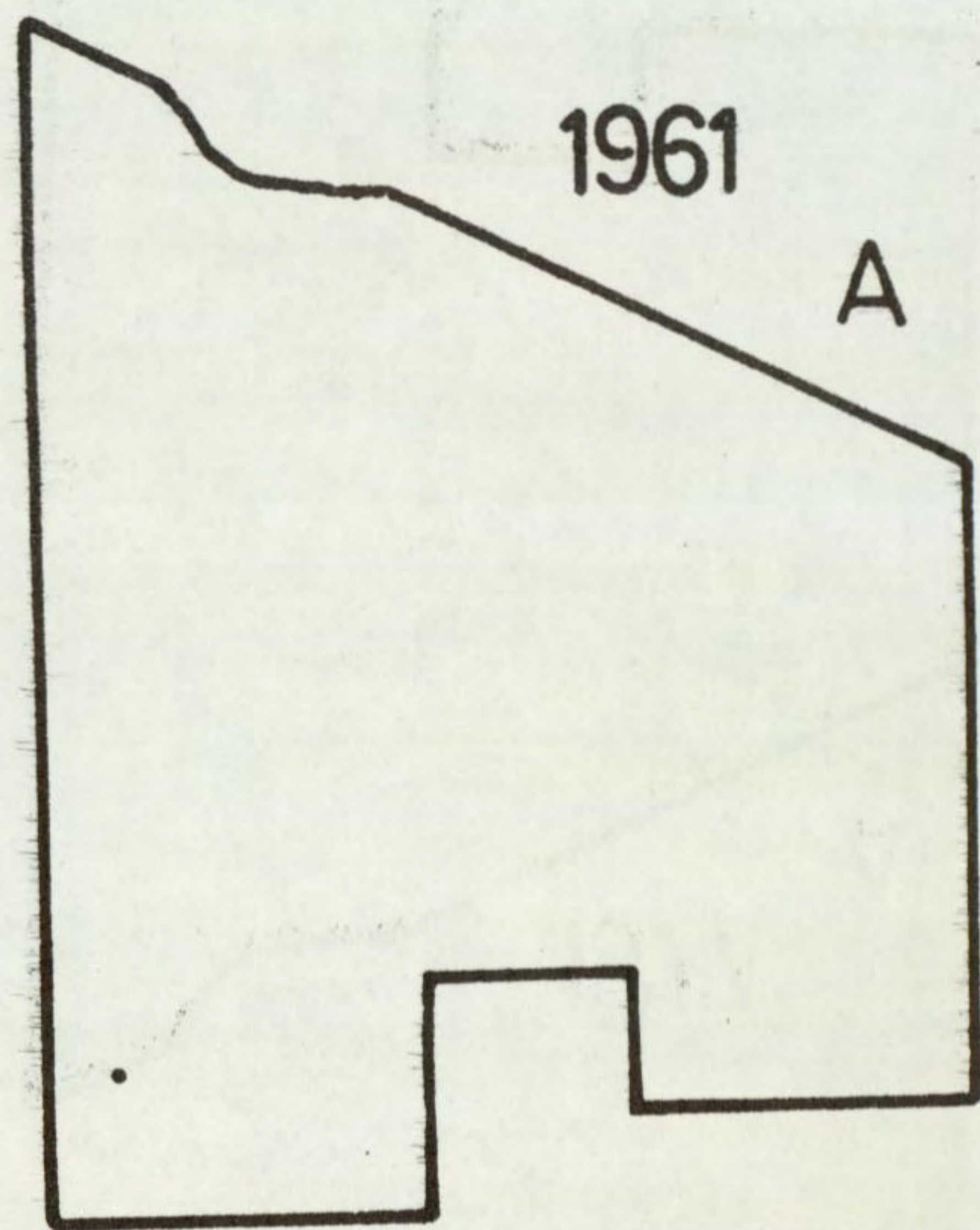
Stellaria media

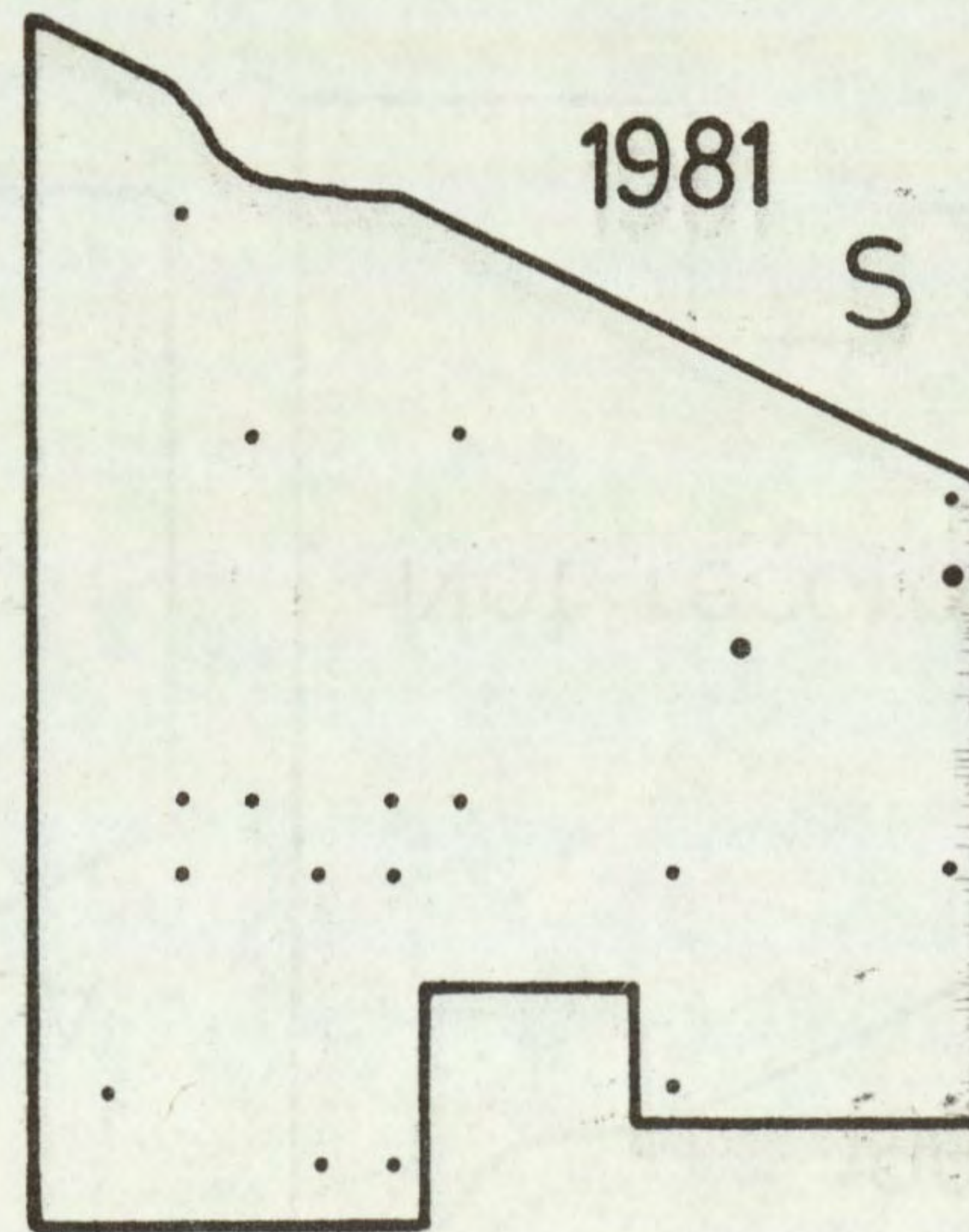
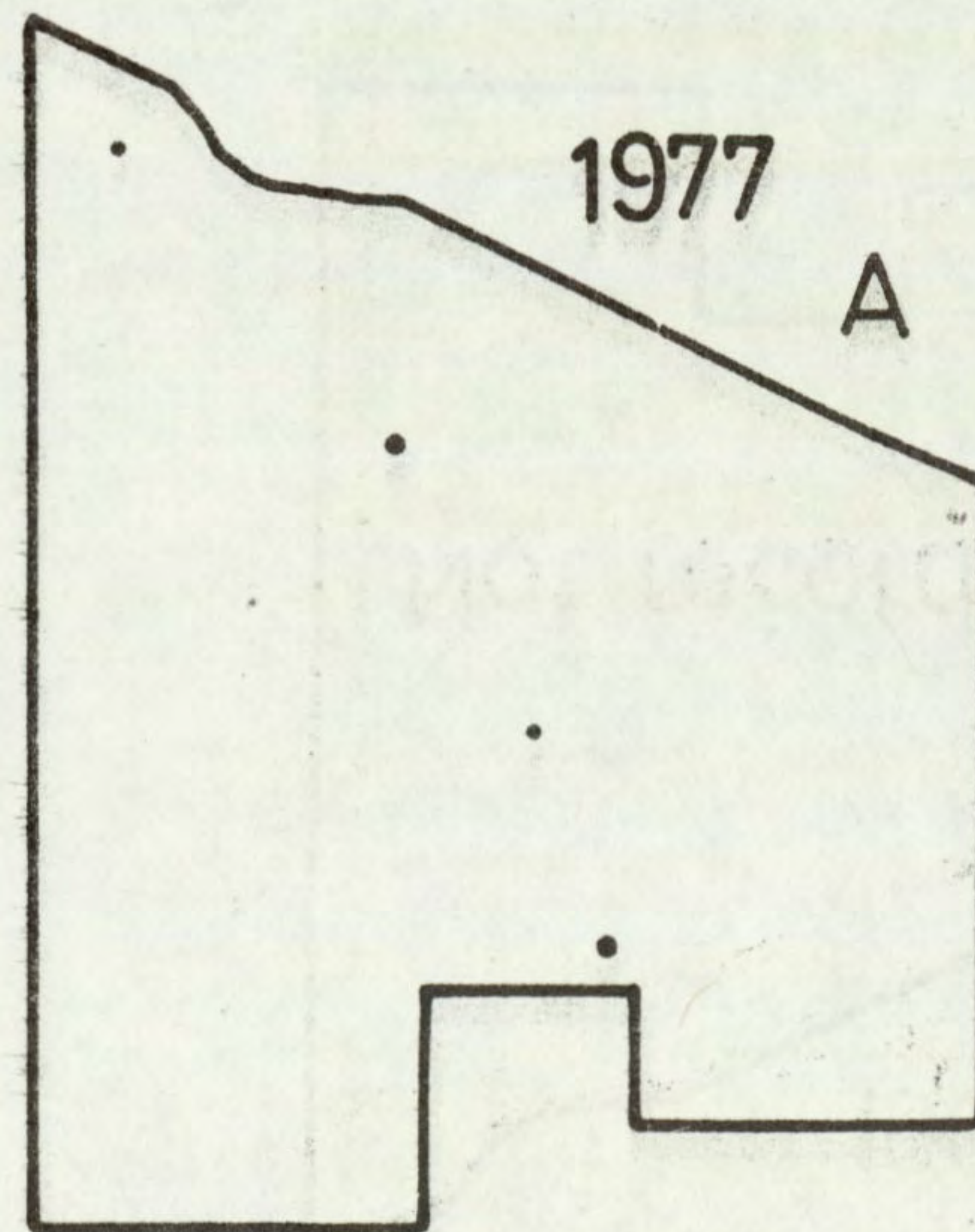
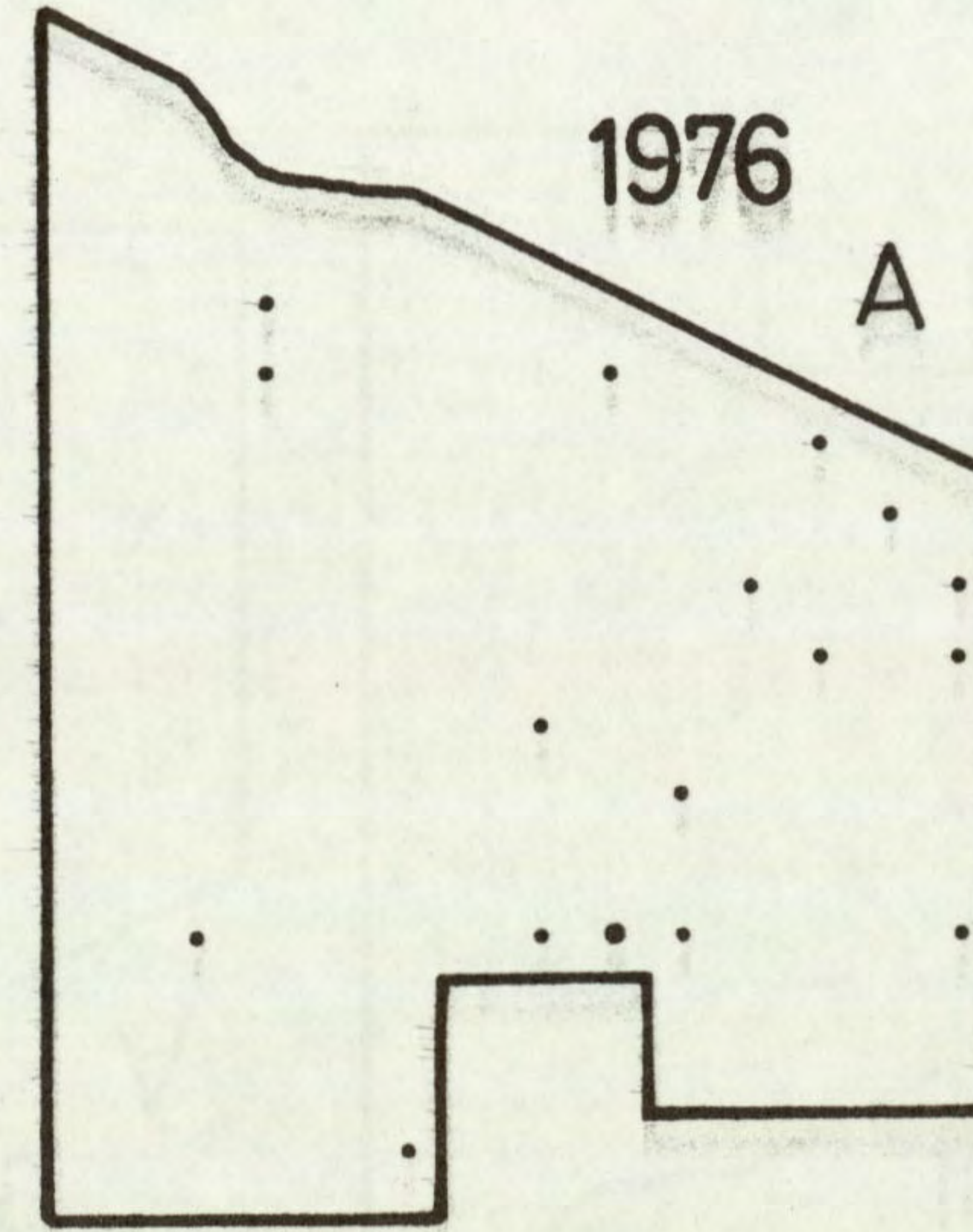
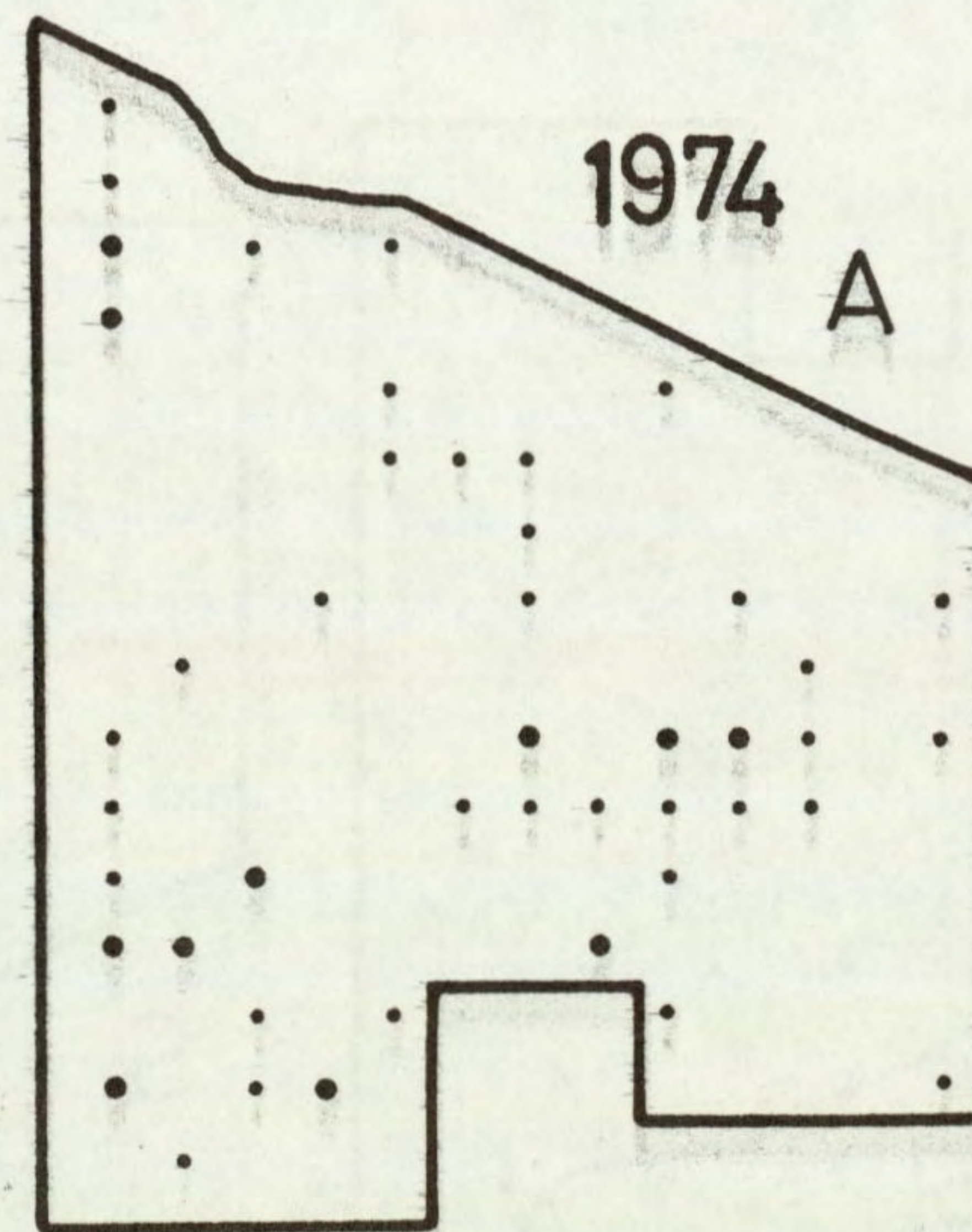
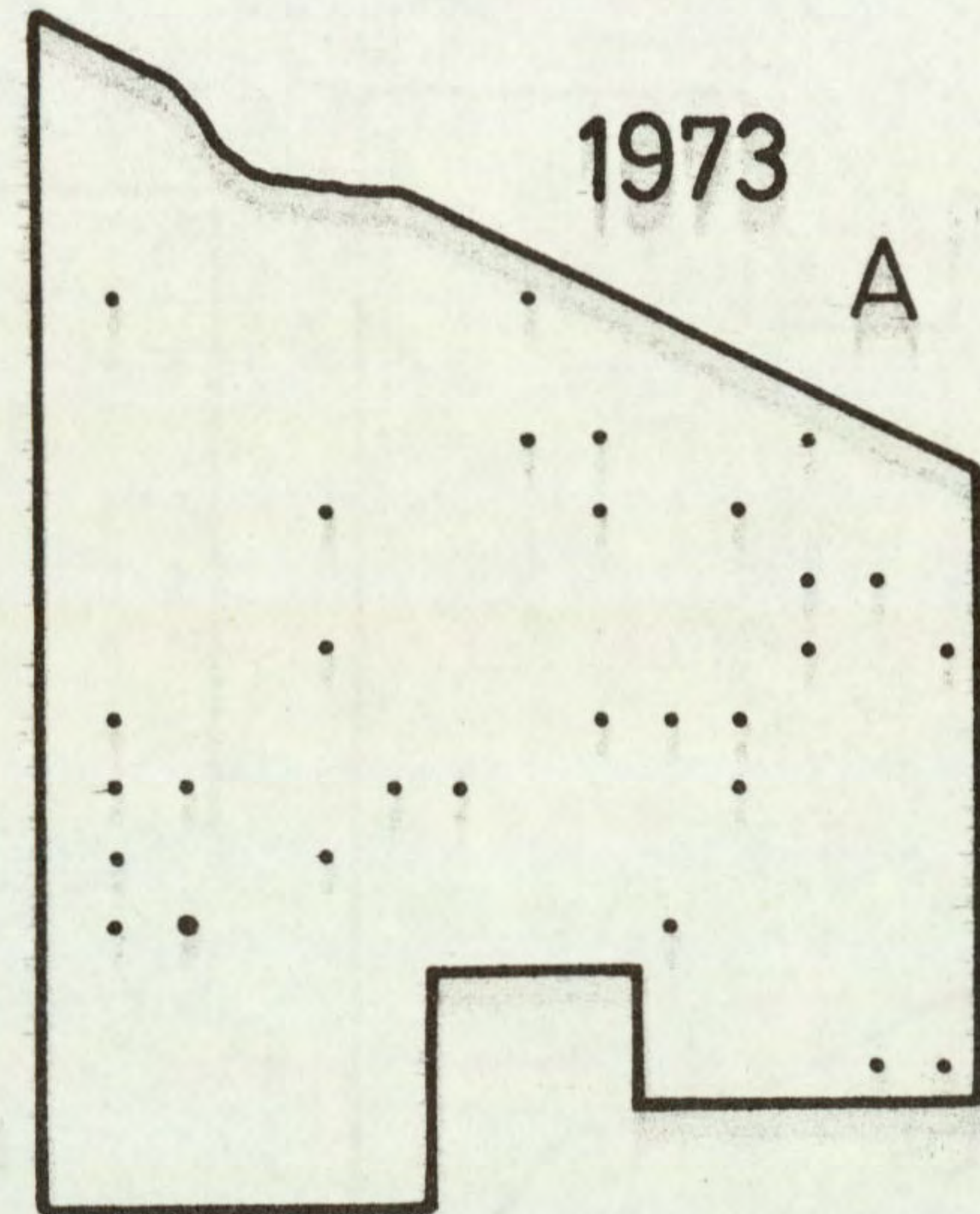
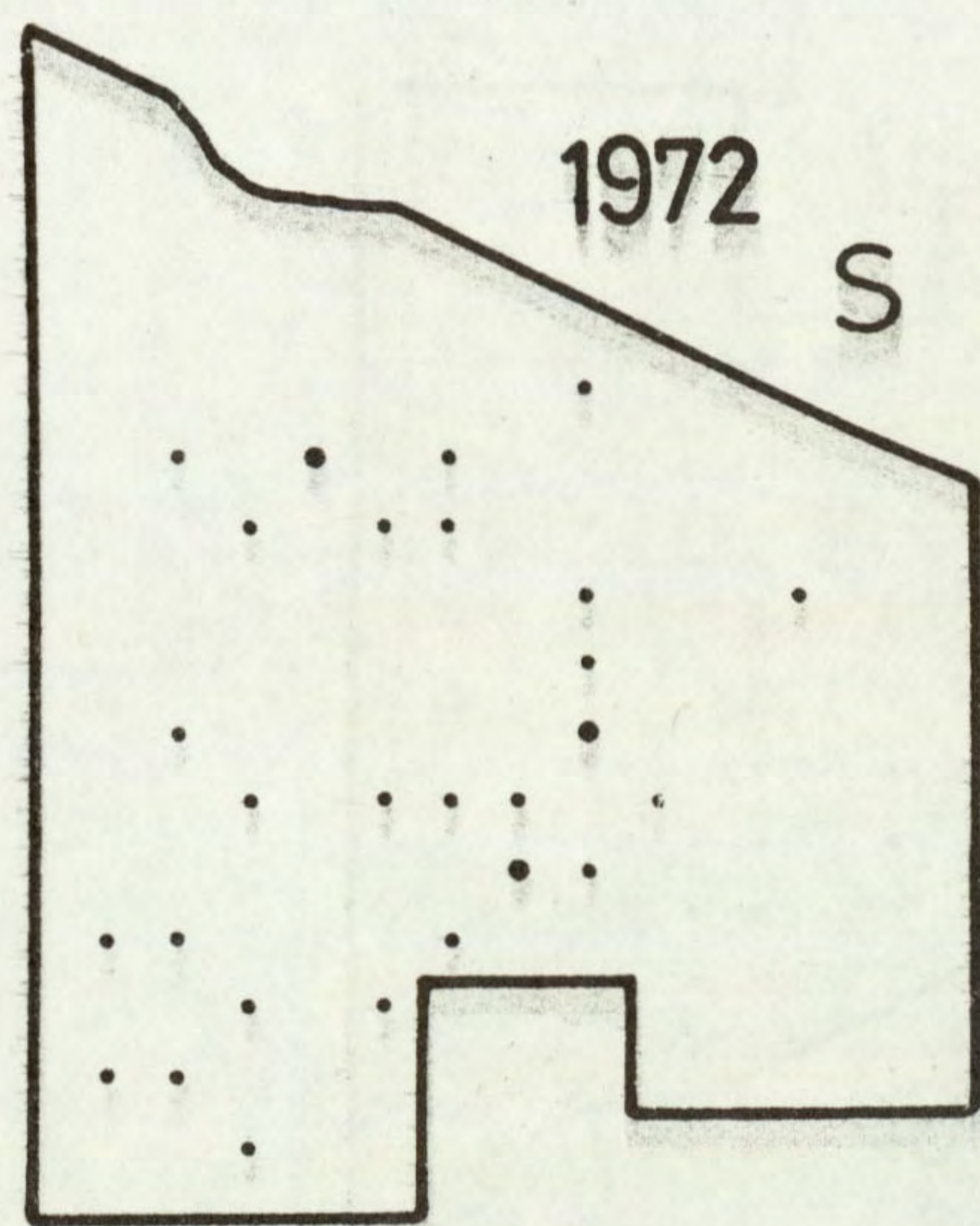
Like *Chamomilla recutita*, this species occurred only as scattered plants until 1969. Thereafter it increased, reaching its maximum density in 1974. Unlike *C. recutita*, relatively few seedlings of *S. media* were recorded in 1977. *S. media* germinates almost equally in spring and autumn so no obvious differences in density are apparent in spring and autumn-sown crops. It is a species which prefers wet conditions and the long hot dry summer of 1976 may be the reason for the reduced numbers in 1977.



Senecio vulgaris

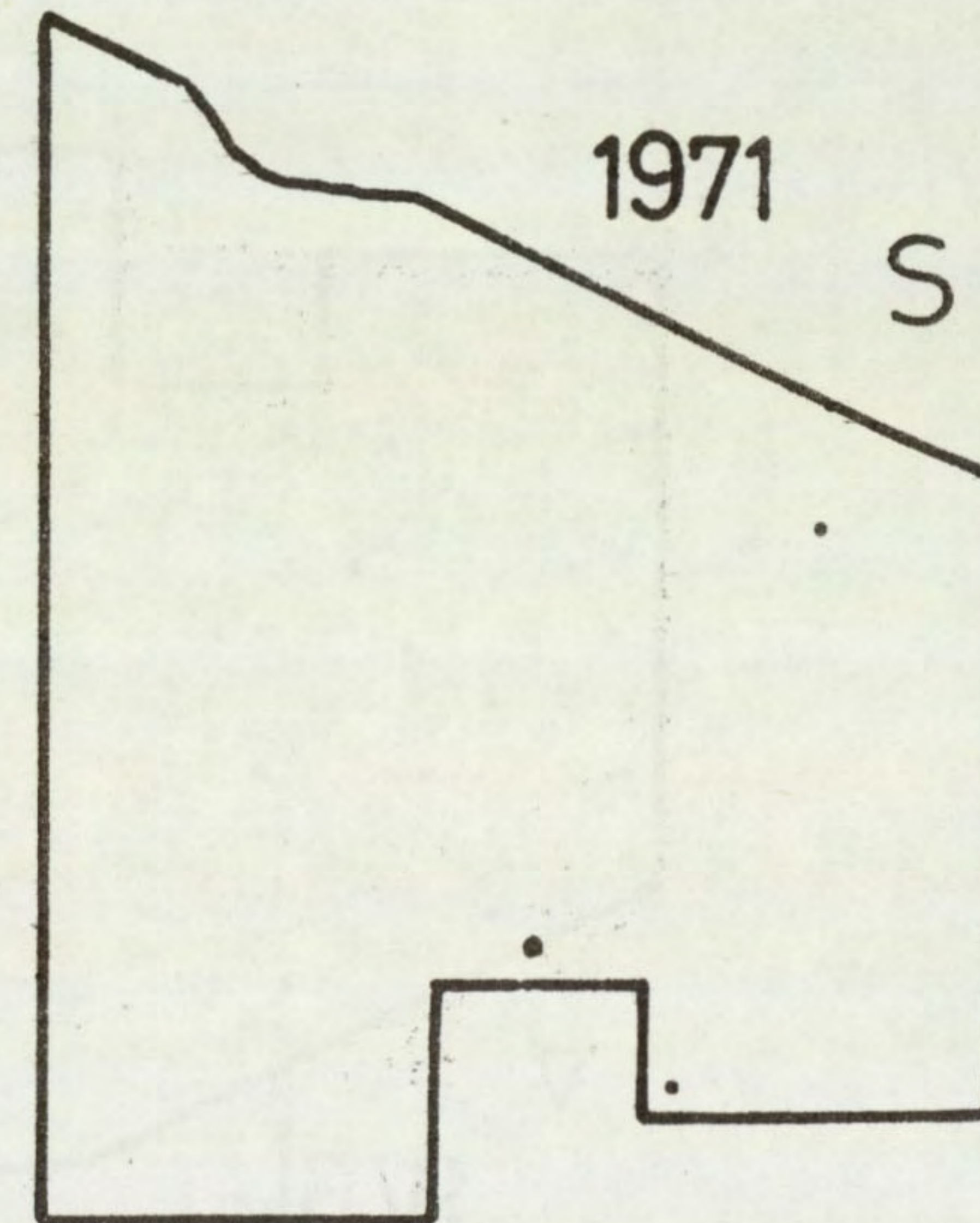
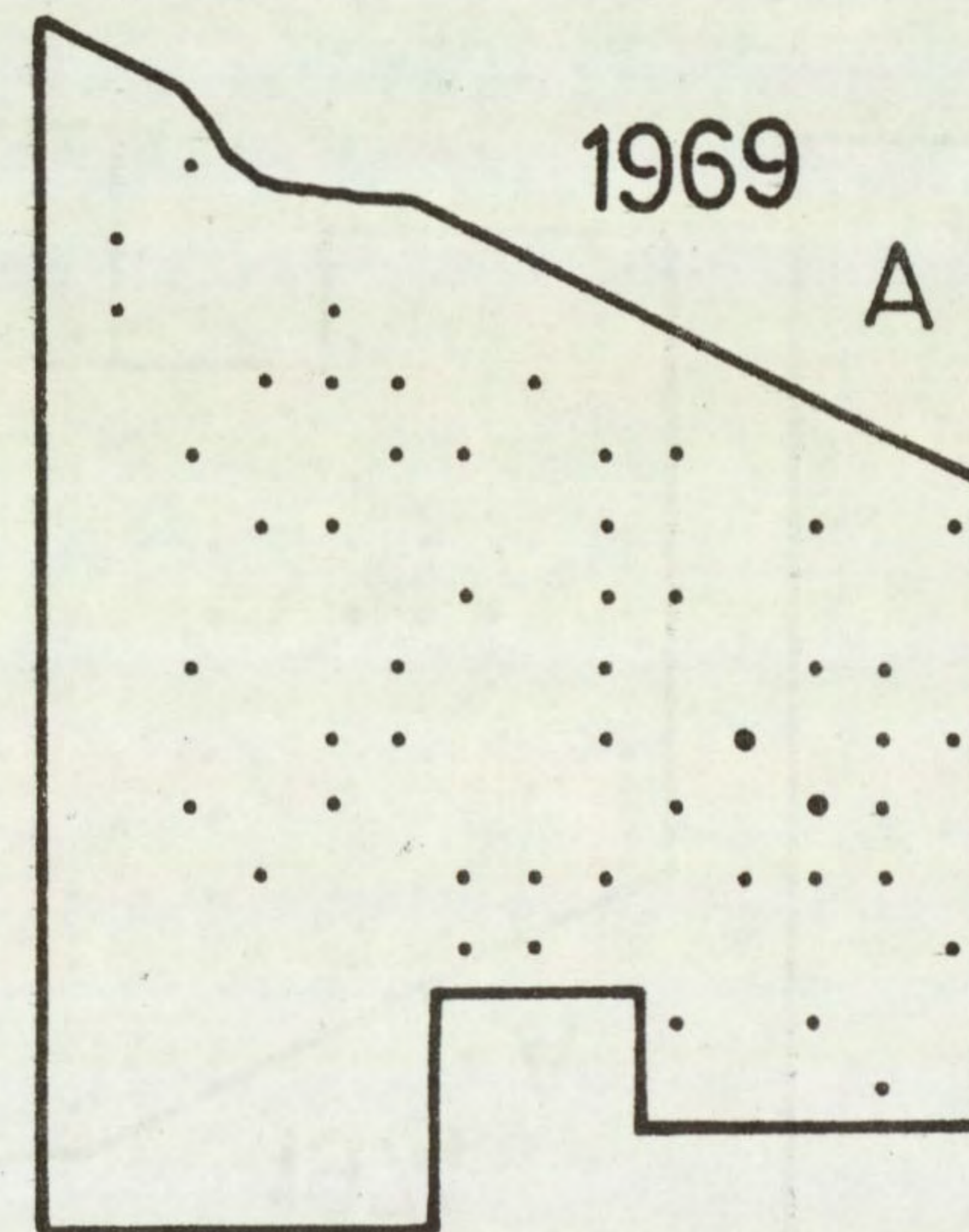
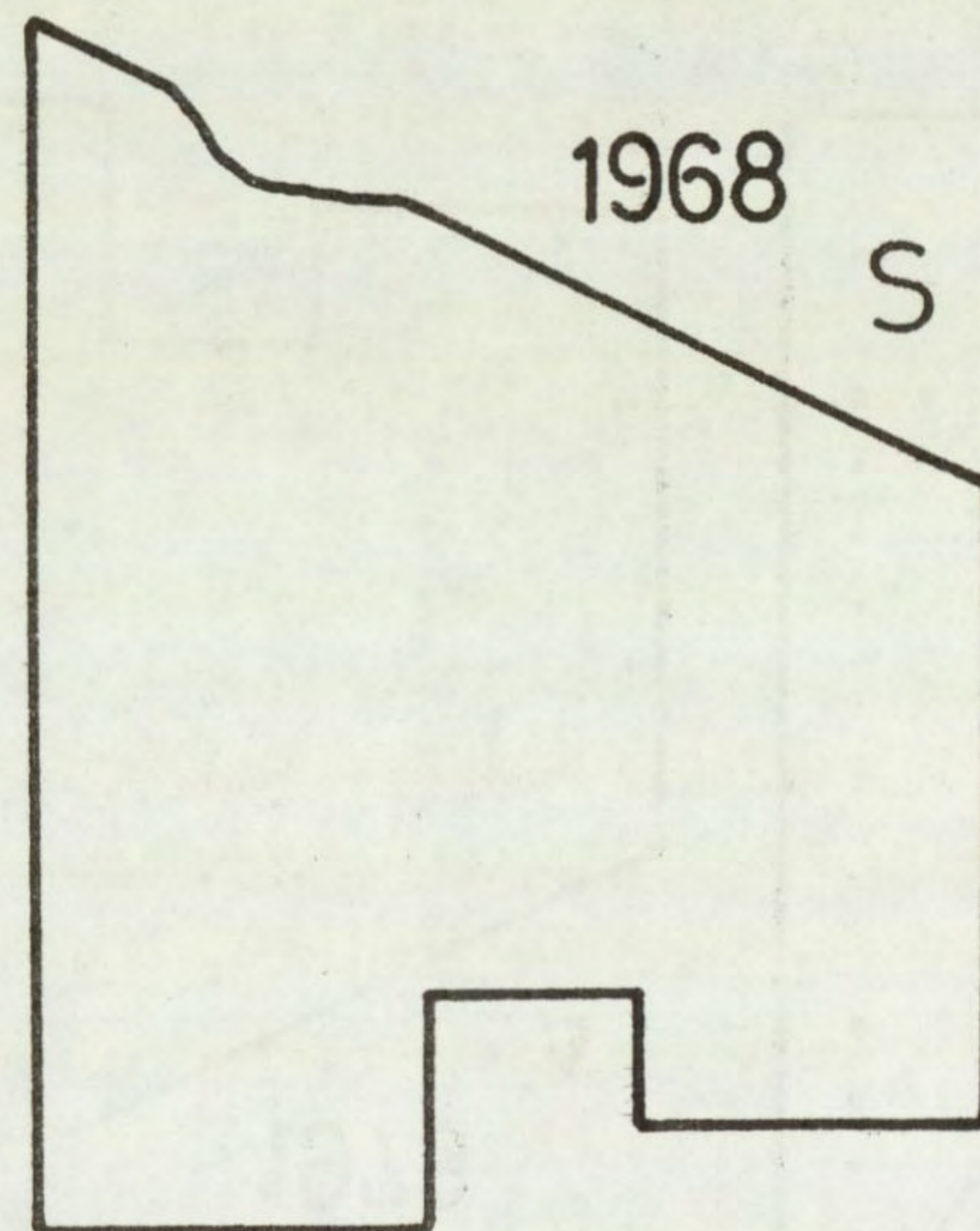
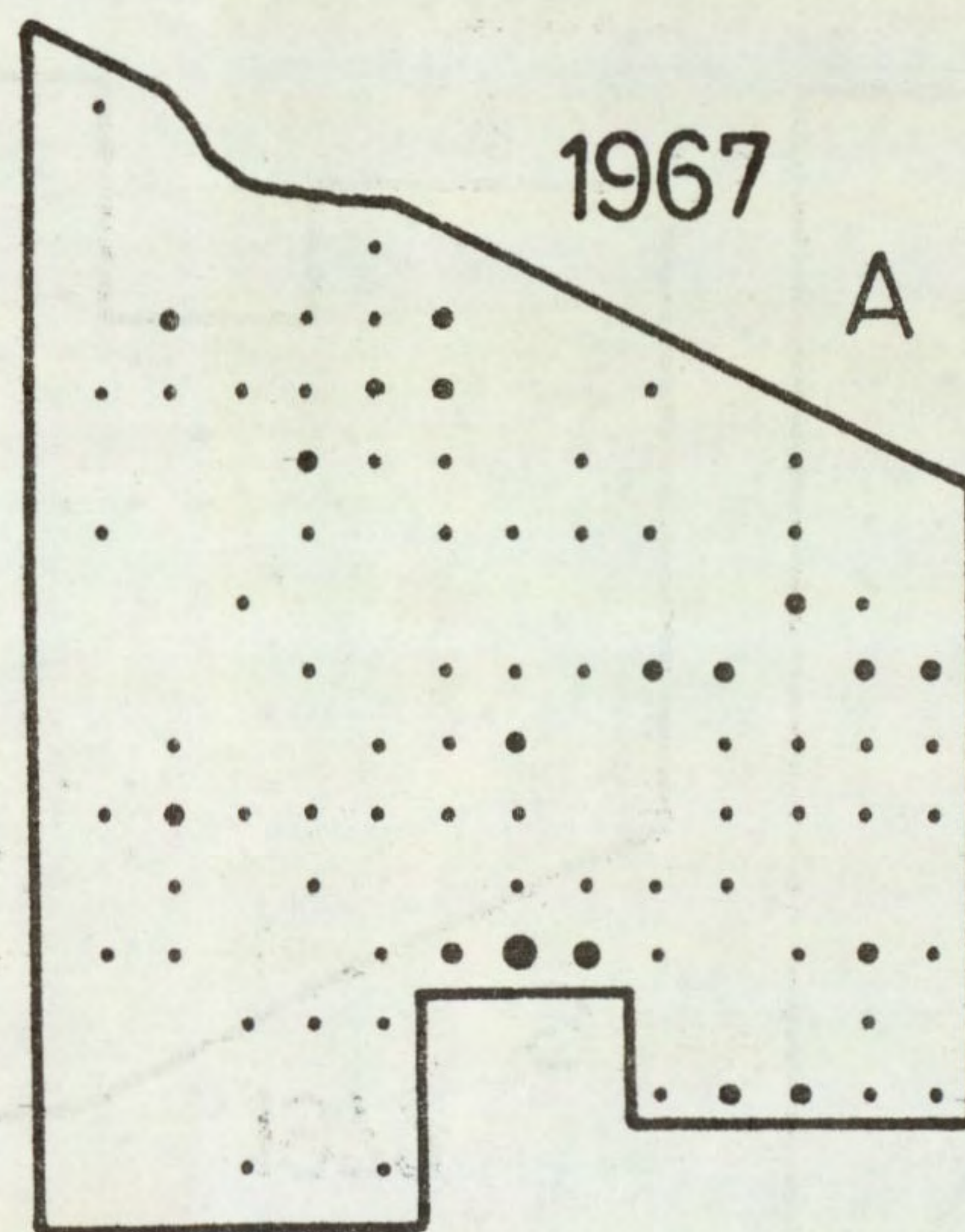
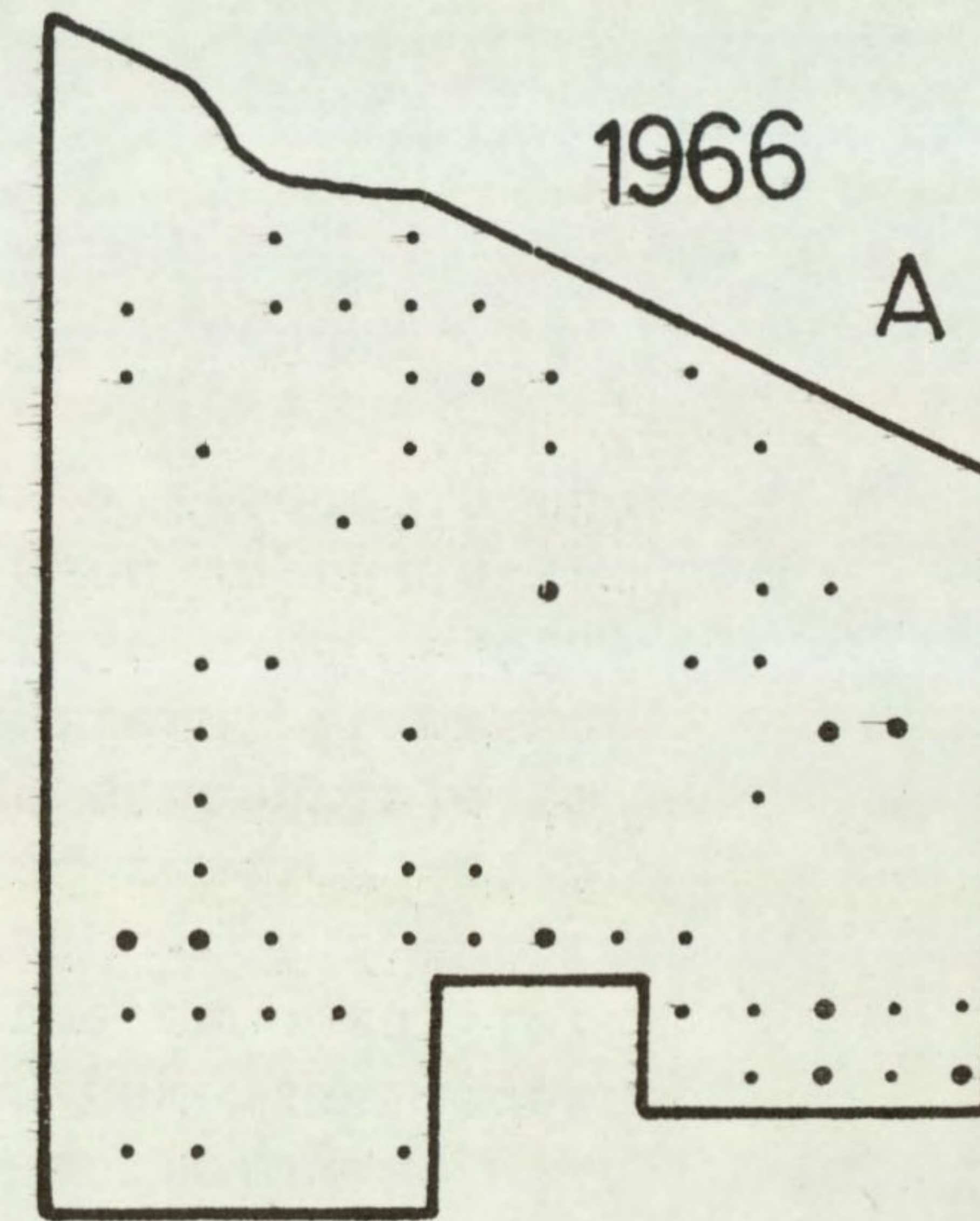
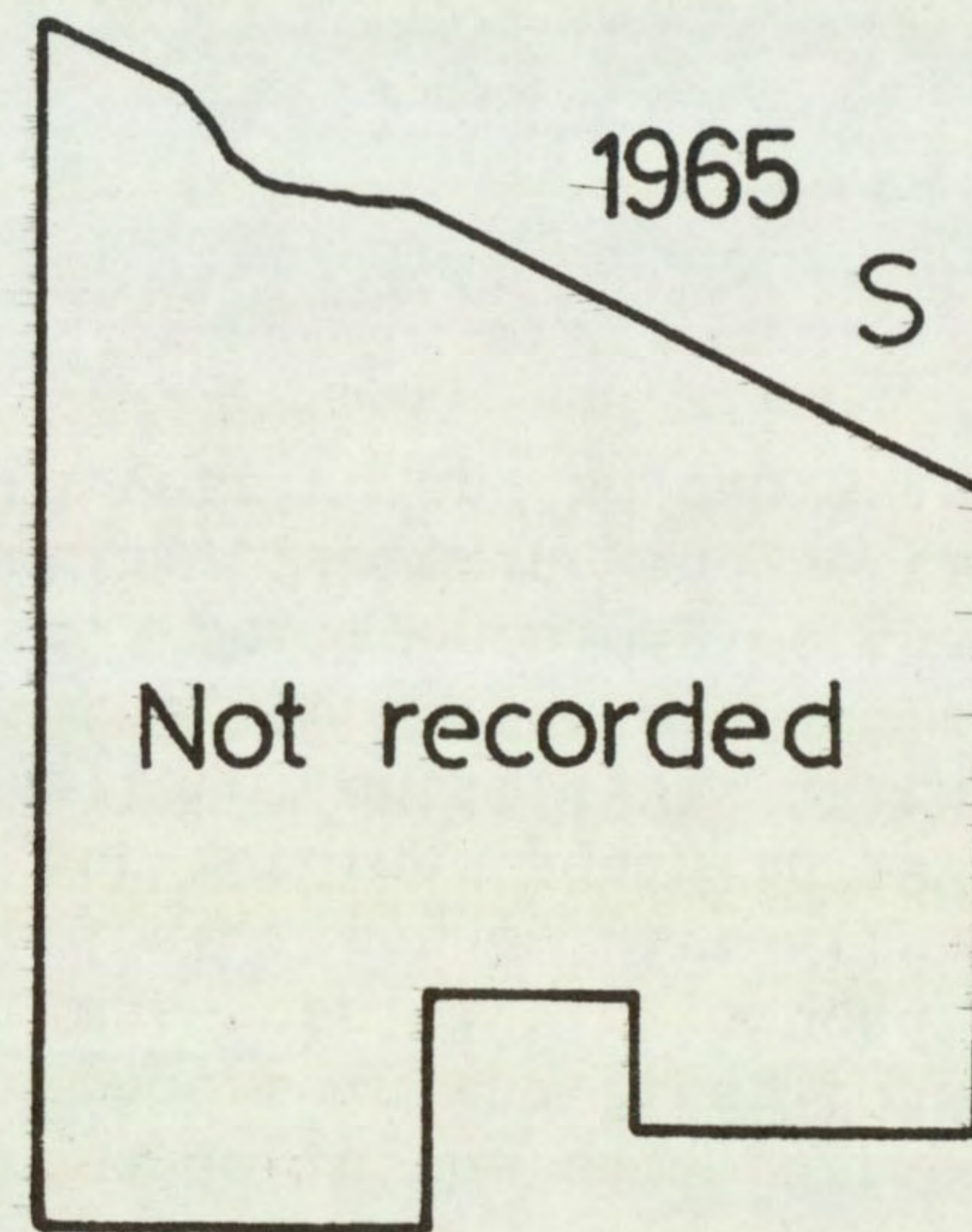
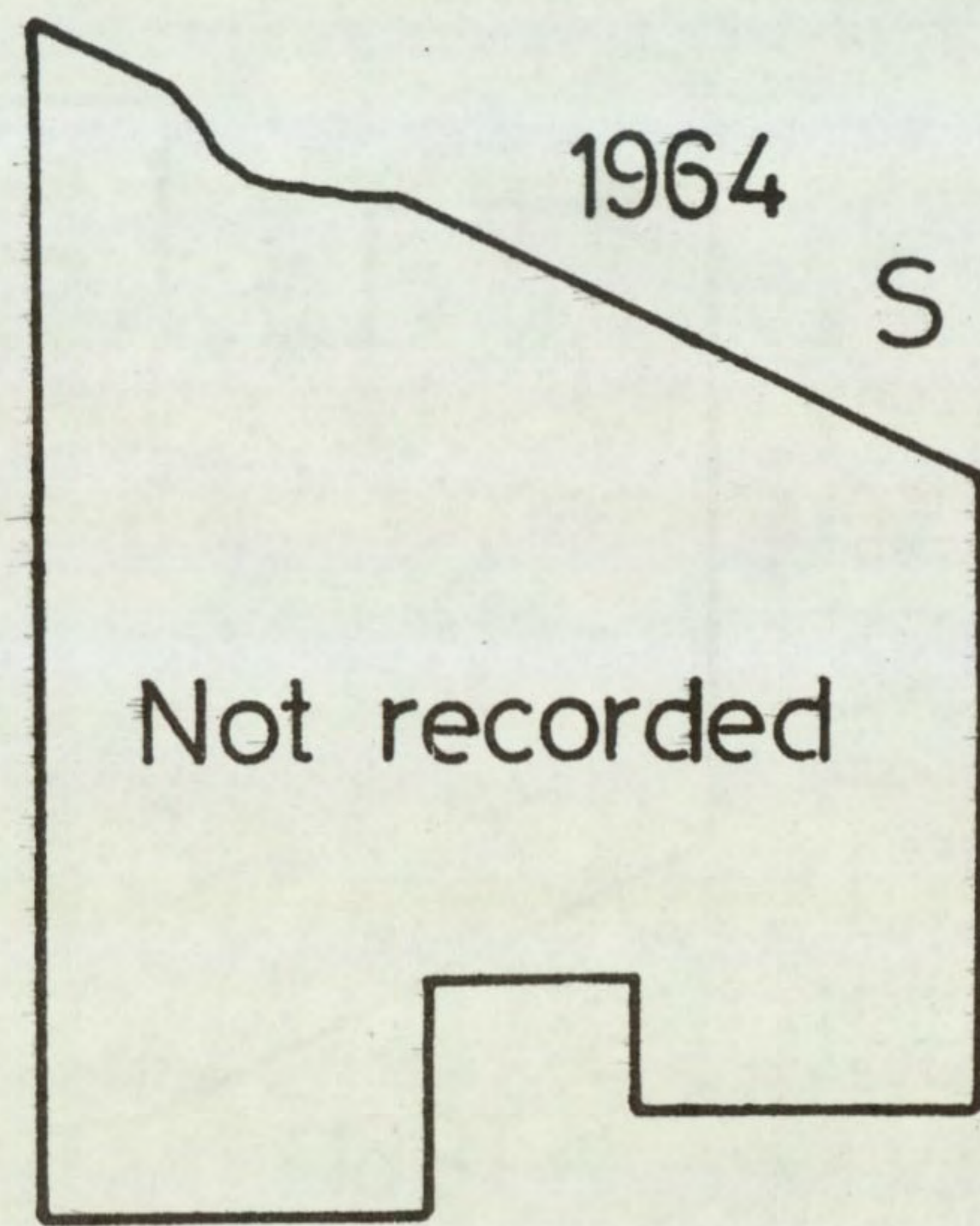
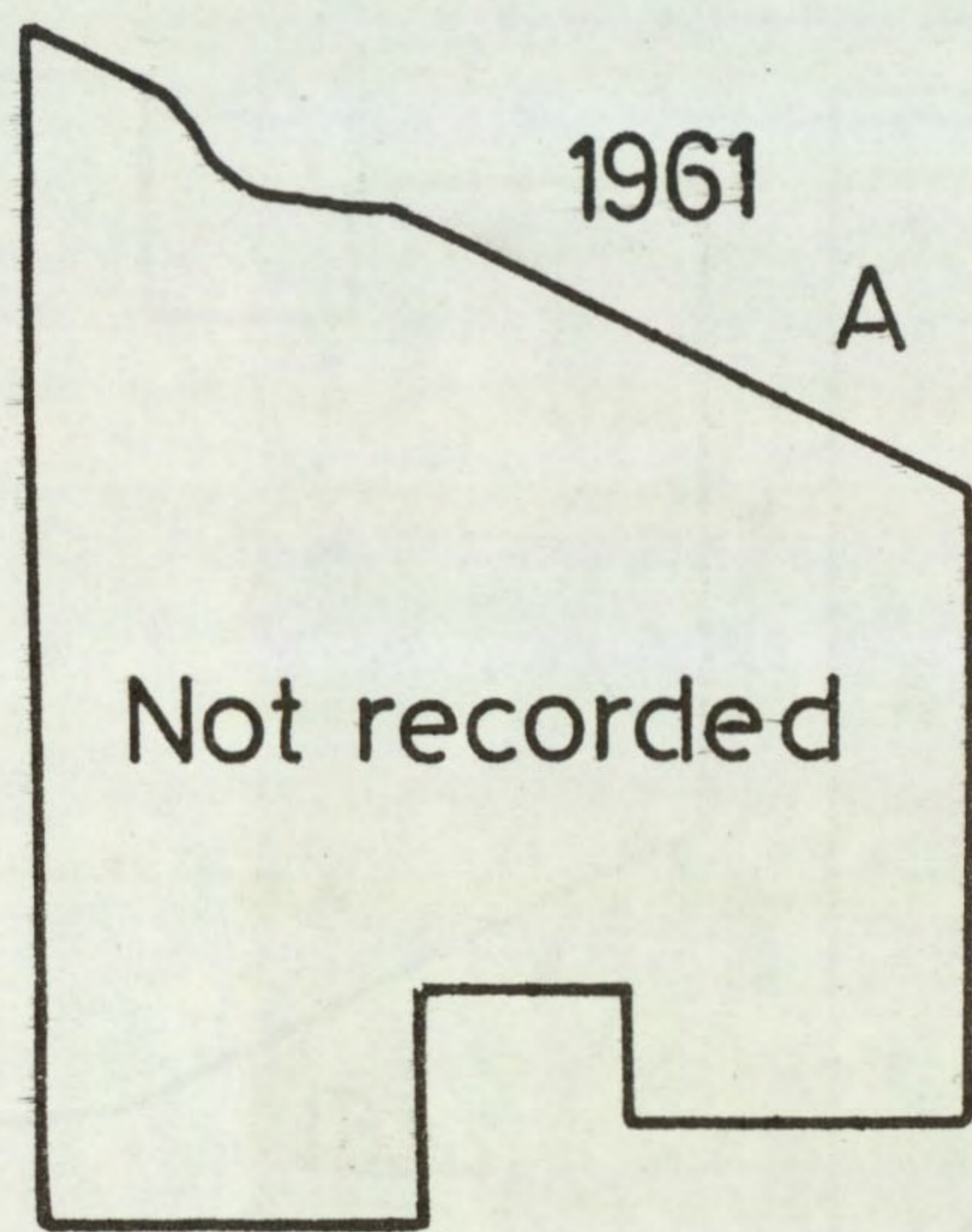
Although not normally a weed of cereals *S. vulgaris* can occur in arable crops. It invaded this field by windborne seed, for, although virtually absent from the fields in 1961, it seeded copiously on uncropped areas near the farm buildings in 1961-3 and spread to Boddington Barn field reaching maximum density in 1964. Over the next five years its density gradually declined, though it increased again during 1970-1. This may have been due in part to the field being used for experiments in these two years.

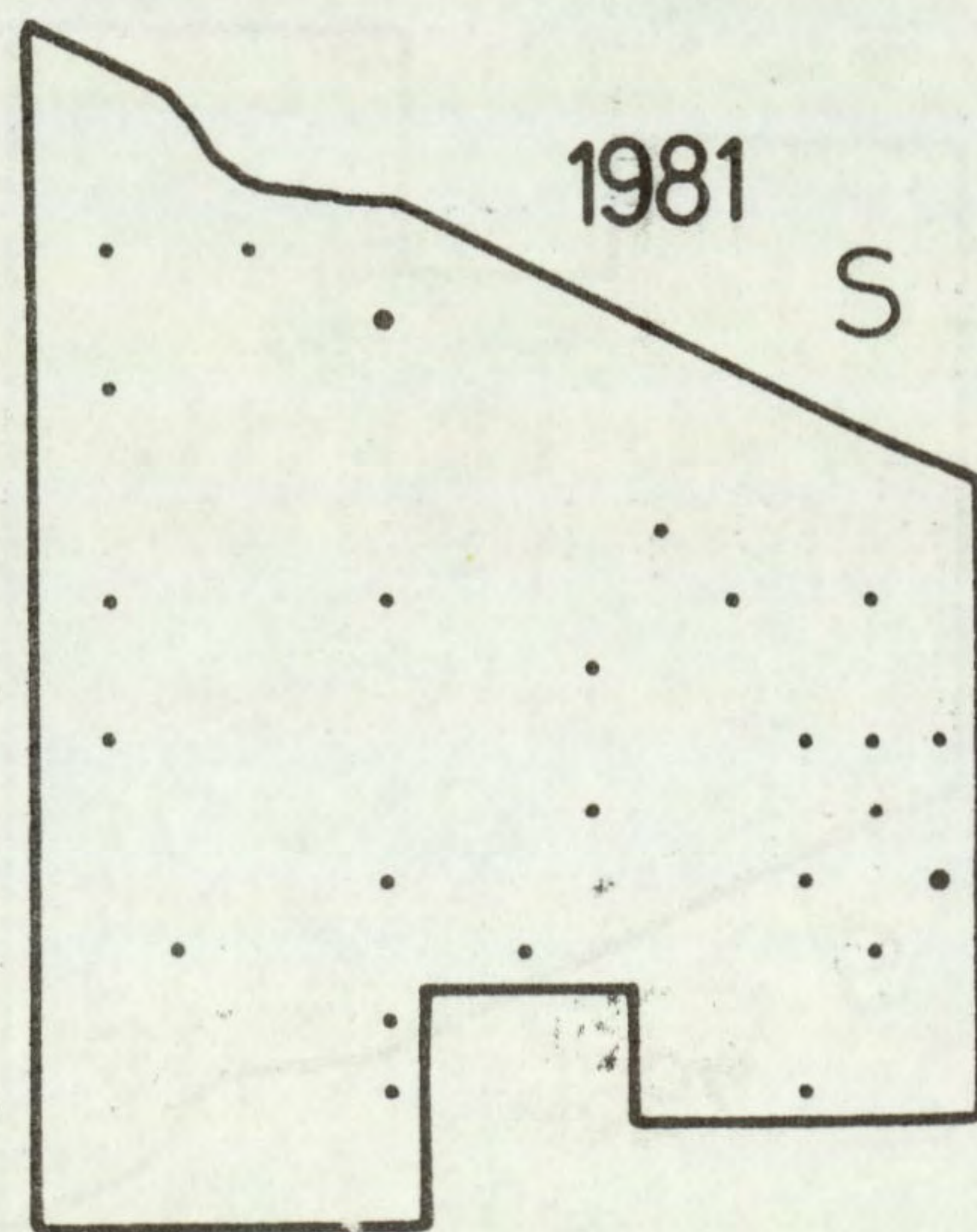
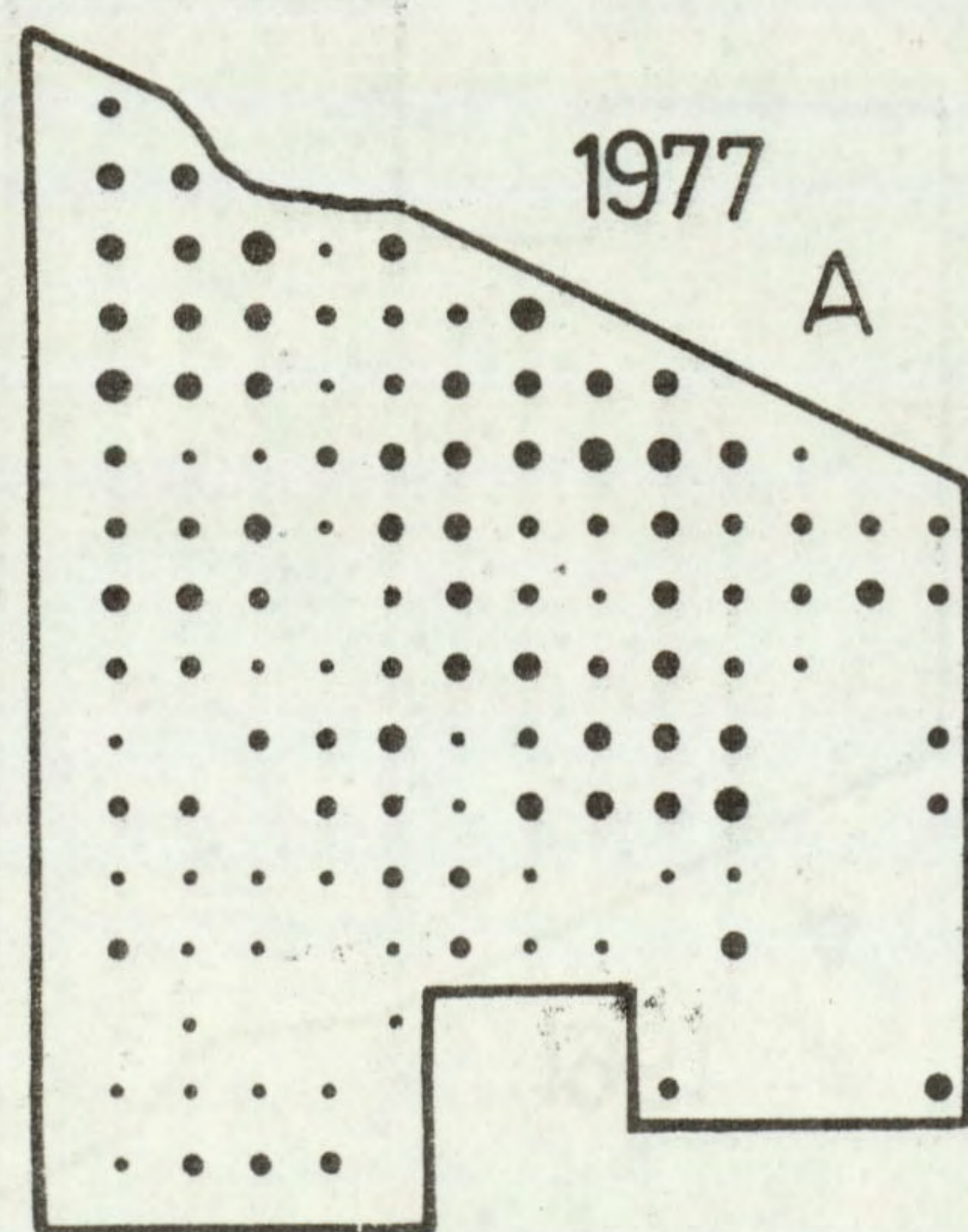
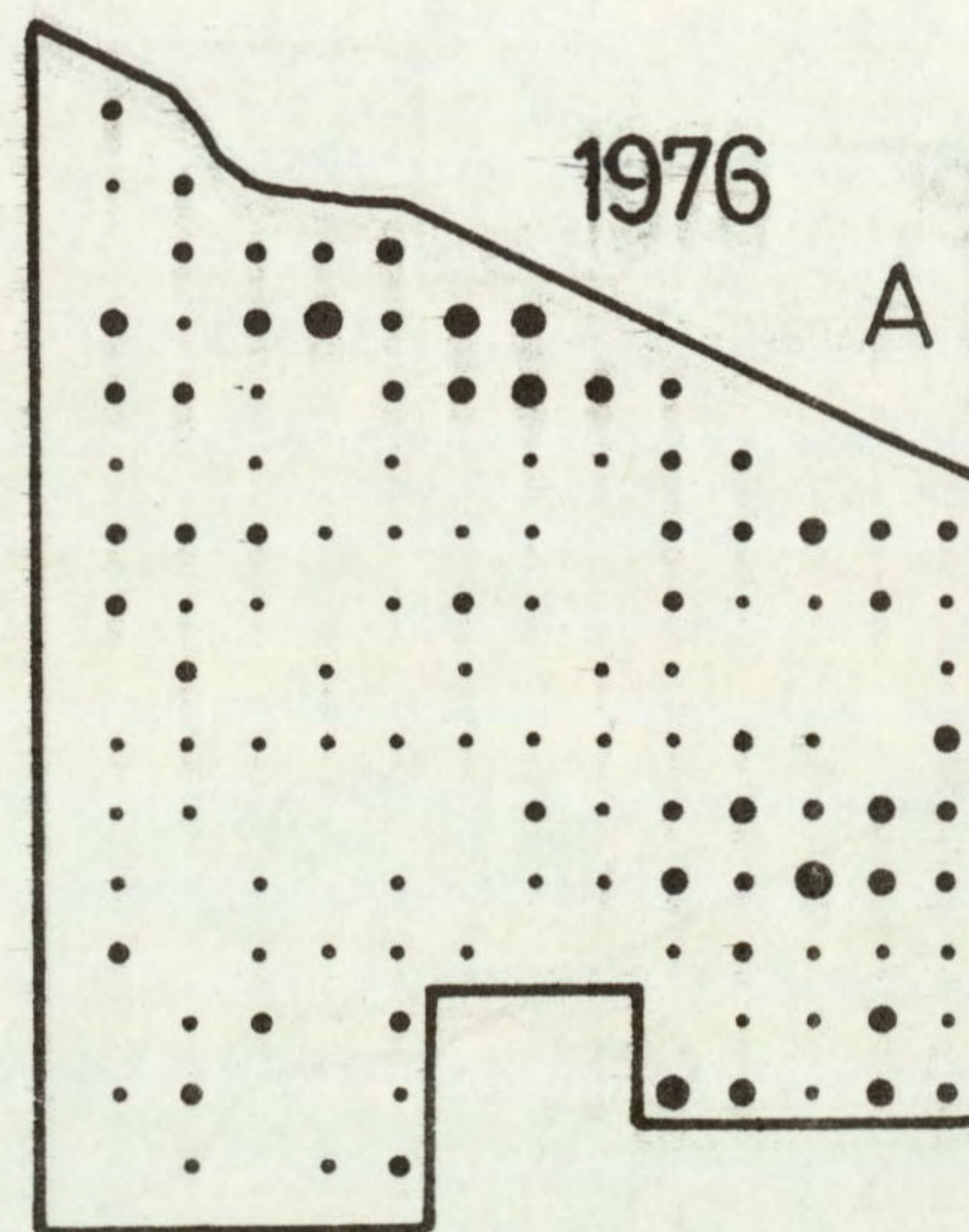
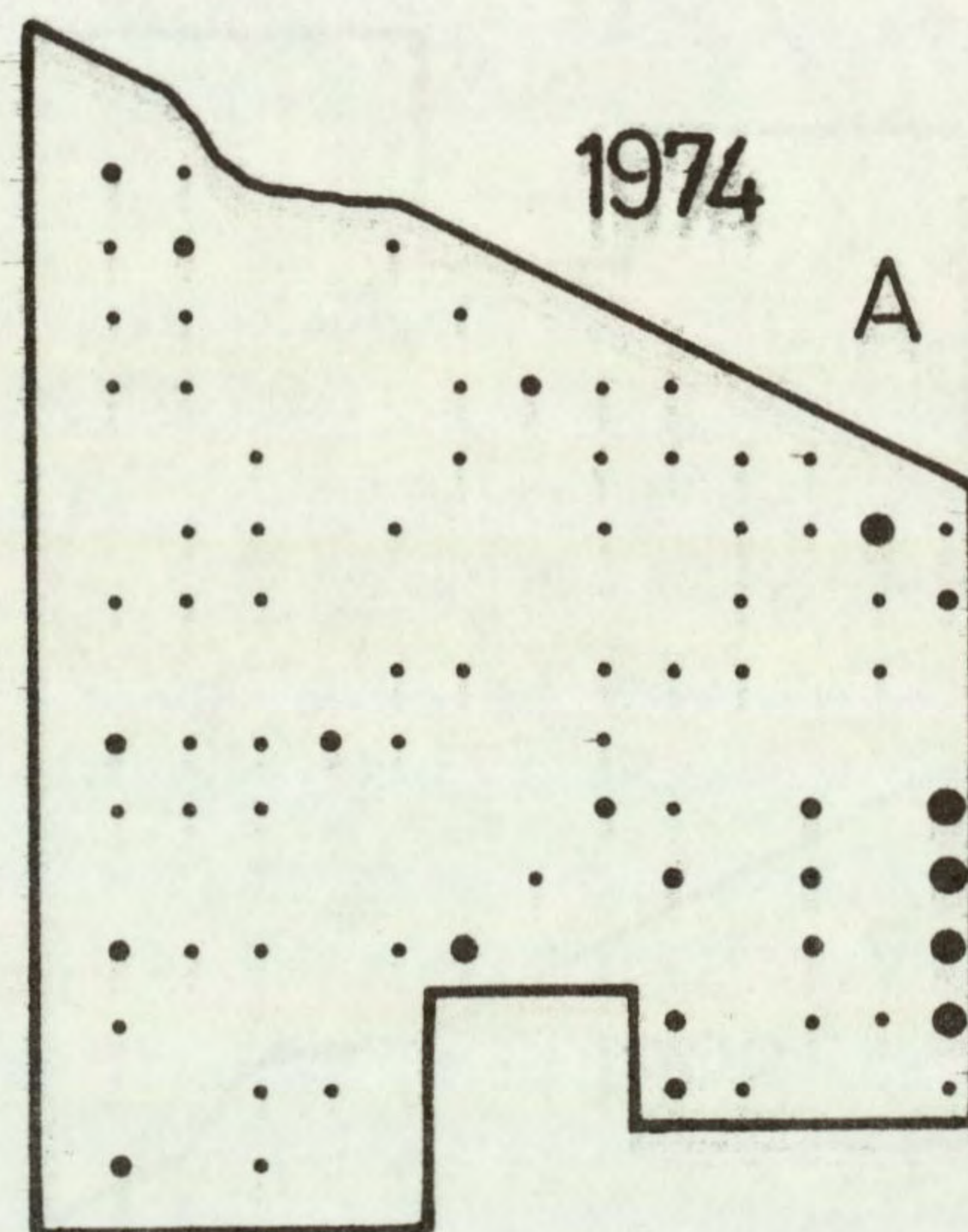
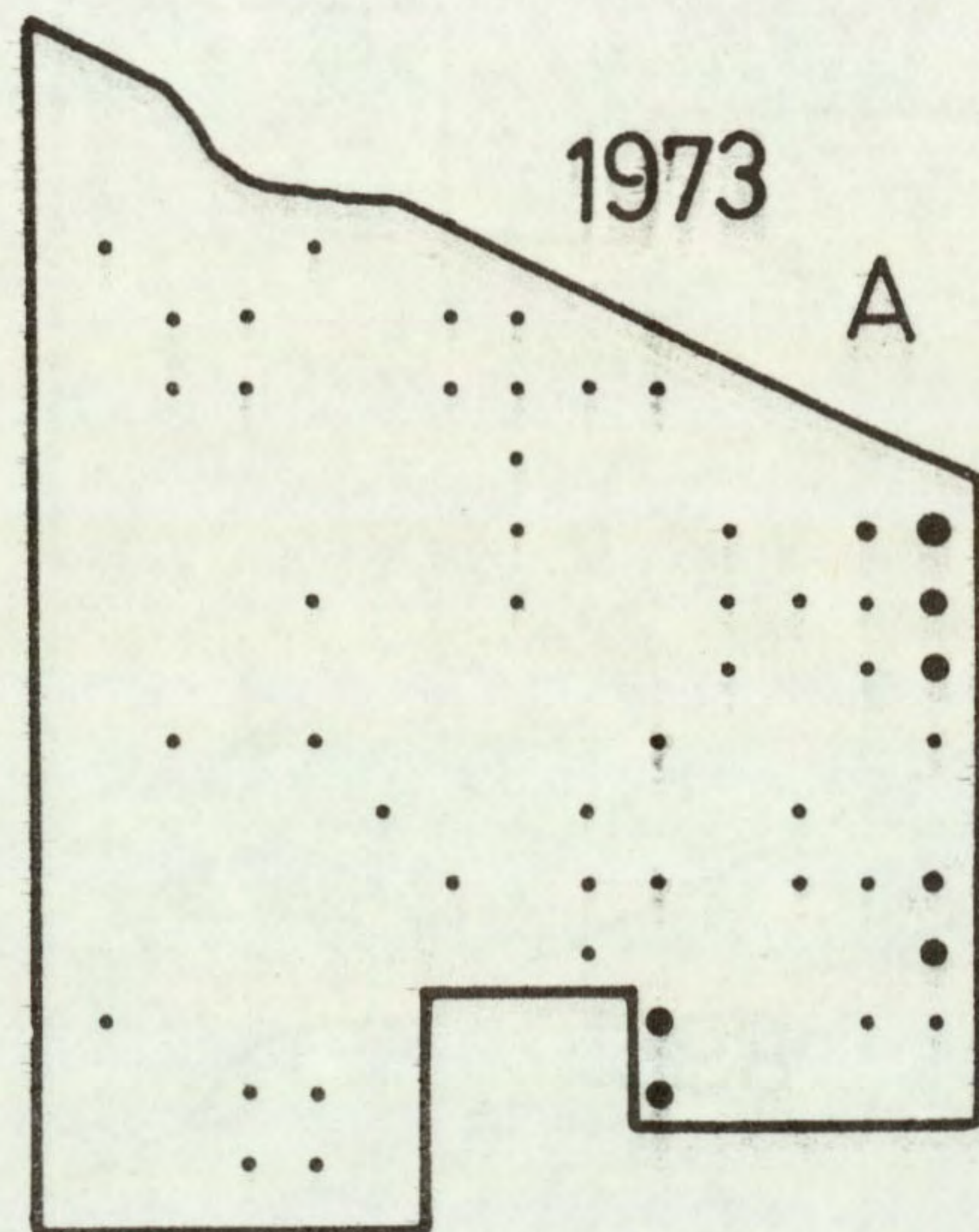
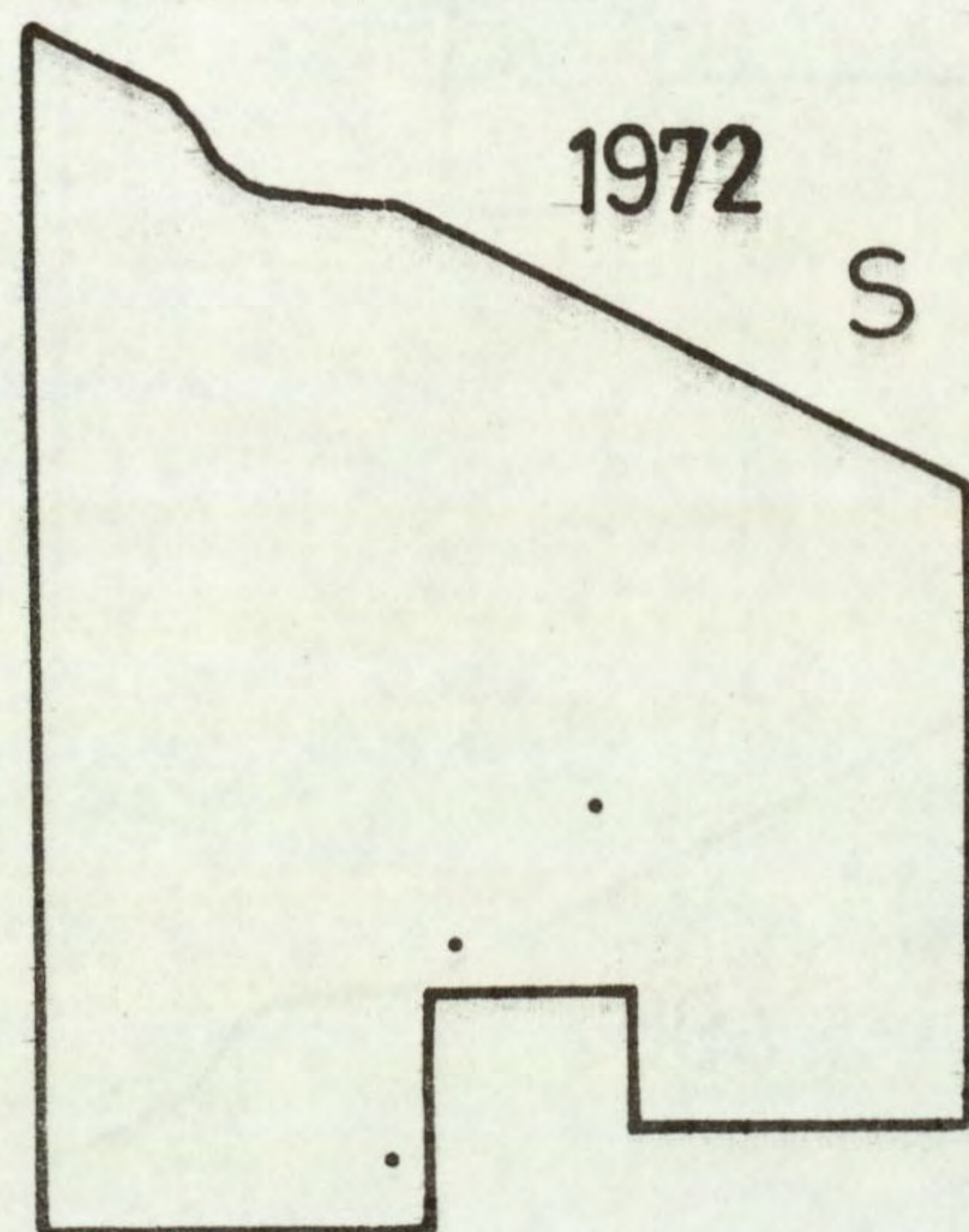




Capsella bursa-pastoris

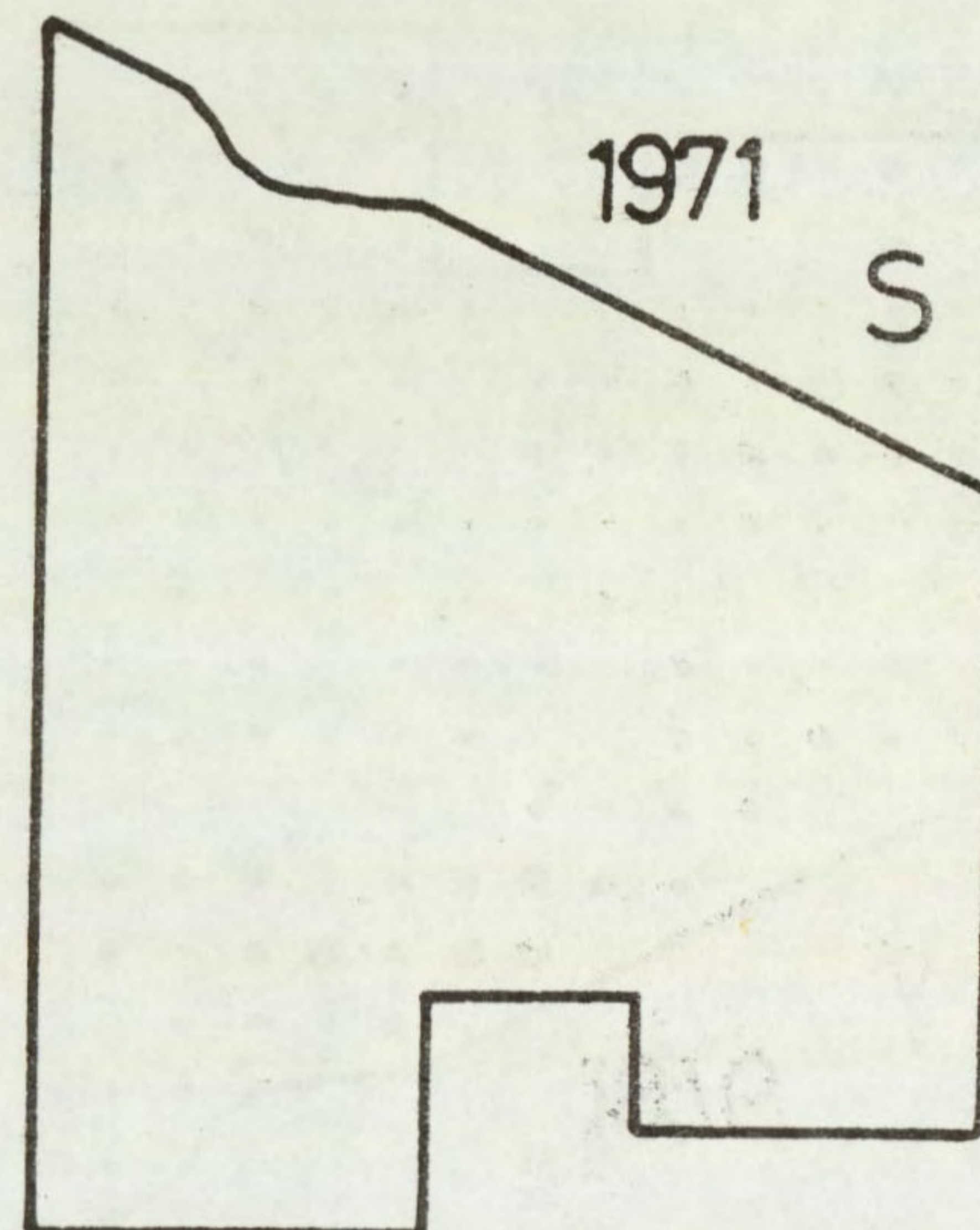
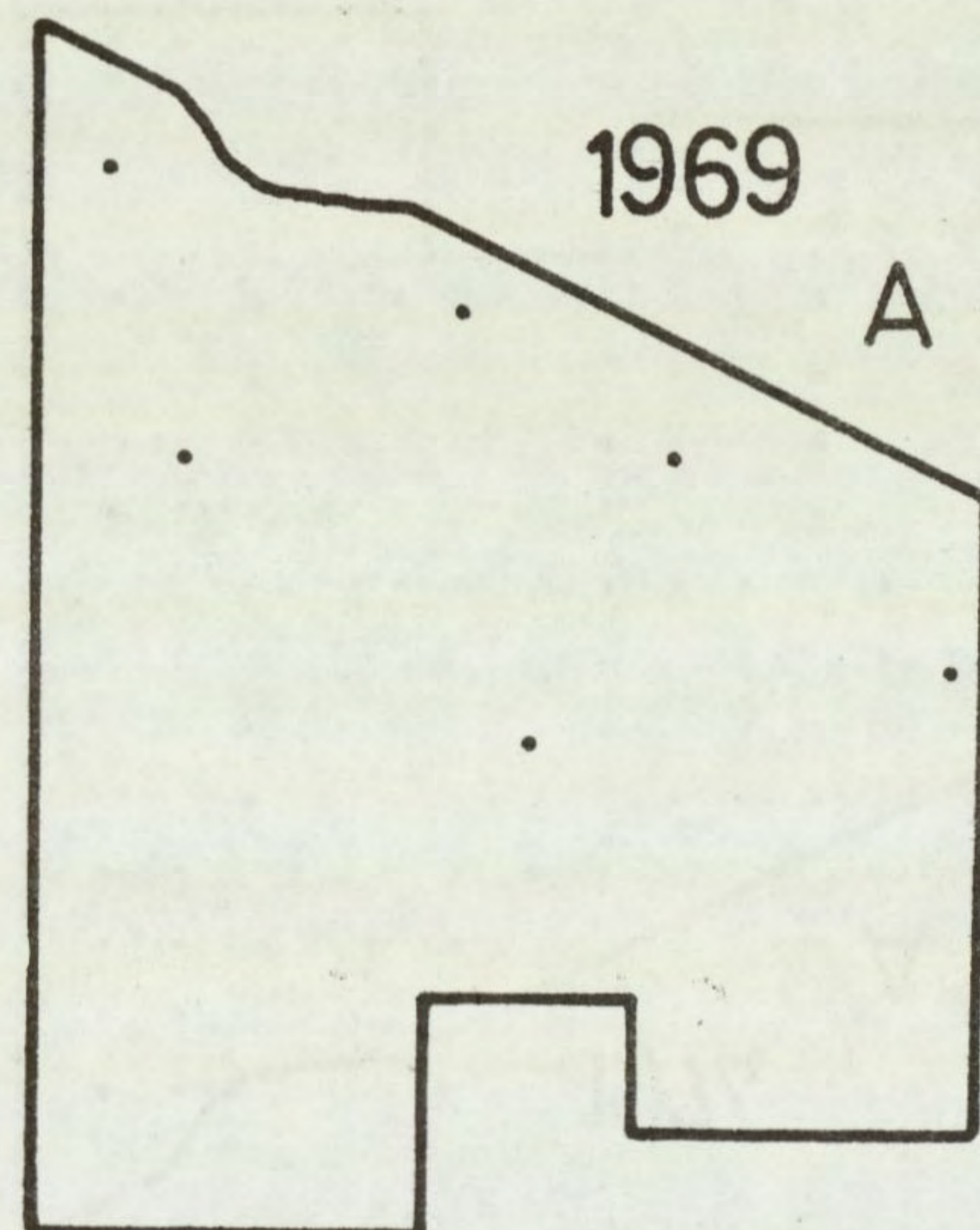
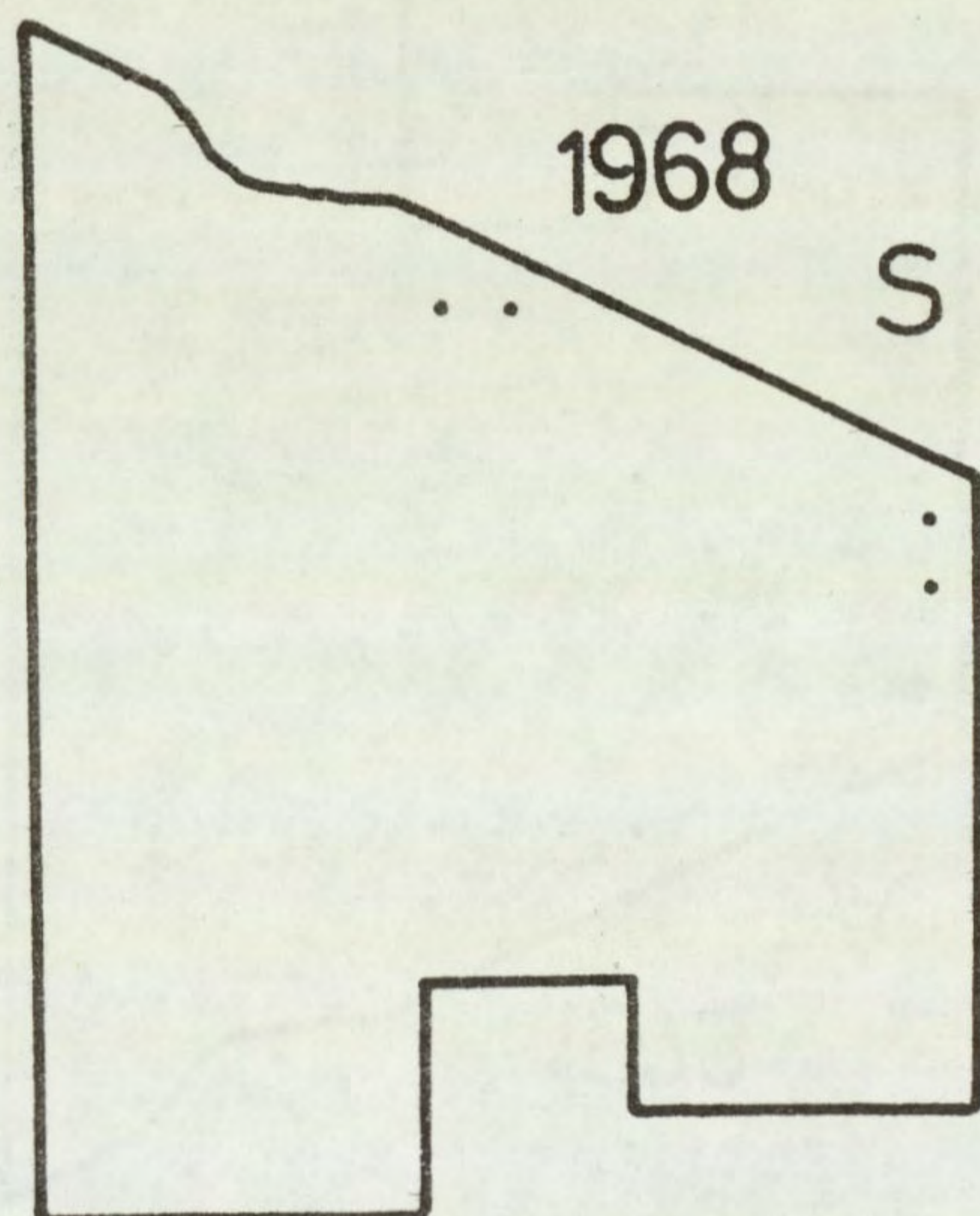
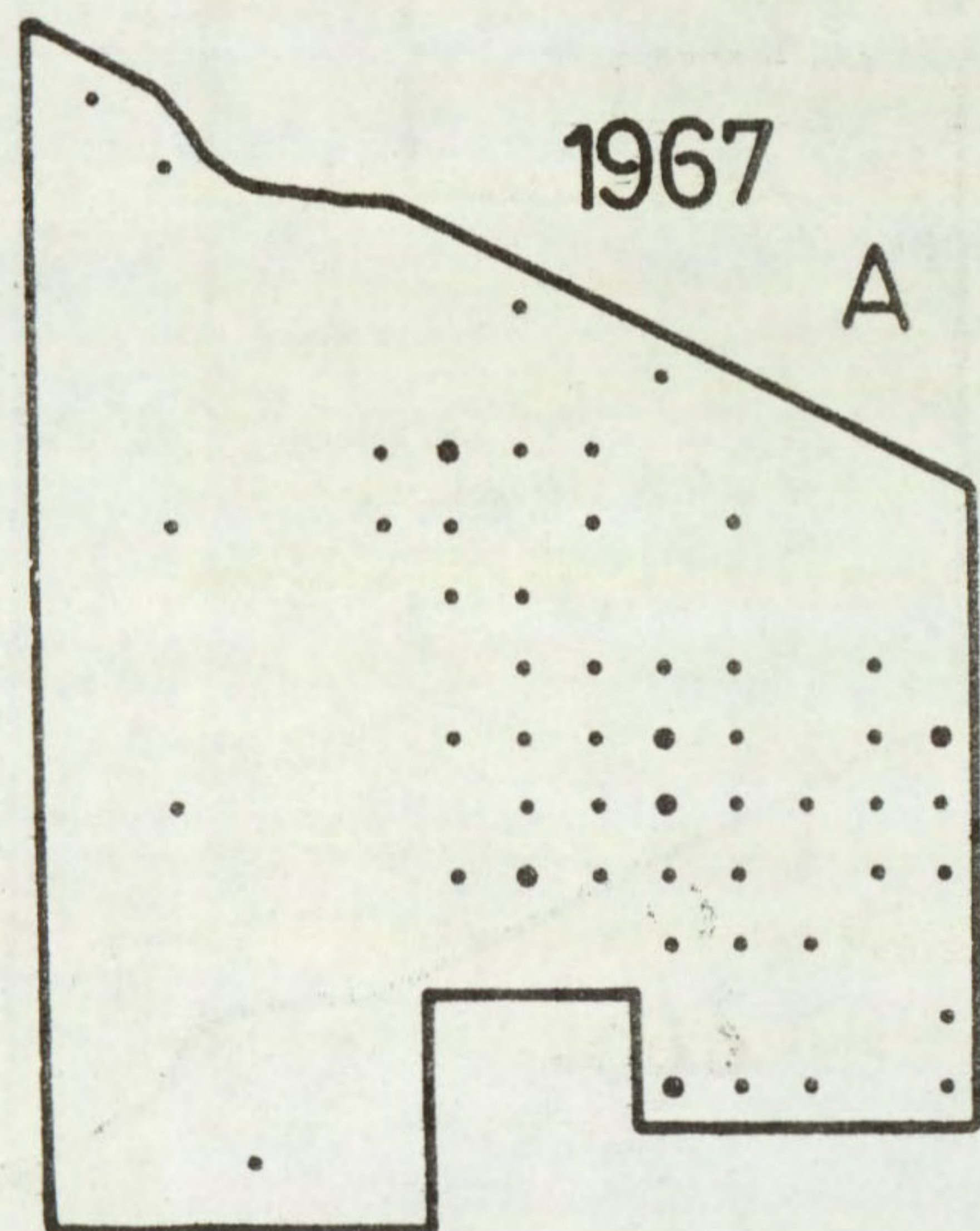
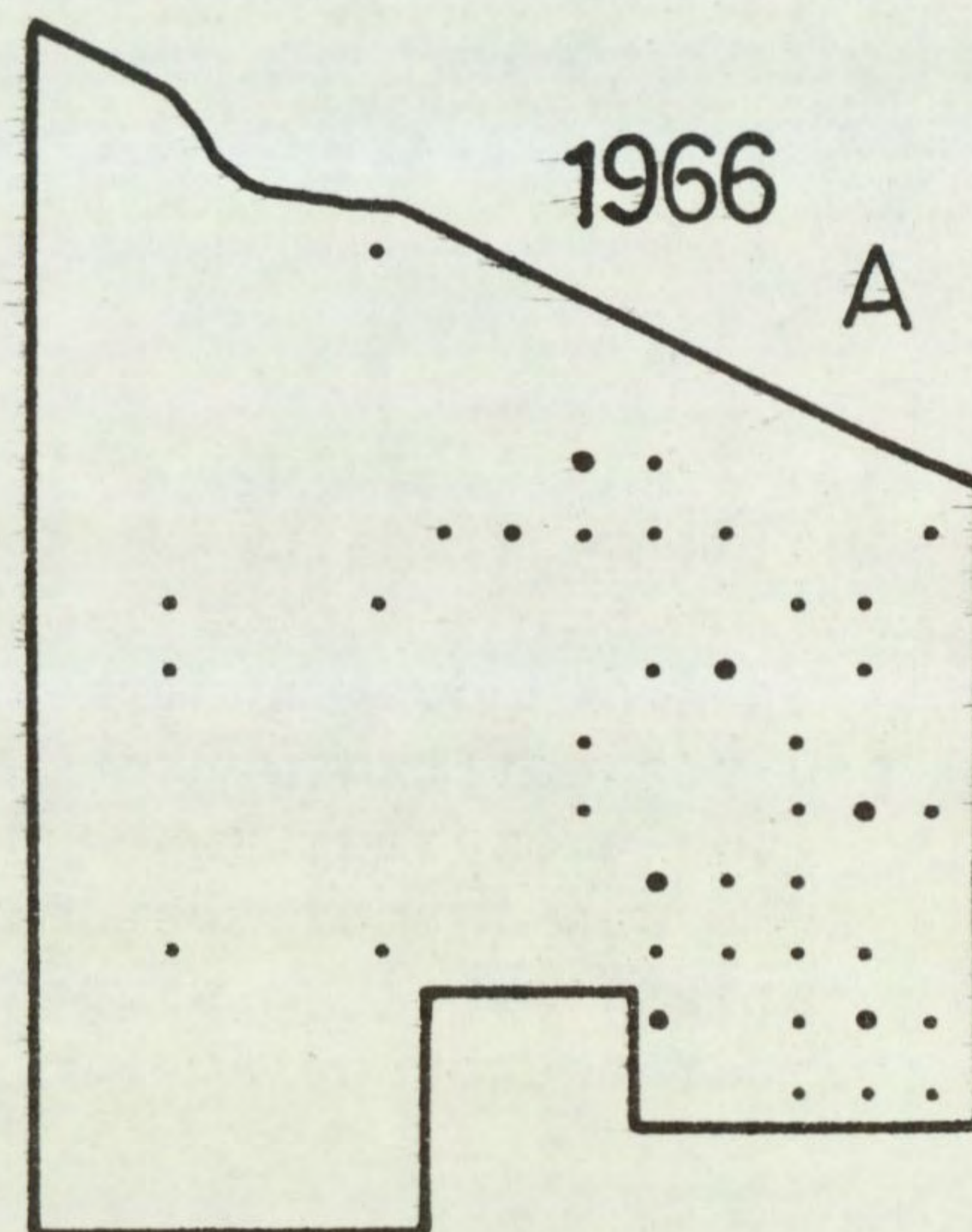
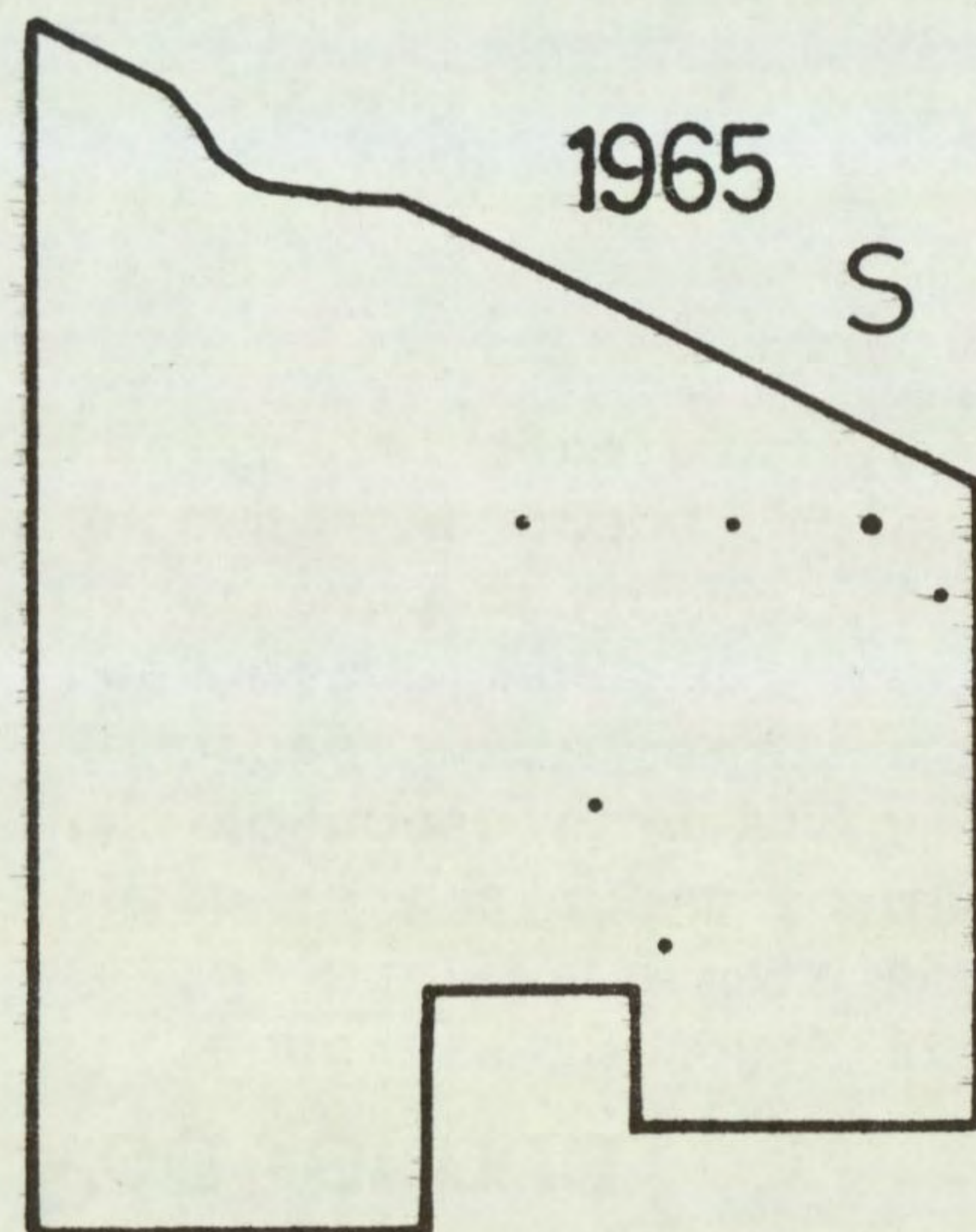
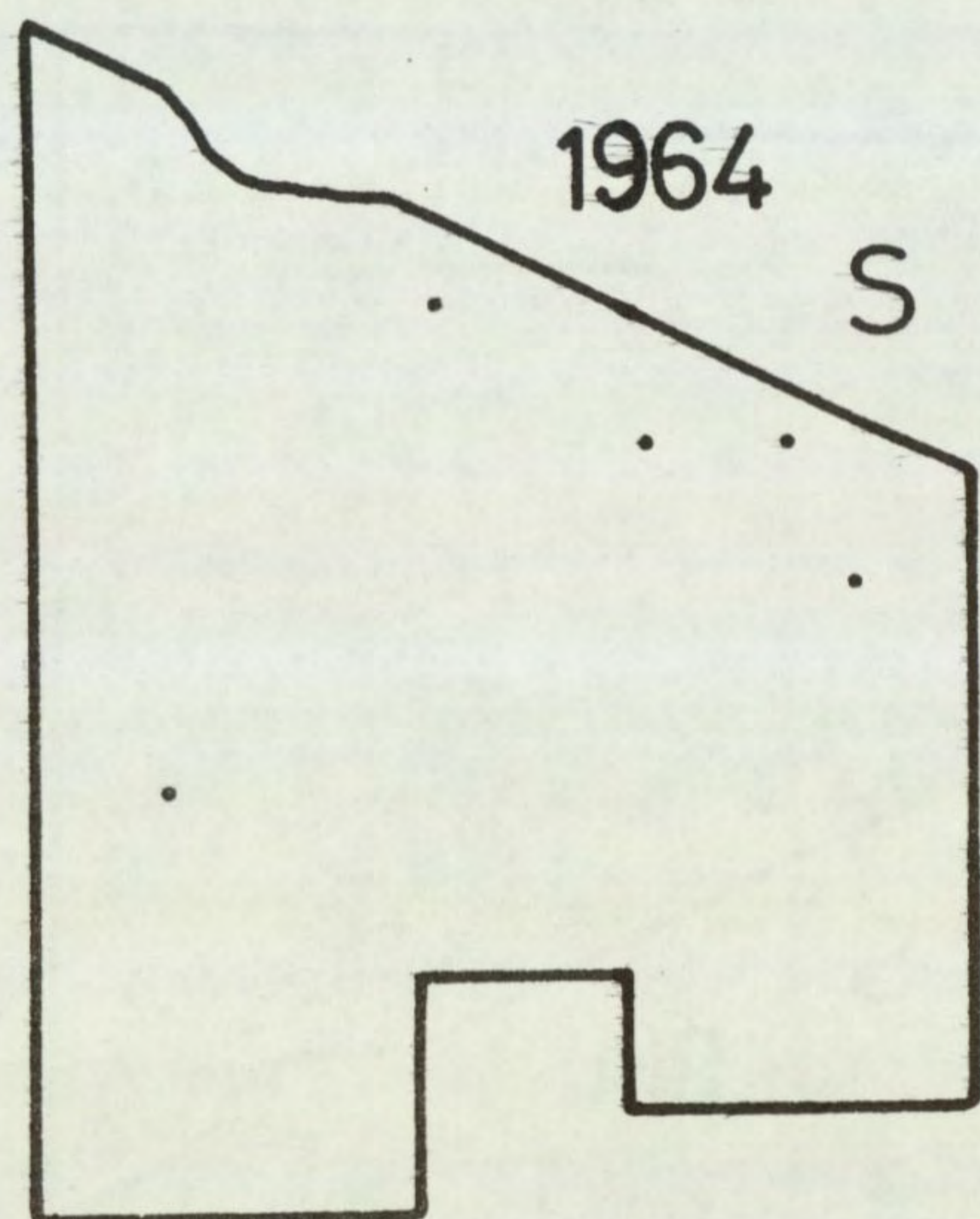
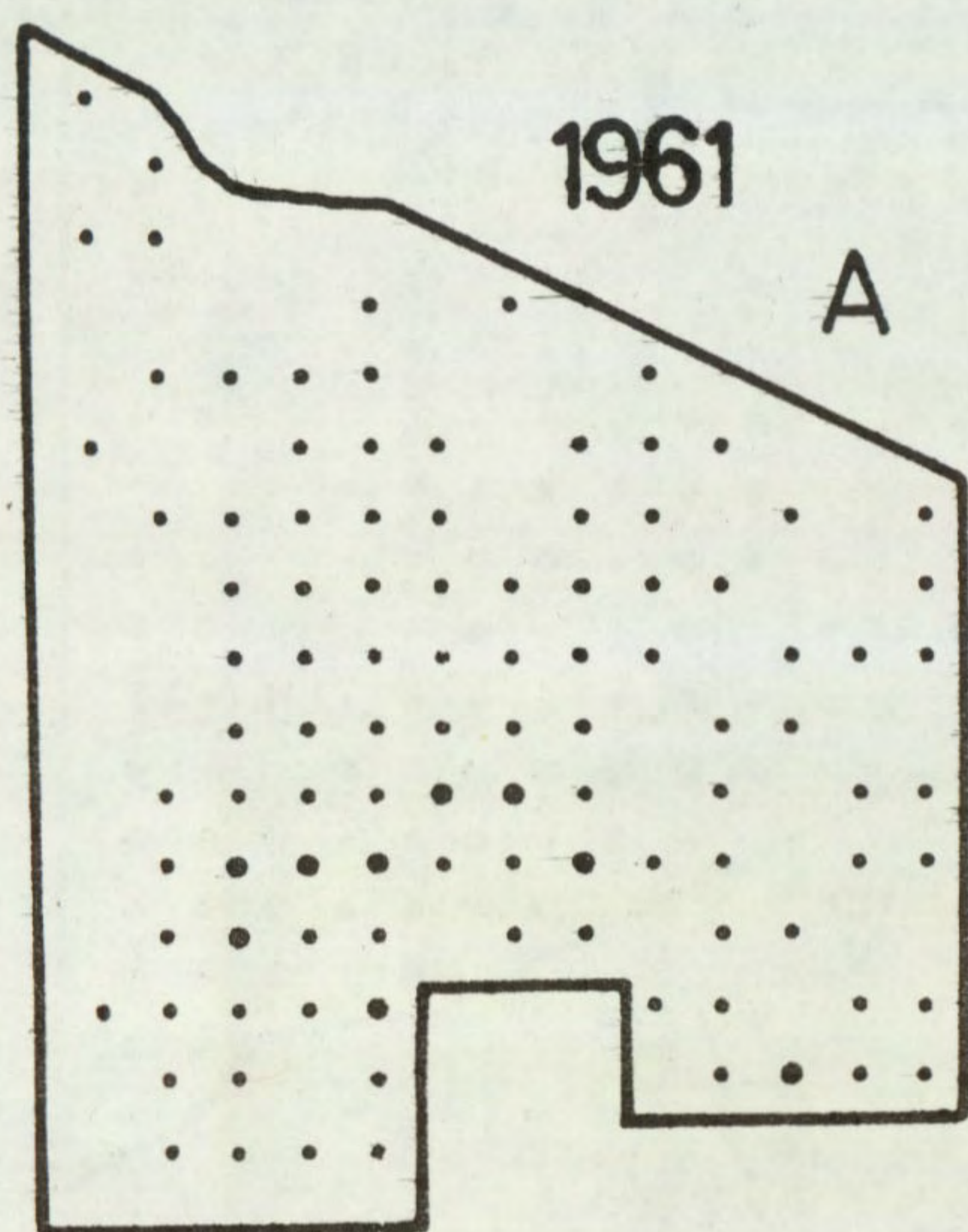
Its presence in the same part of the field as Papaver rhoeas in the first four assessments suggests that it was possibly introduced in the same earlier cultivation. It then virtually disappeared for three years, but returned again in 1971 and remained at a moderate level until 1981. Although susceptible to many of the herbicides used in this field, it has survived. The reason may be that it is capable of germinating, flowering and setting seed in the autumn after harvesting and so can maintain its seed in the soil.

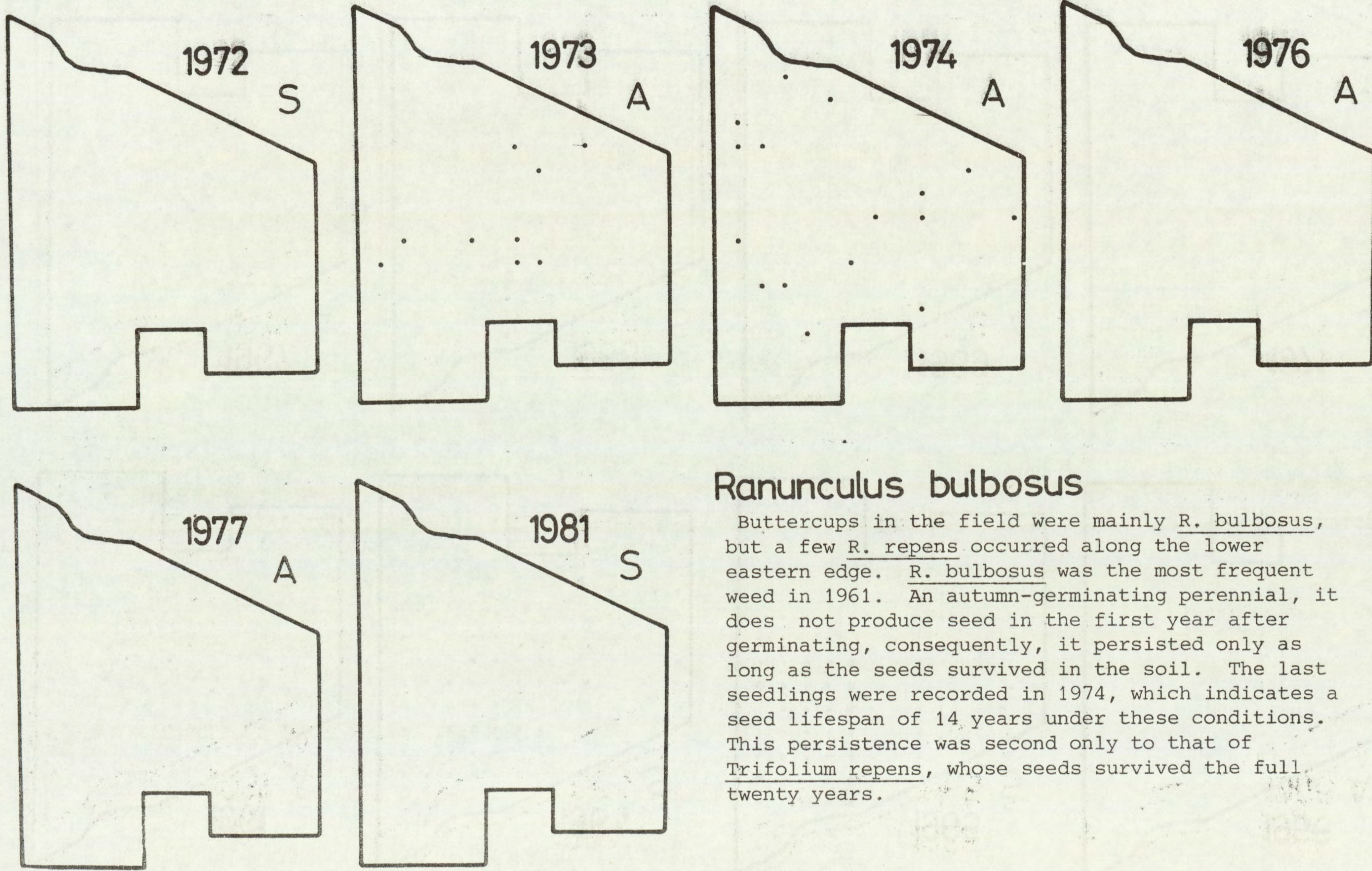




Poa annua

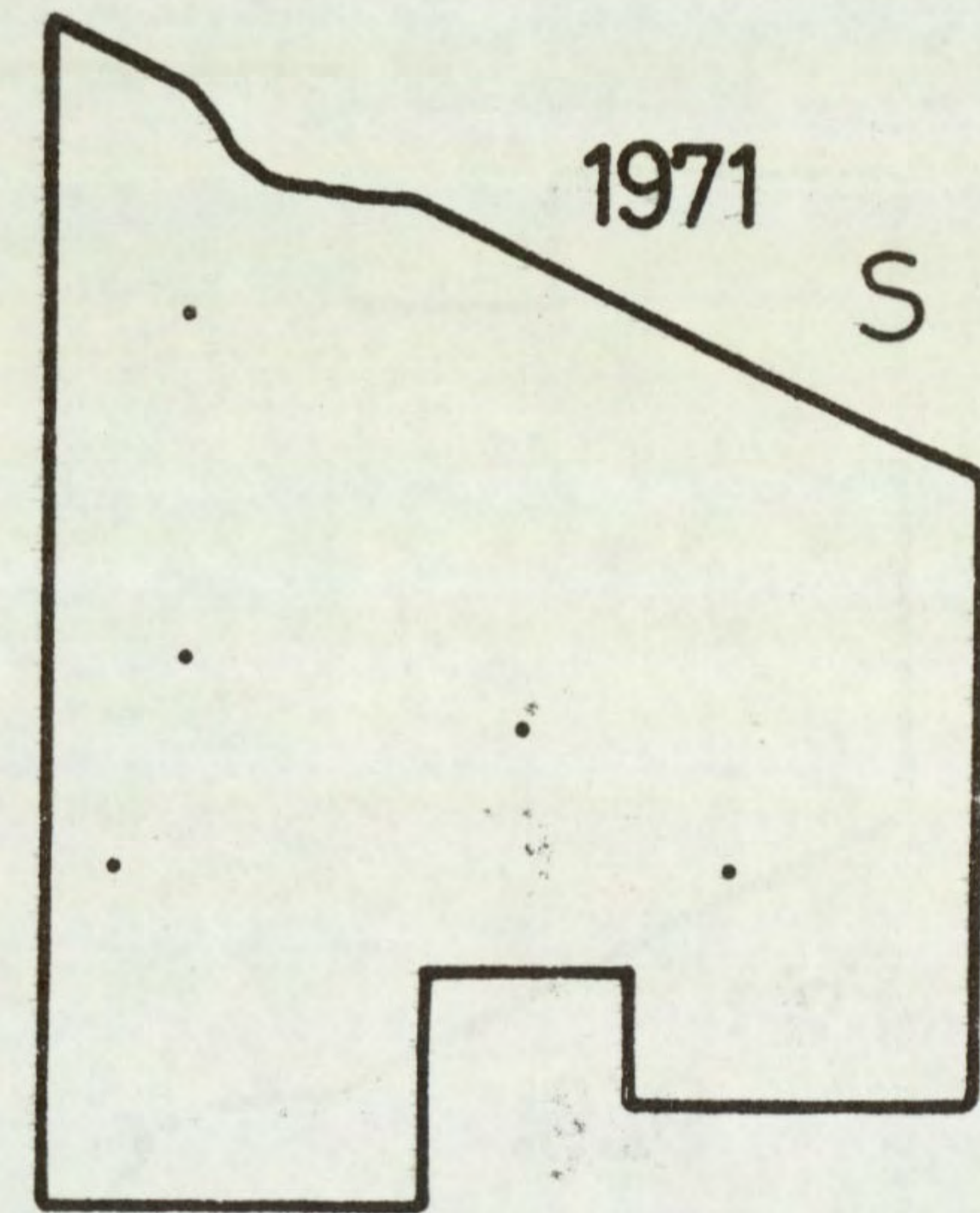
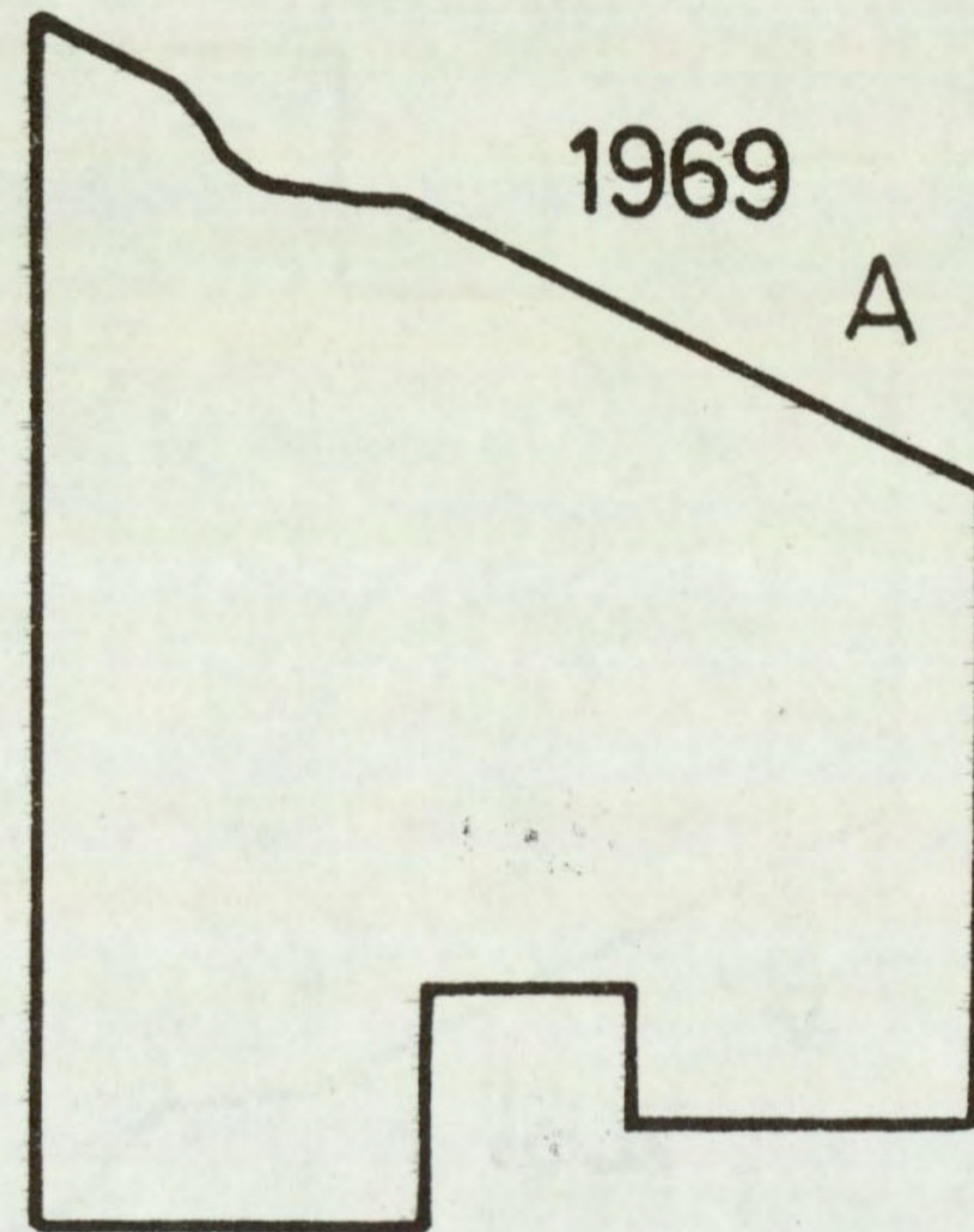
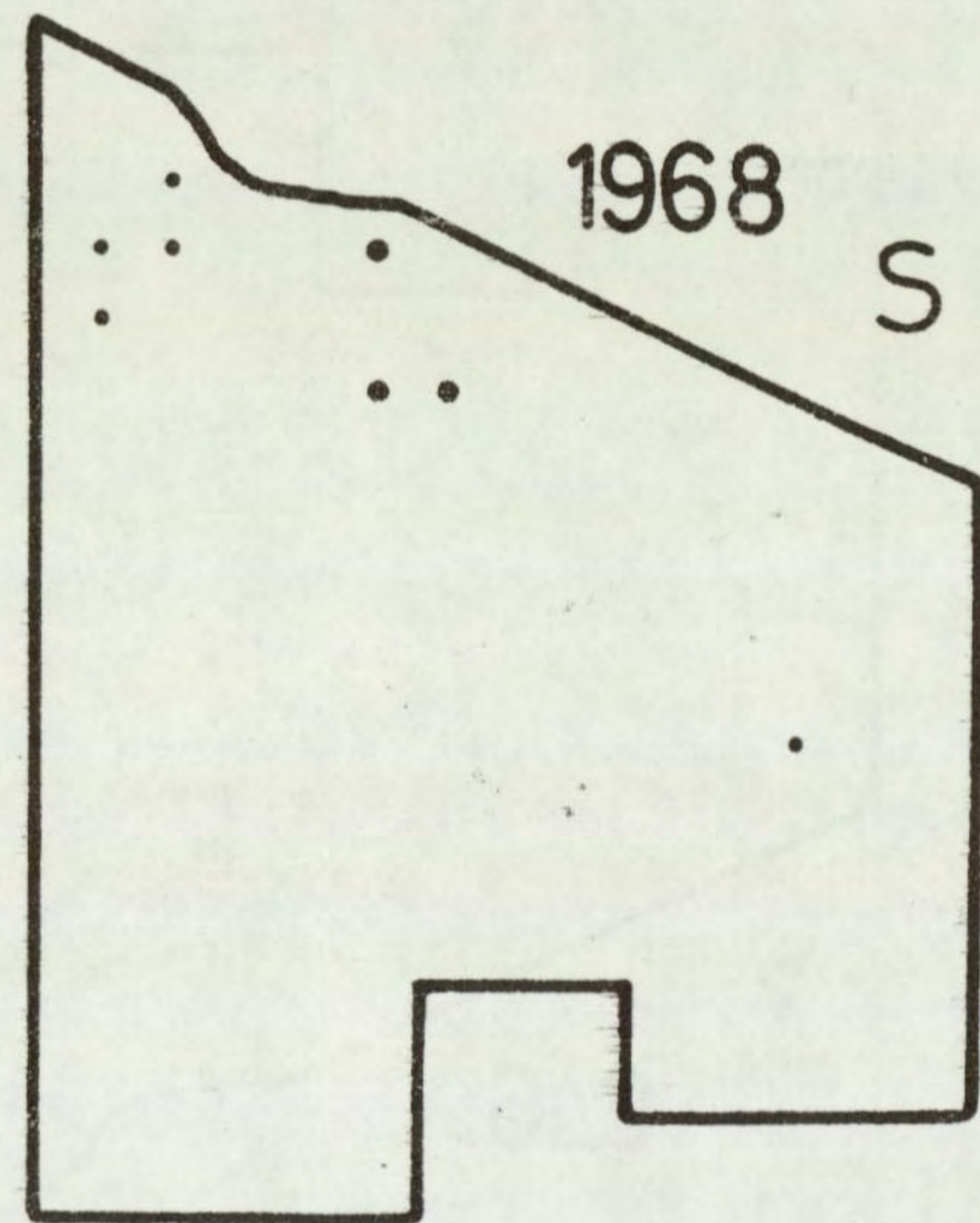
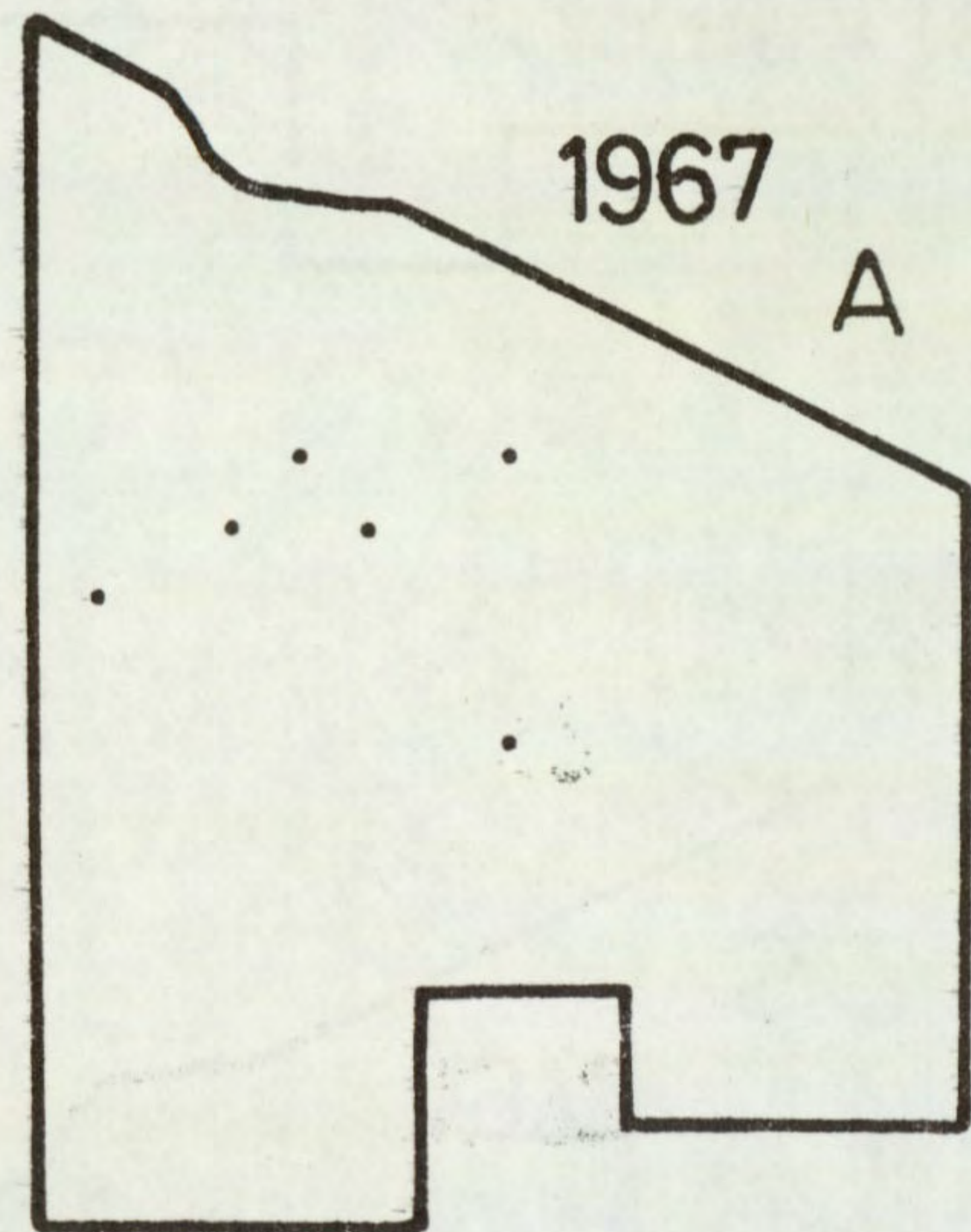
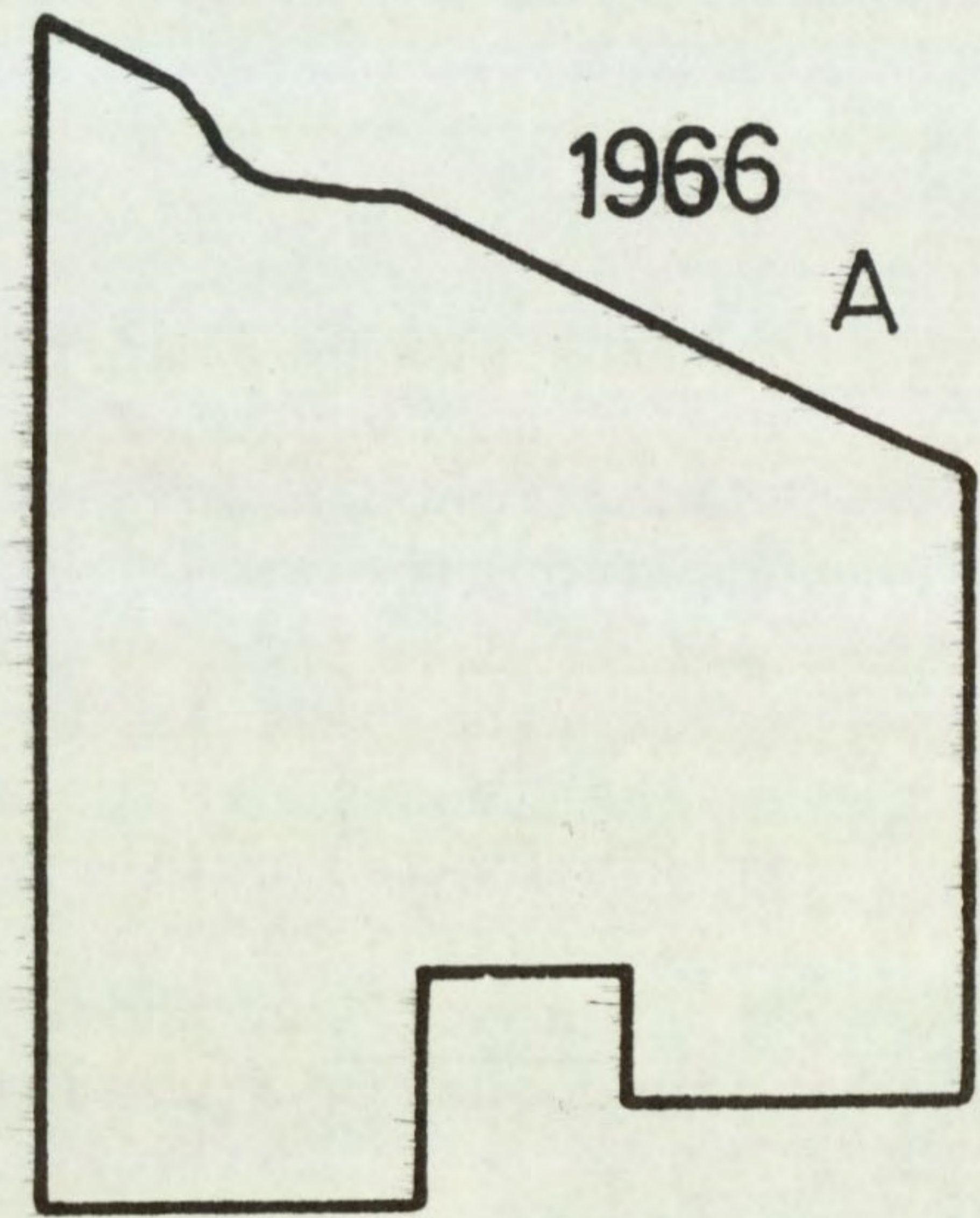
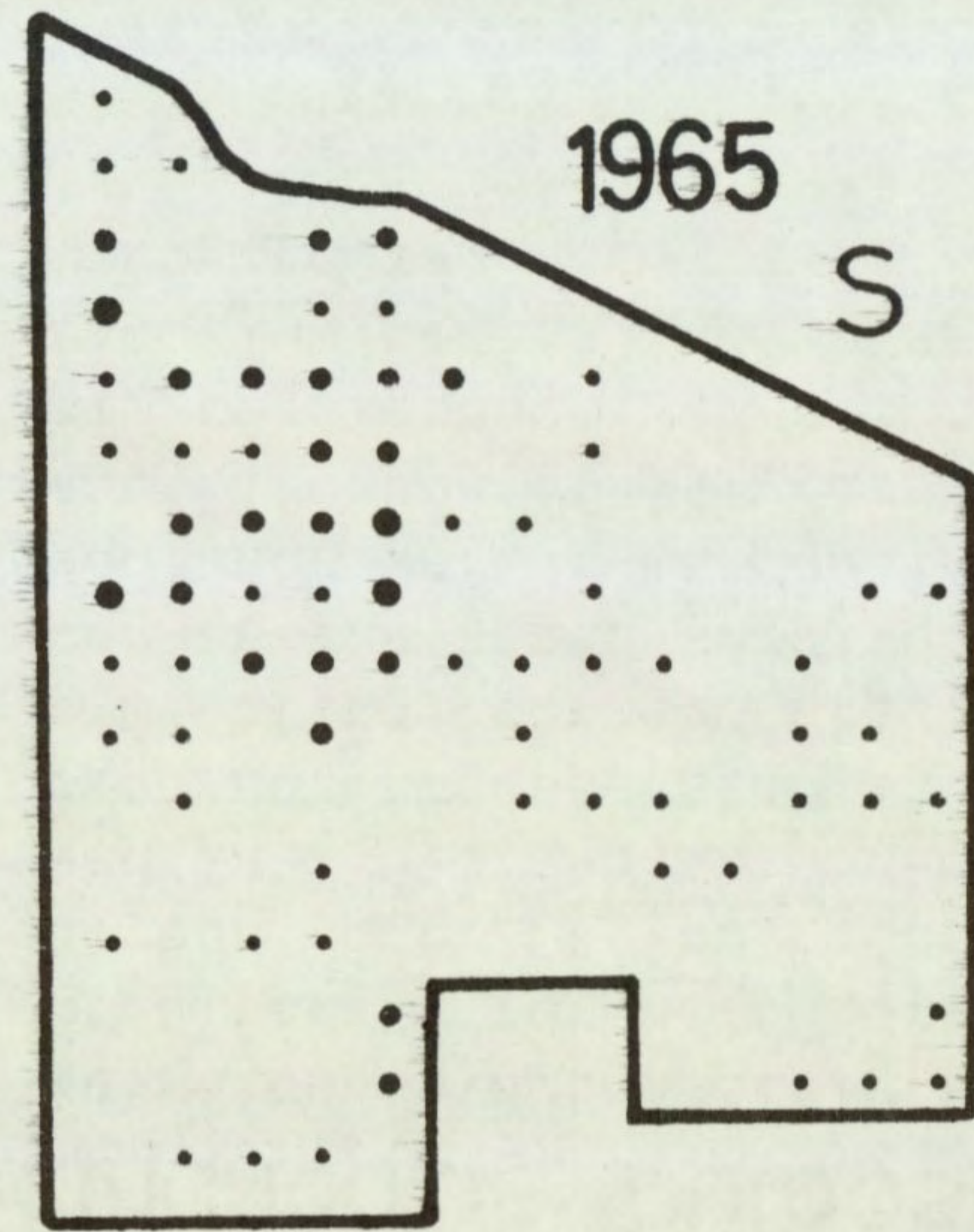
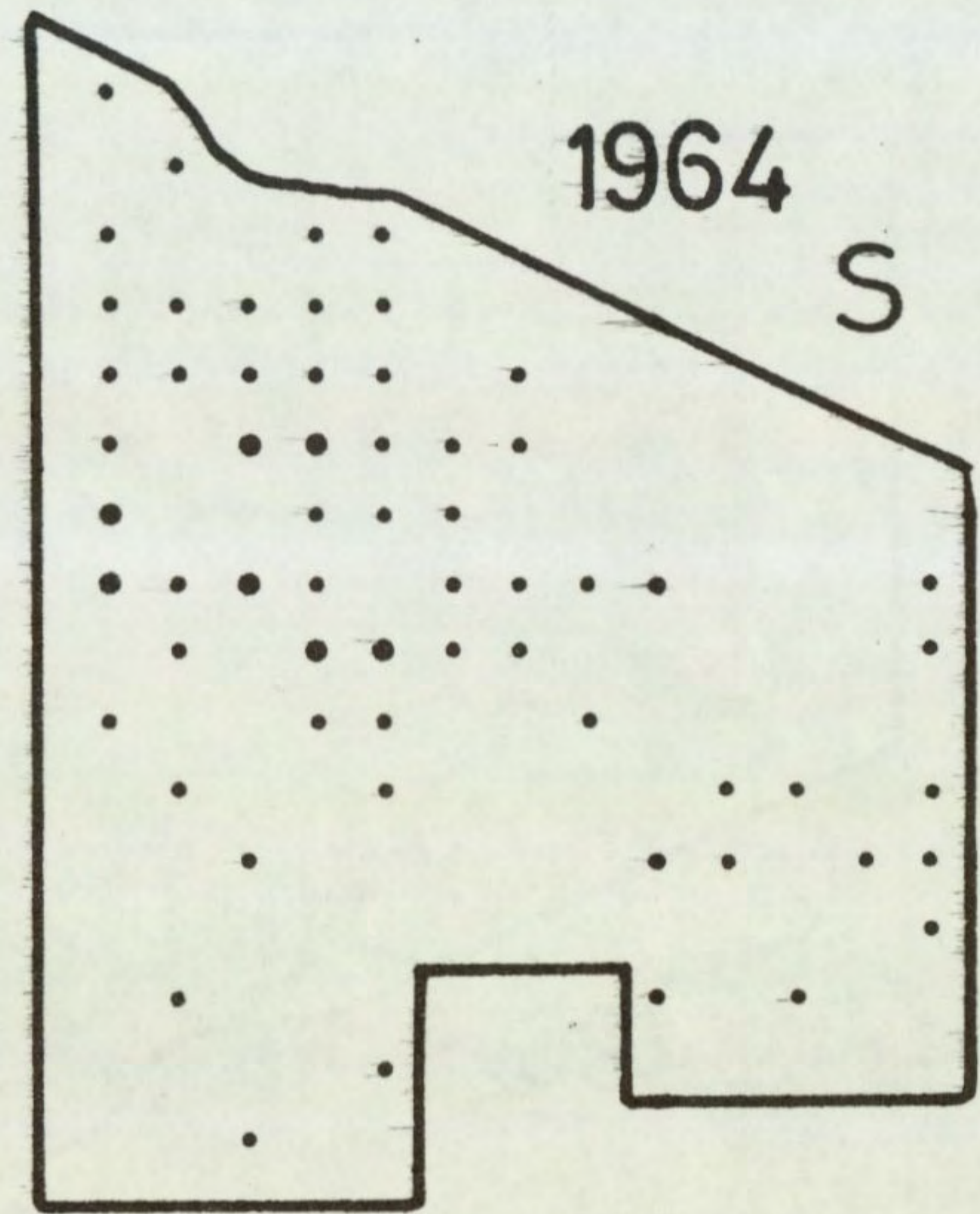
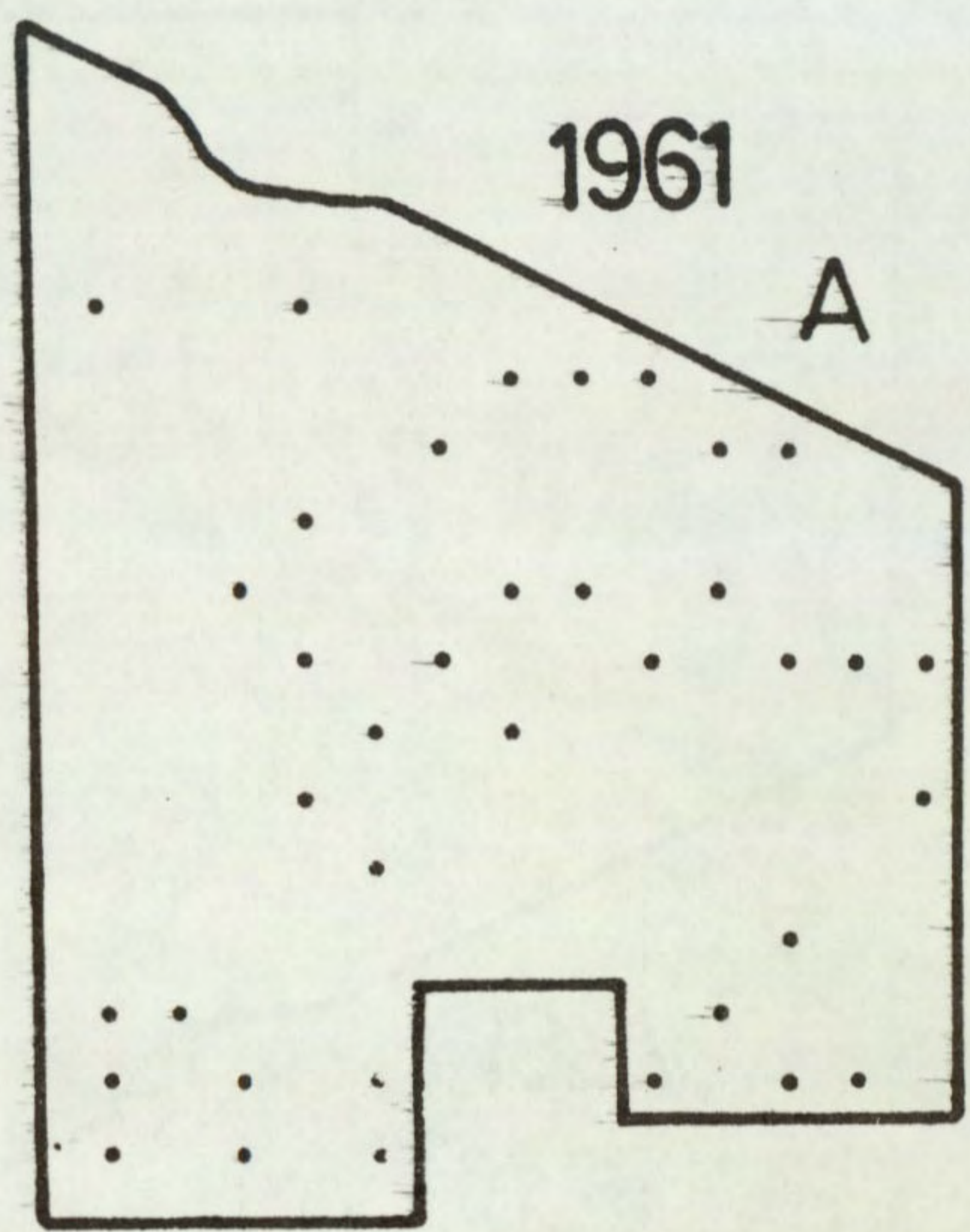
P. annua is the only grass of any abundance in the field, but there were some plants of P. trivialis, which is difficult to distinguish from P. annua at the youngest stages. P. annua was therefore not recorded until definite means of identification had been established. Later assessments show that it fluctuated greatly, the highest counts being in autumn-sown crops and the lowest in spring-sown ones, yet it can germinate in every month of the year.

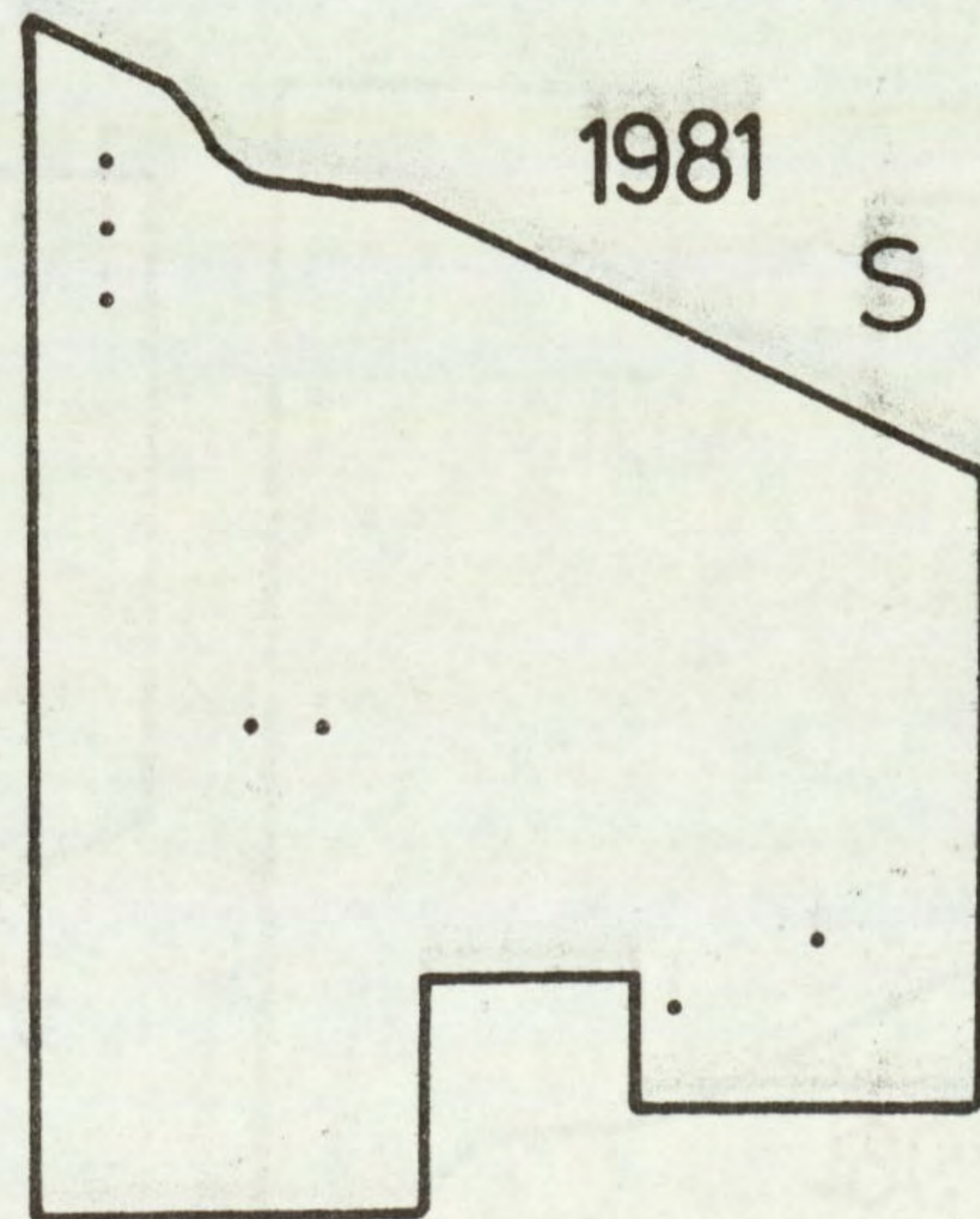
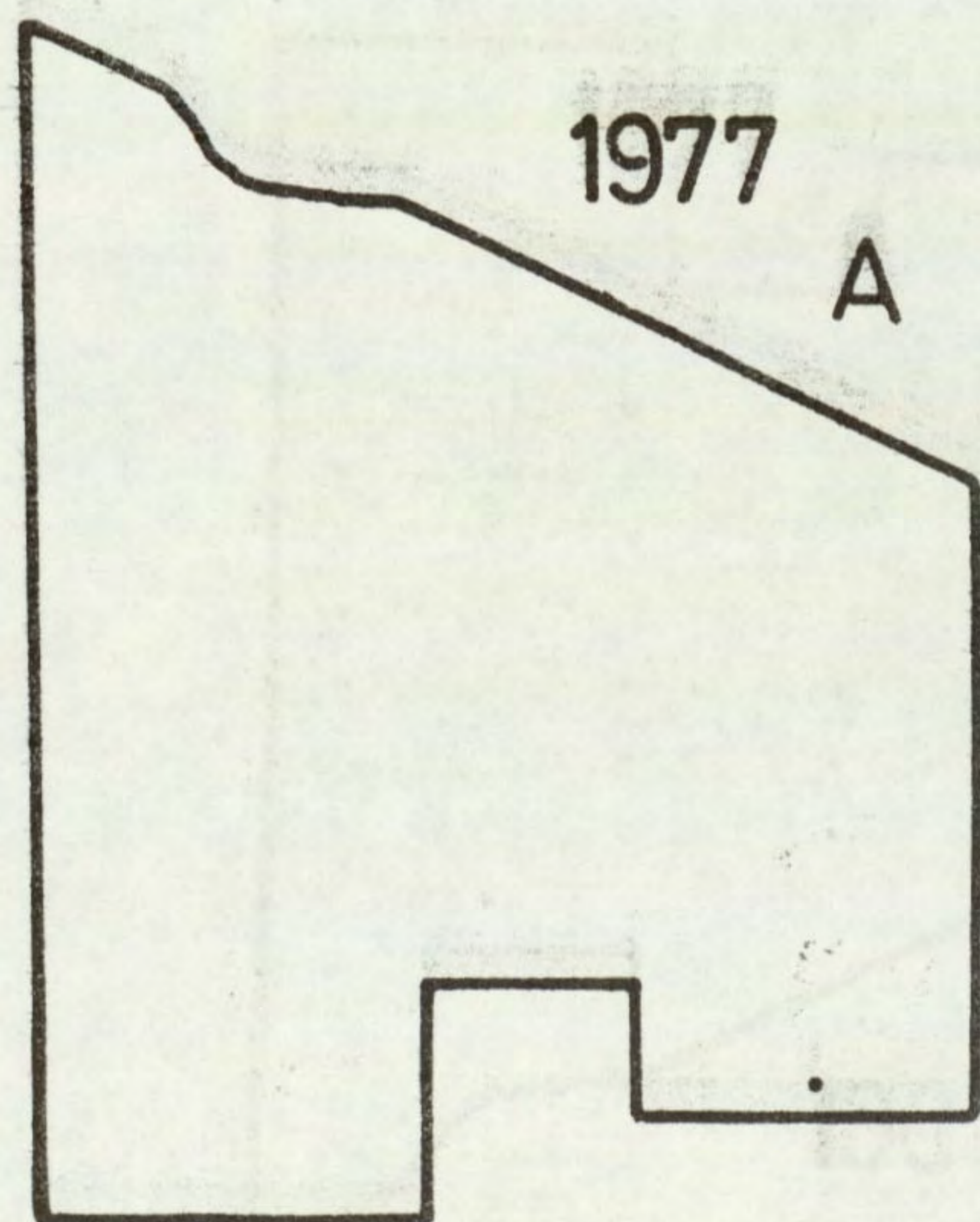
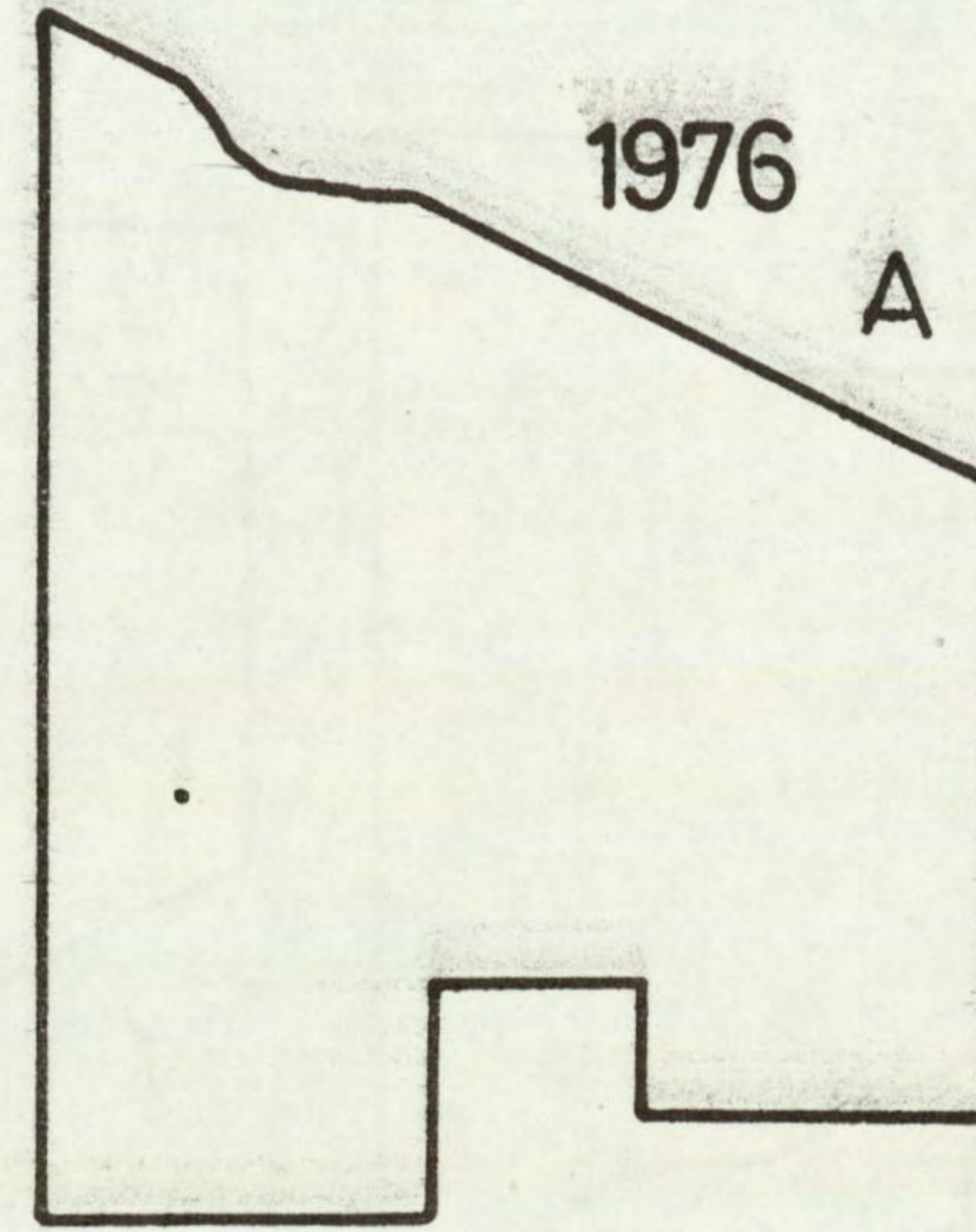
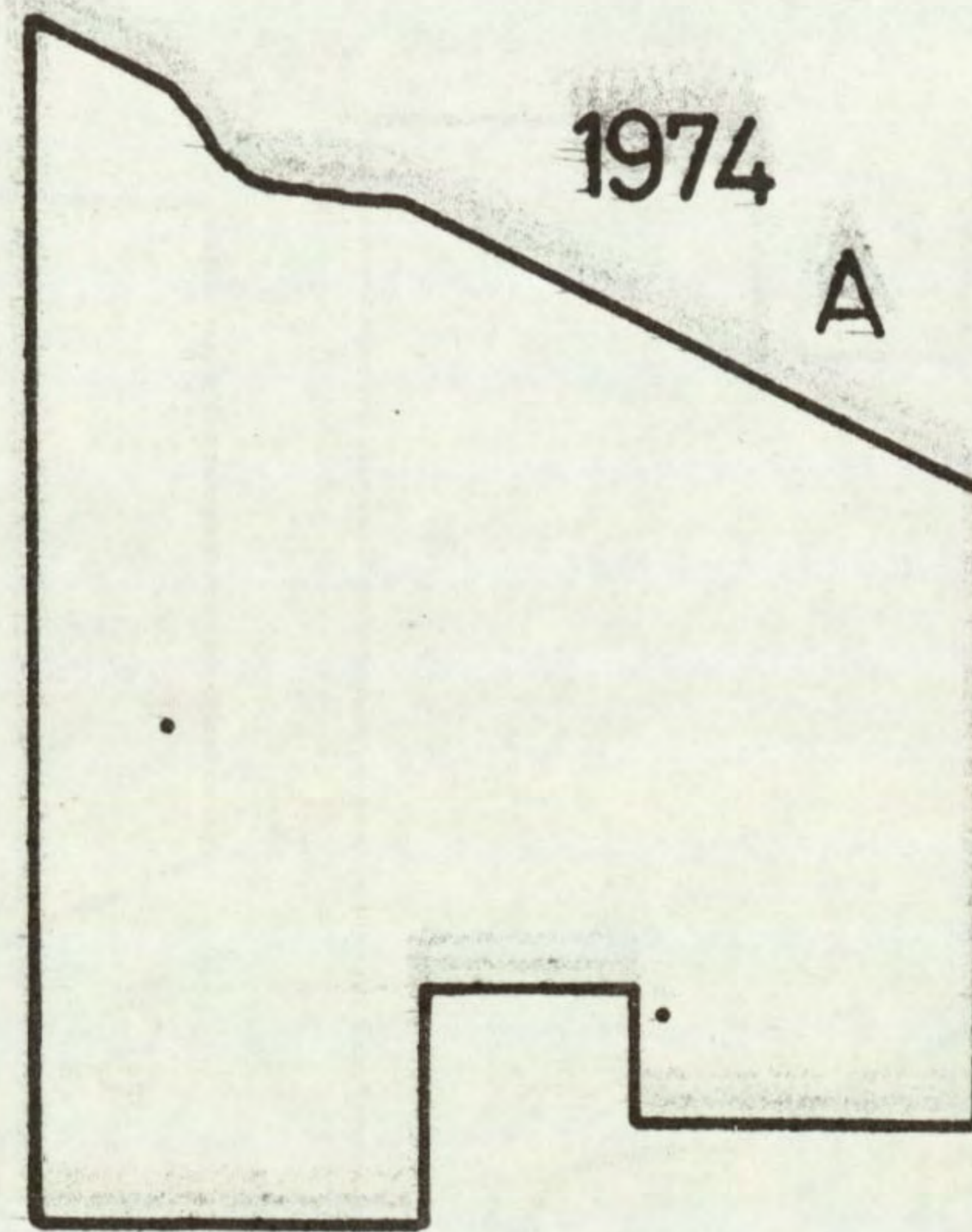
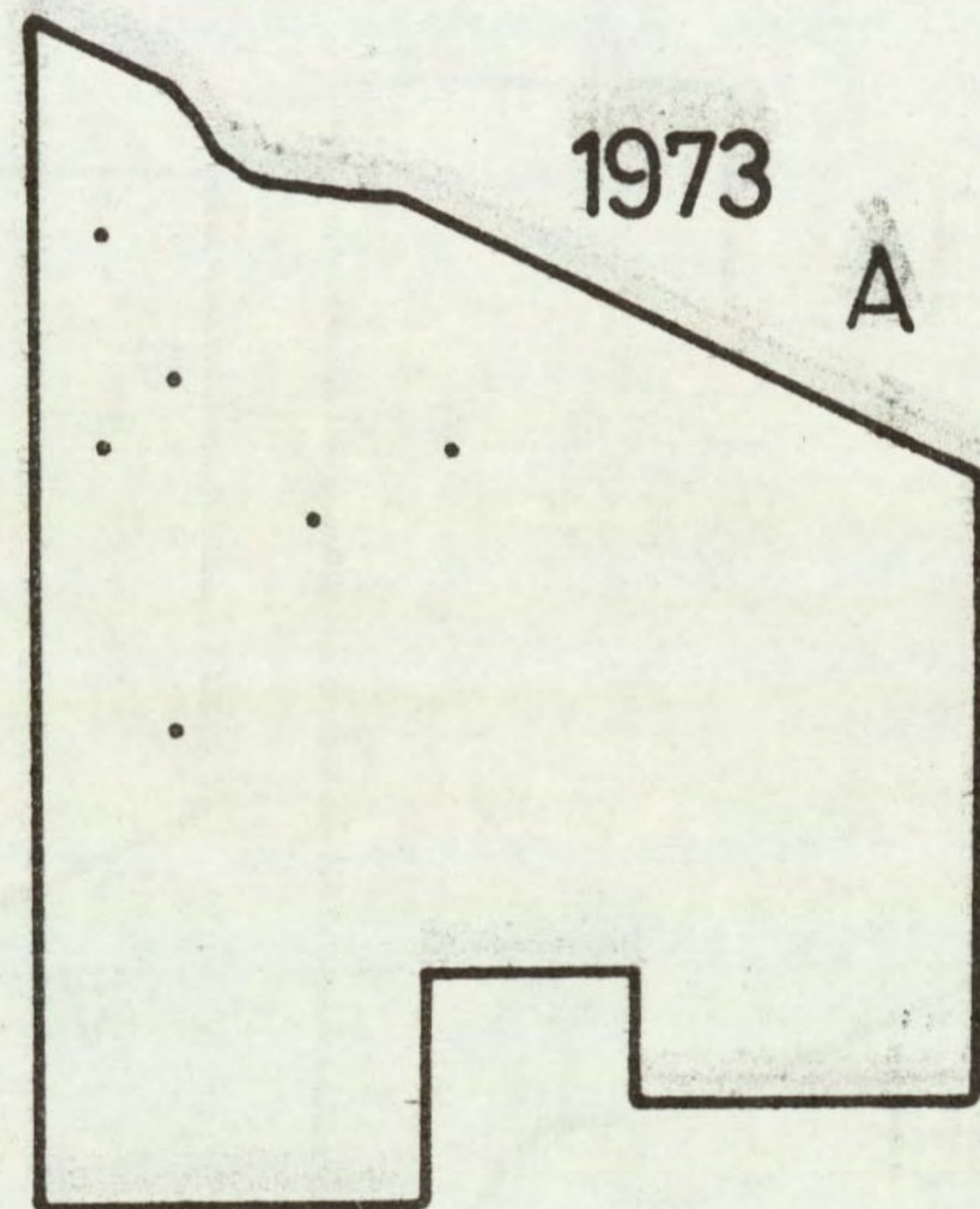
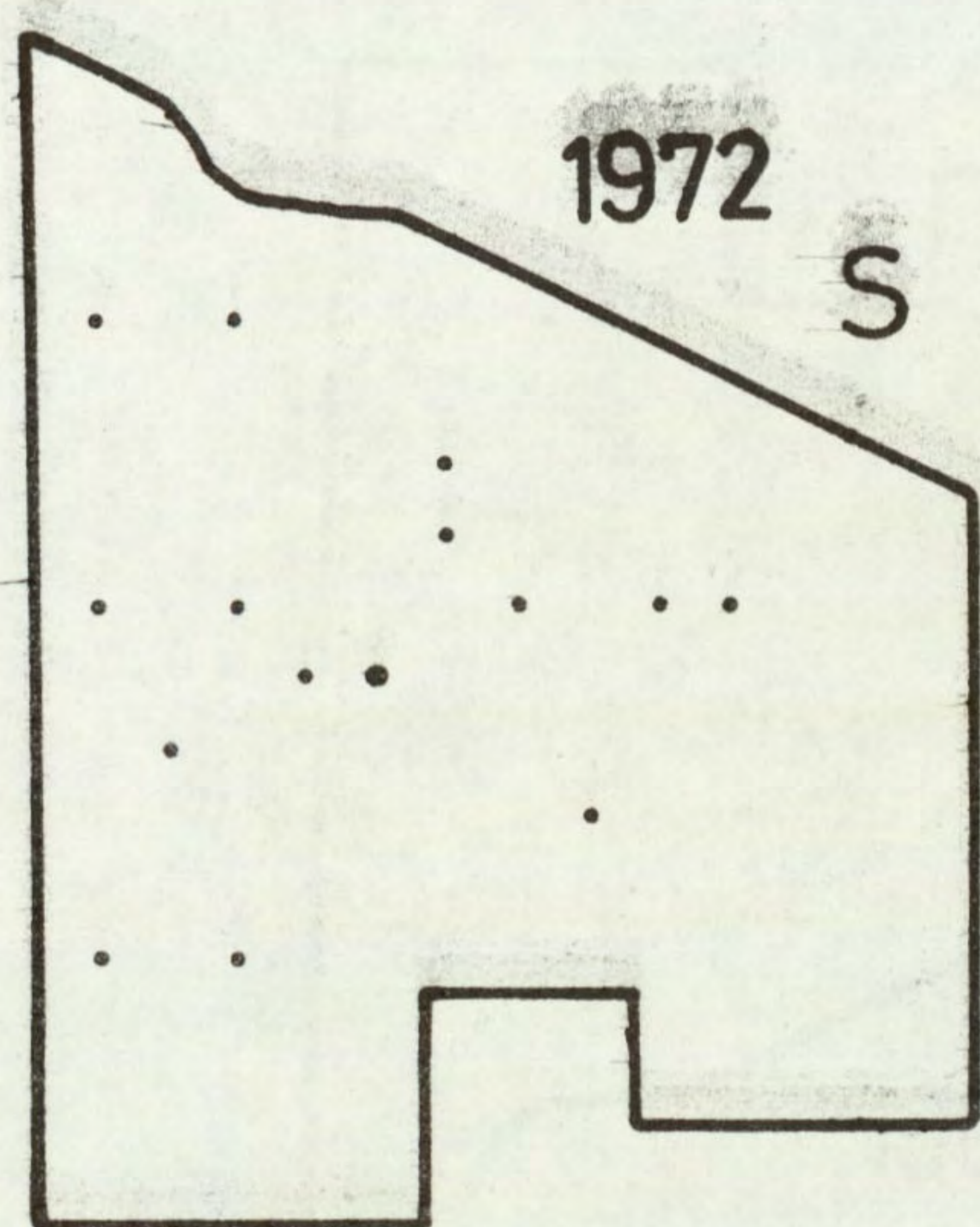




Ranunculus bulbosus

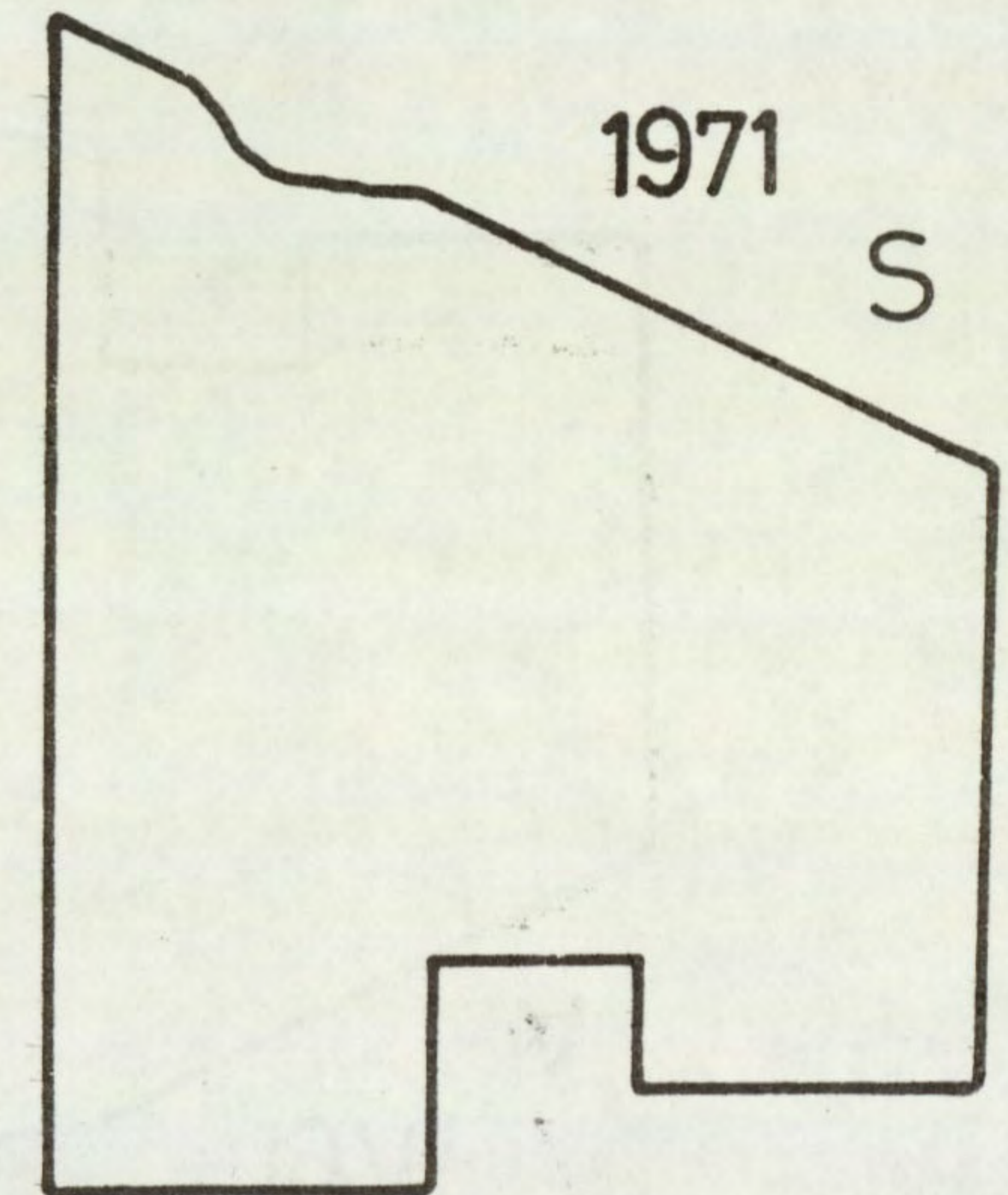
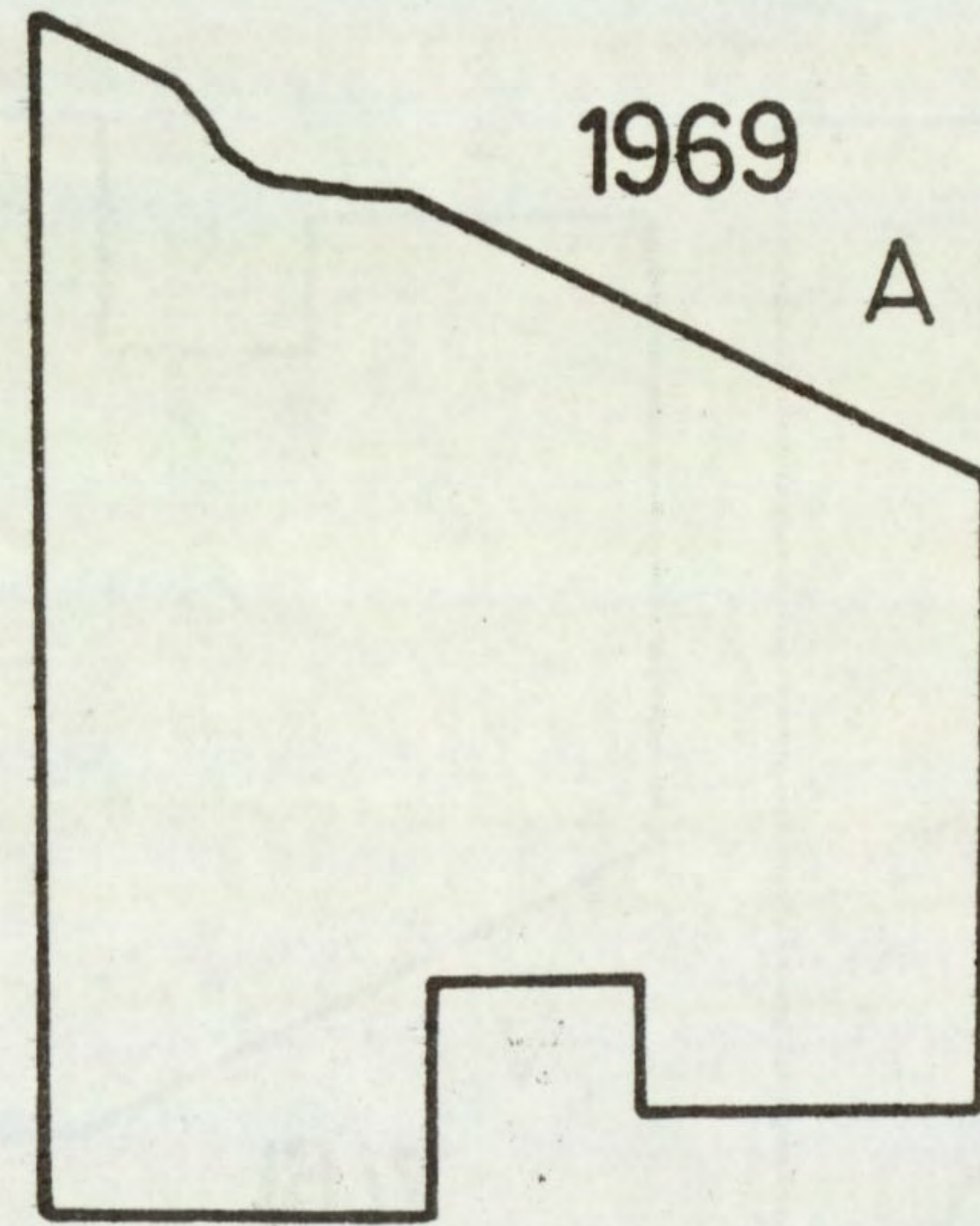
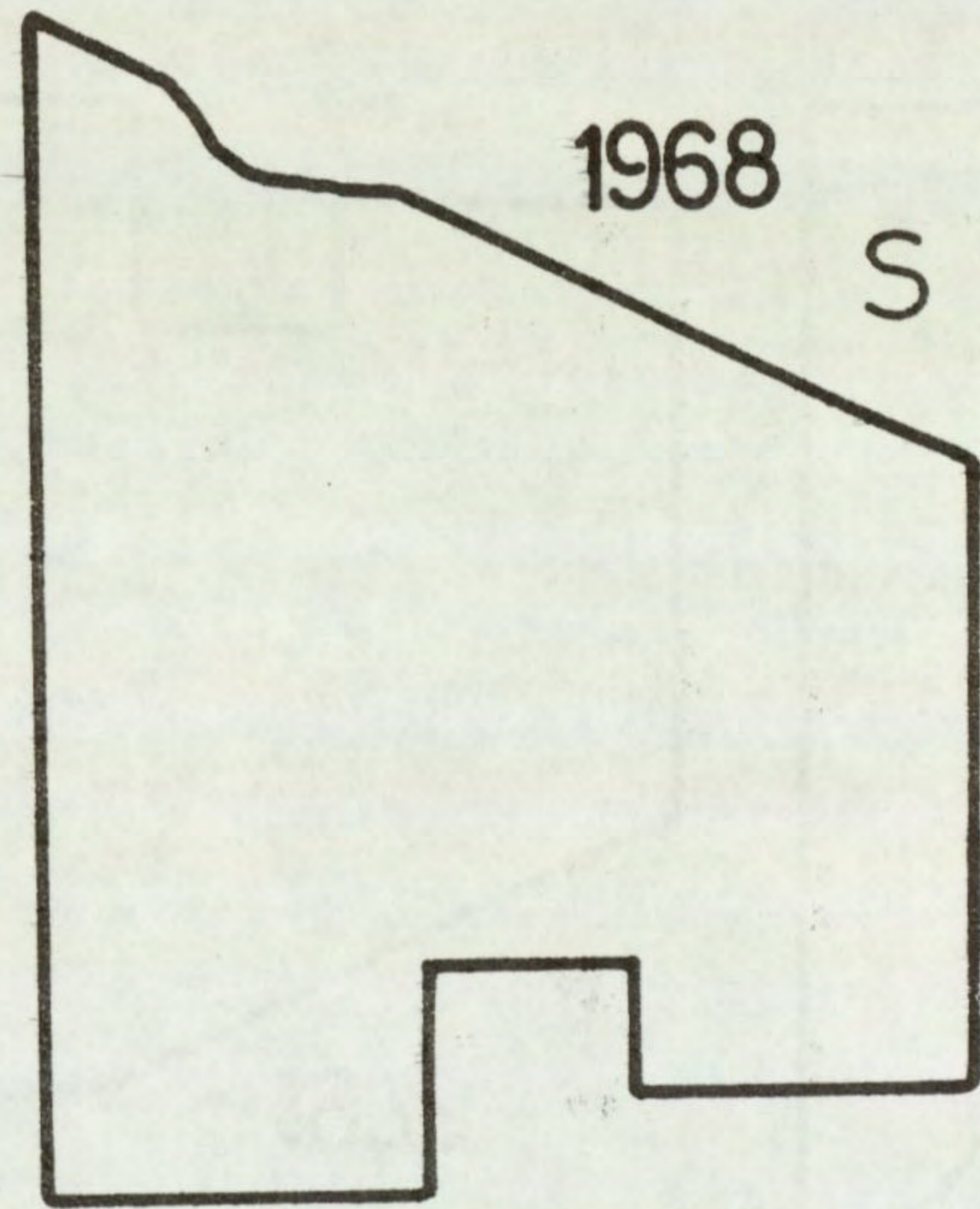
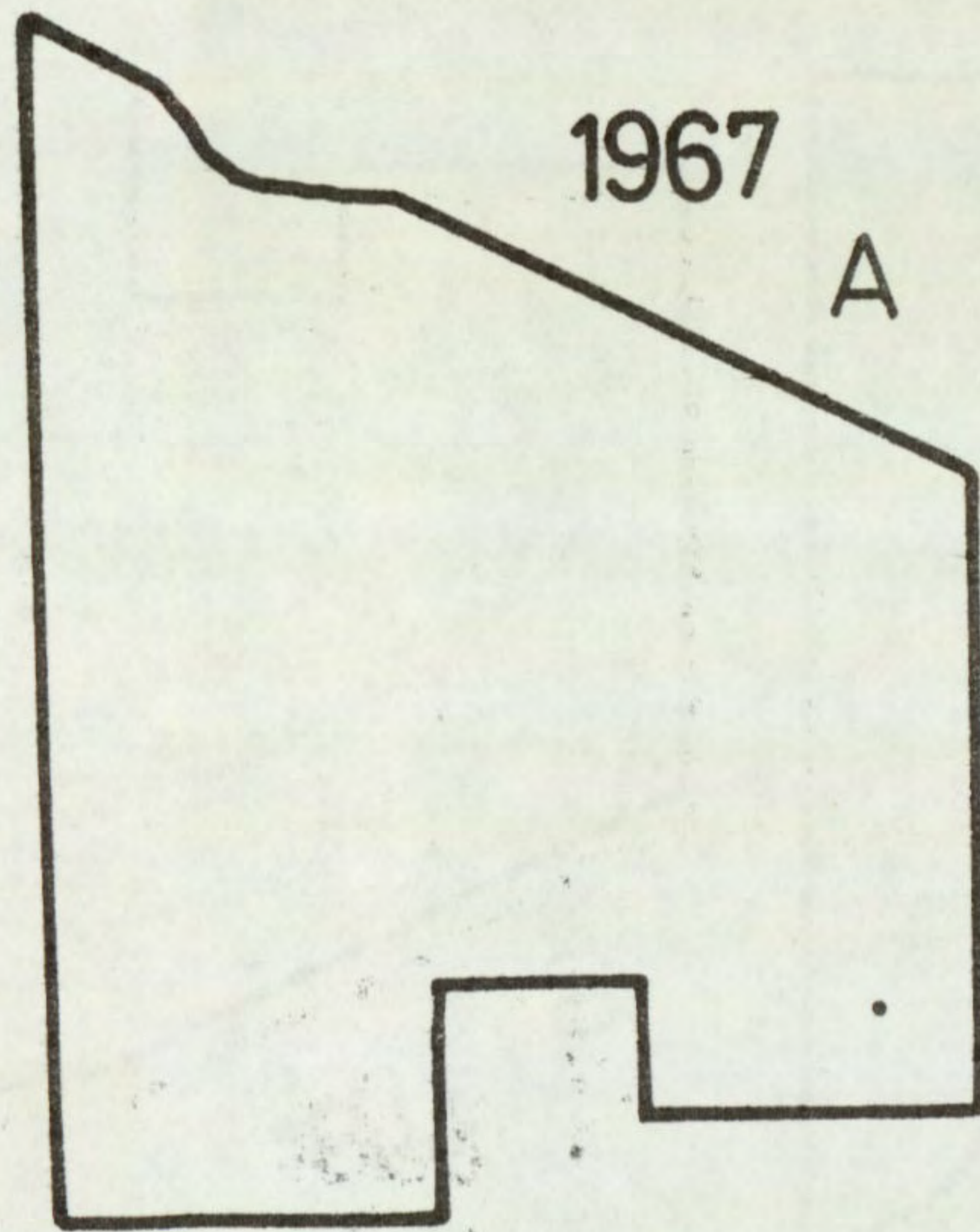
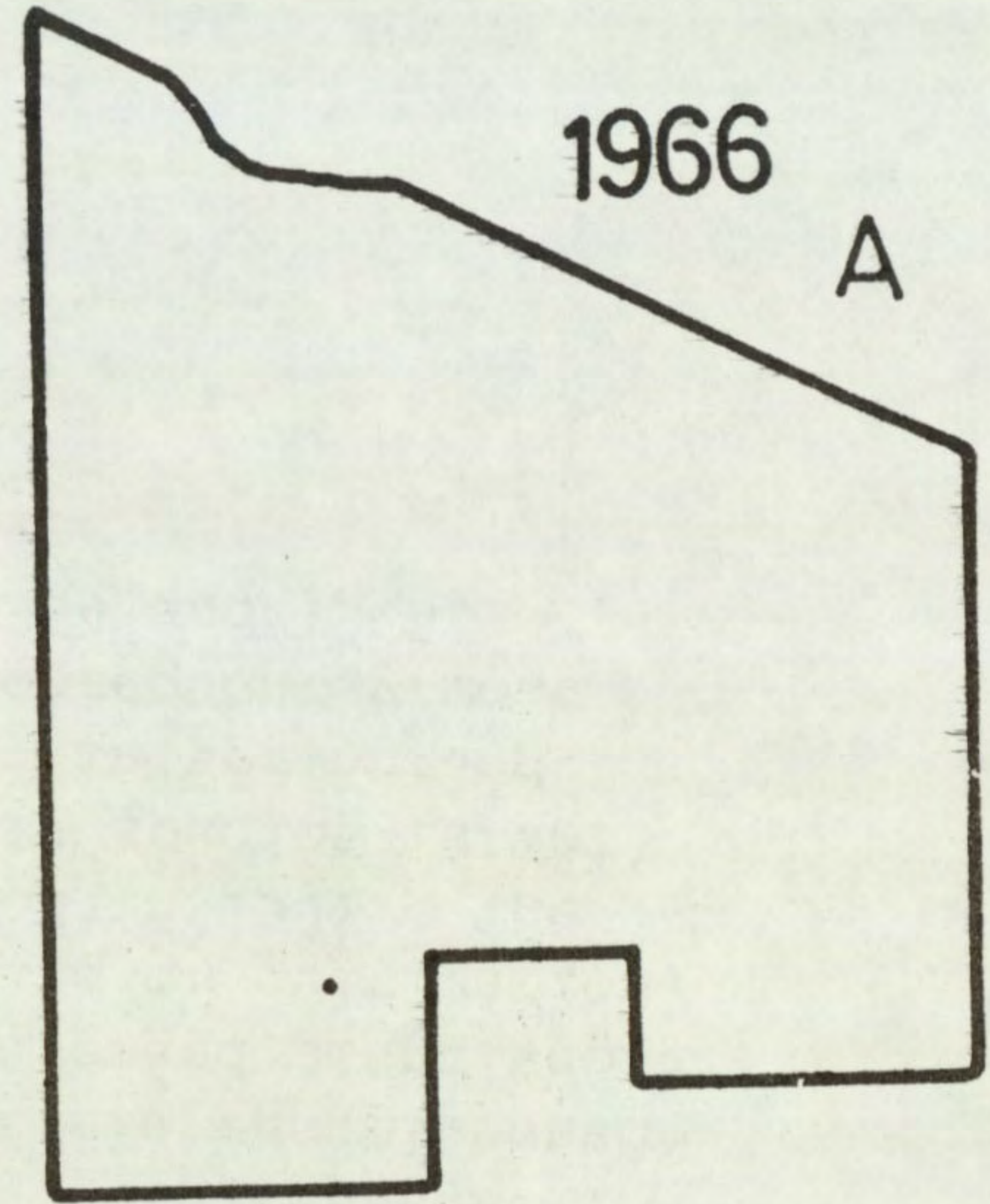
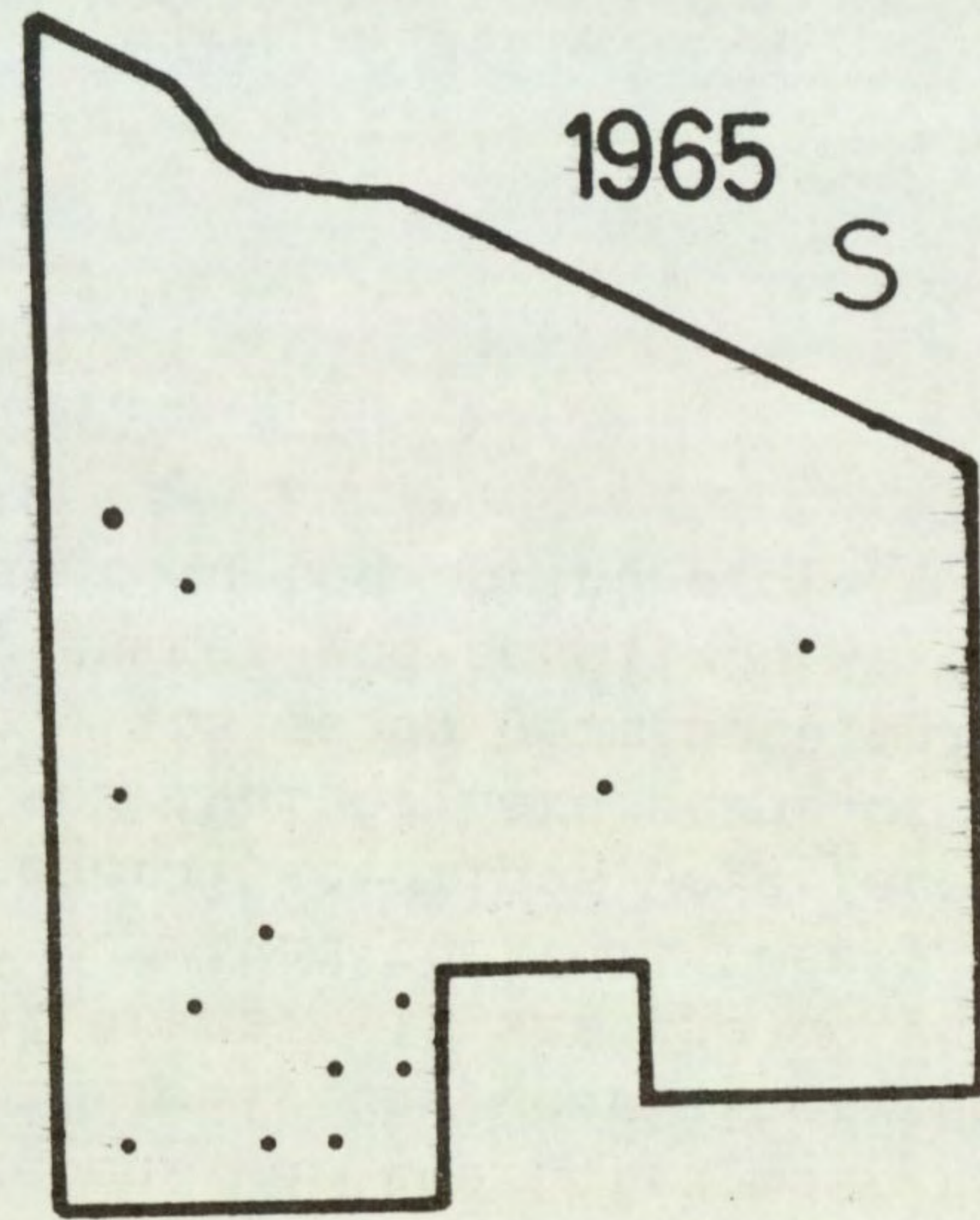
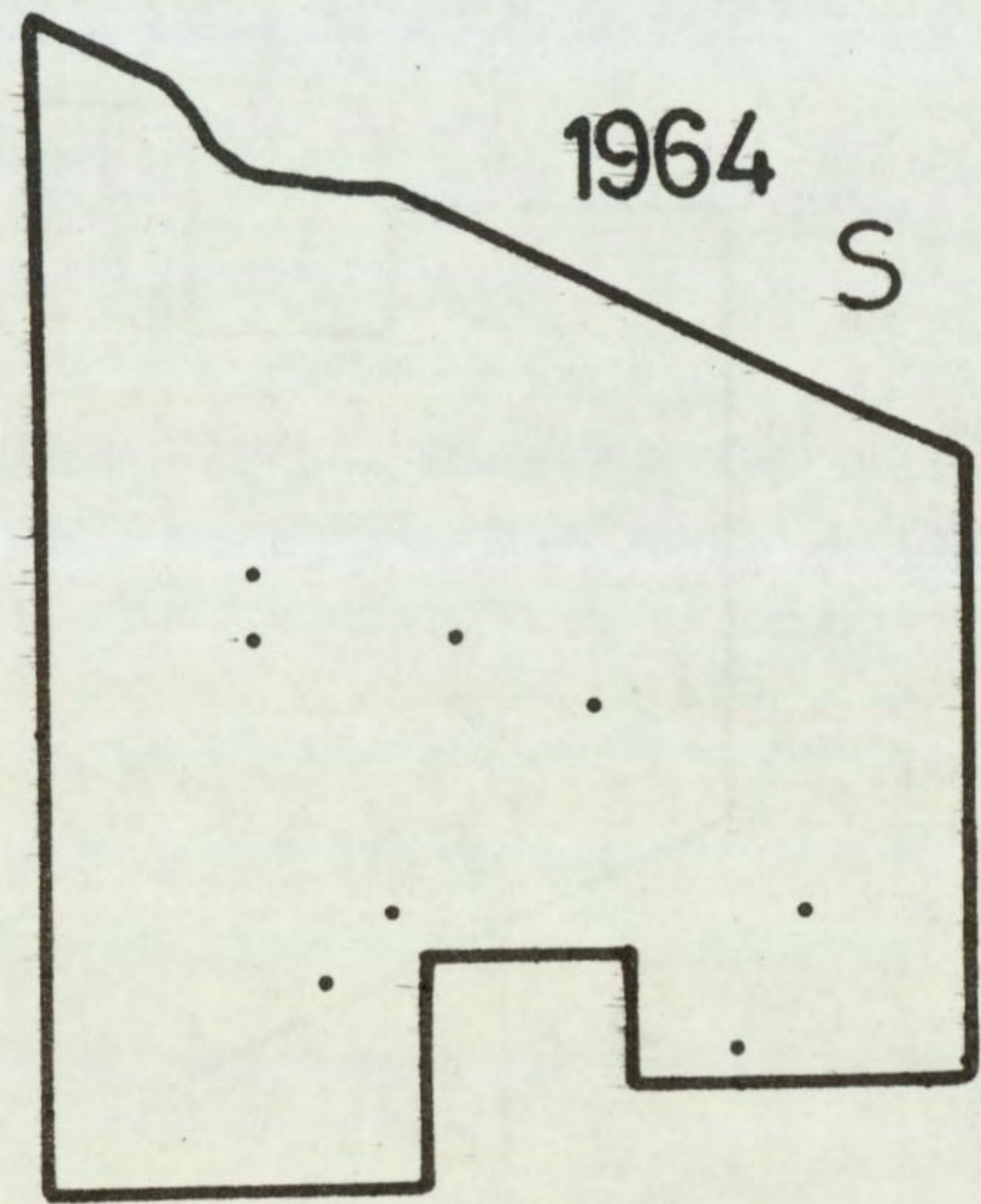
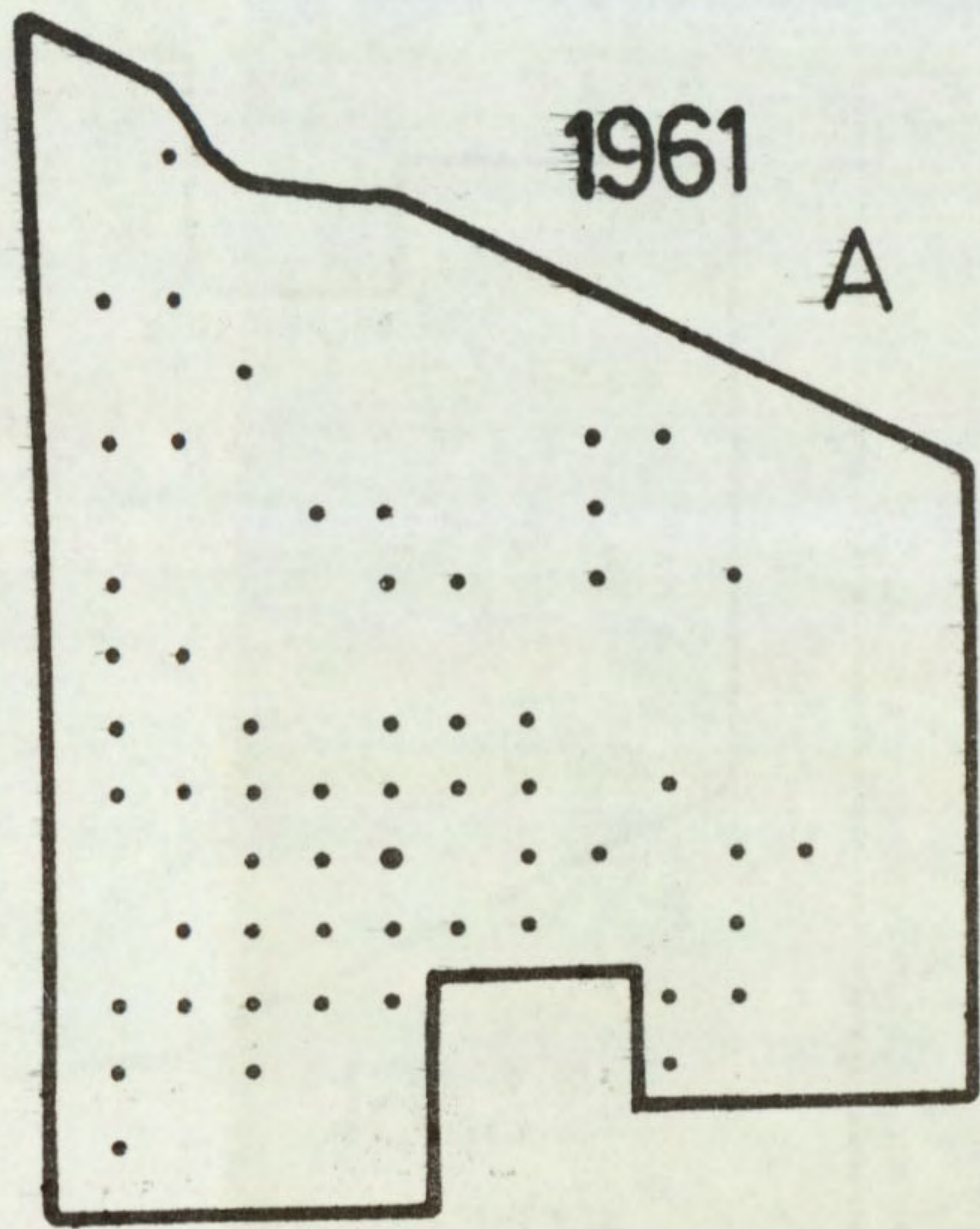
Buttercups in the field were mainly R. bulbosus, but a few R. repens occurred along the lower eastern edge. R. bulbosus was the most frequent weed in 1961. An autumn-germinating perennial, it does not produce seed in the first year after germinating, consequently, it persisted only as long as the seeds survived in the soil. The last seedlings were recorded in 1974, which indicates a seed lifespan of 14 years under these conditions. This persistence was second only to that of Trifolium repens, whose seeds survived the full twenty years.

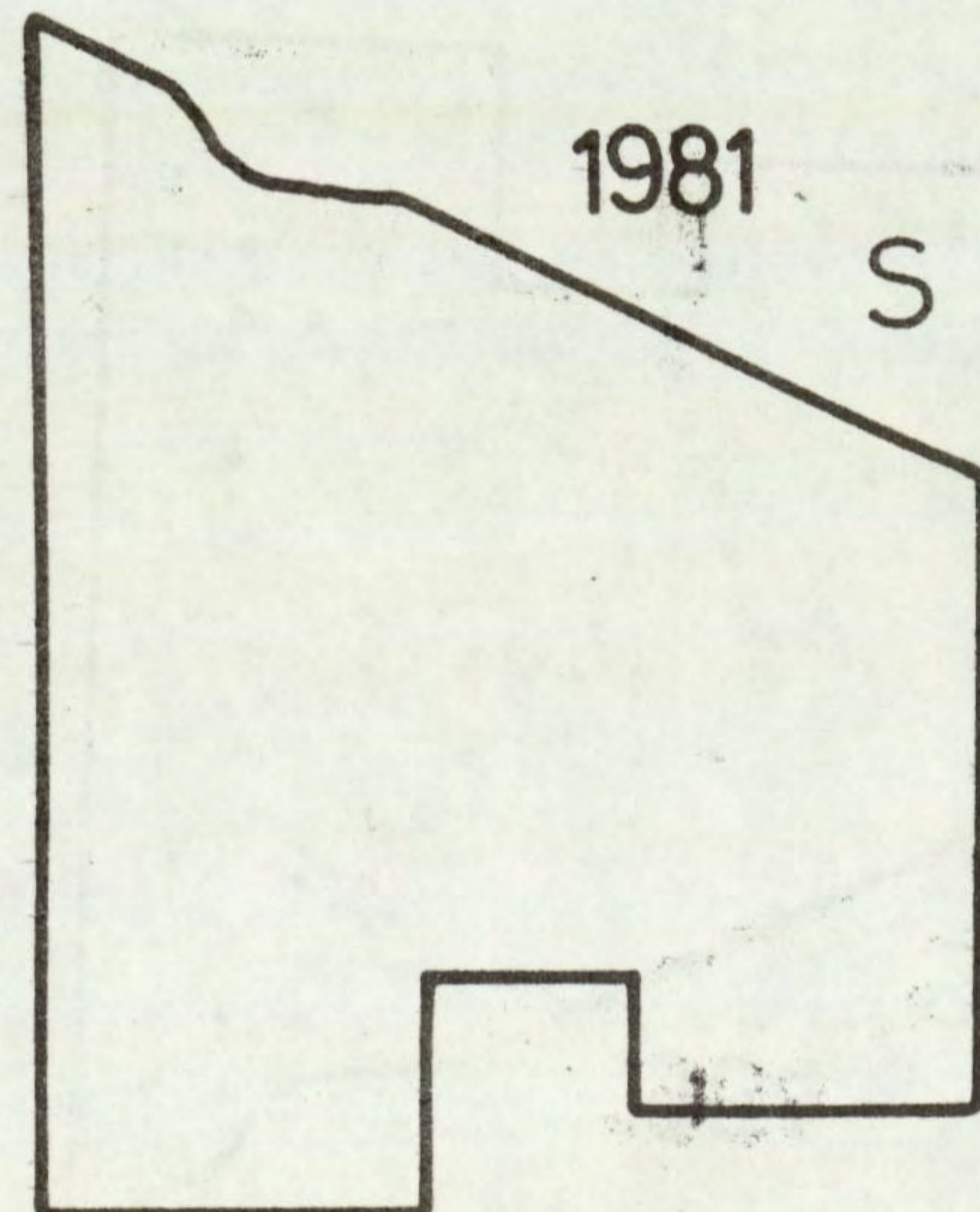
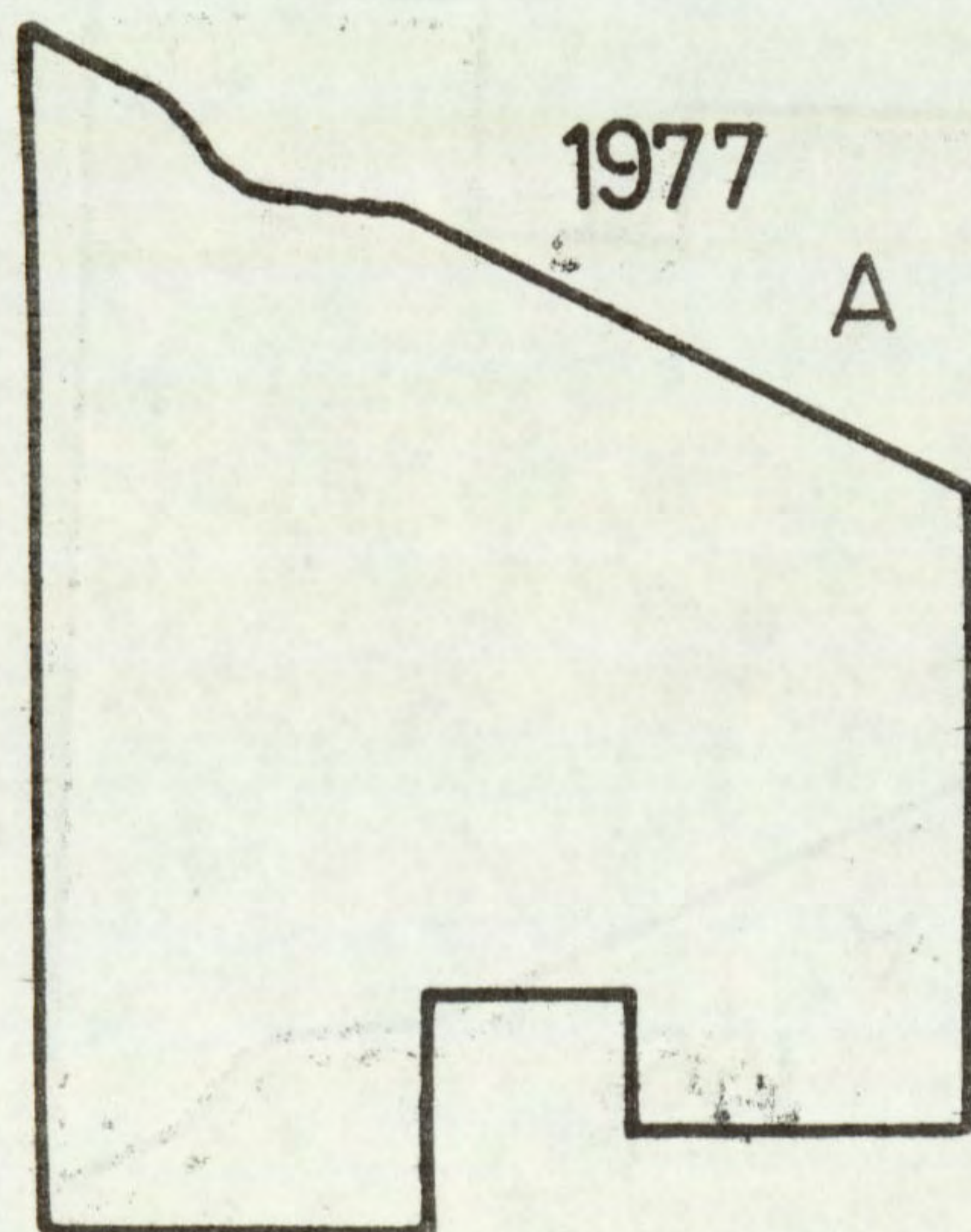
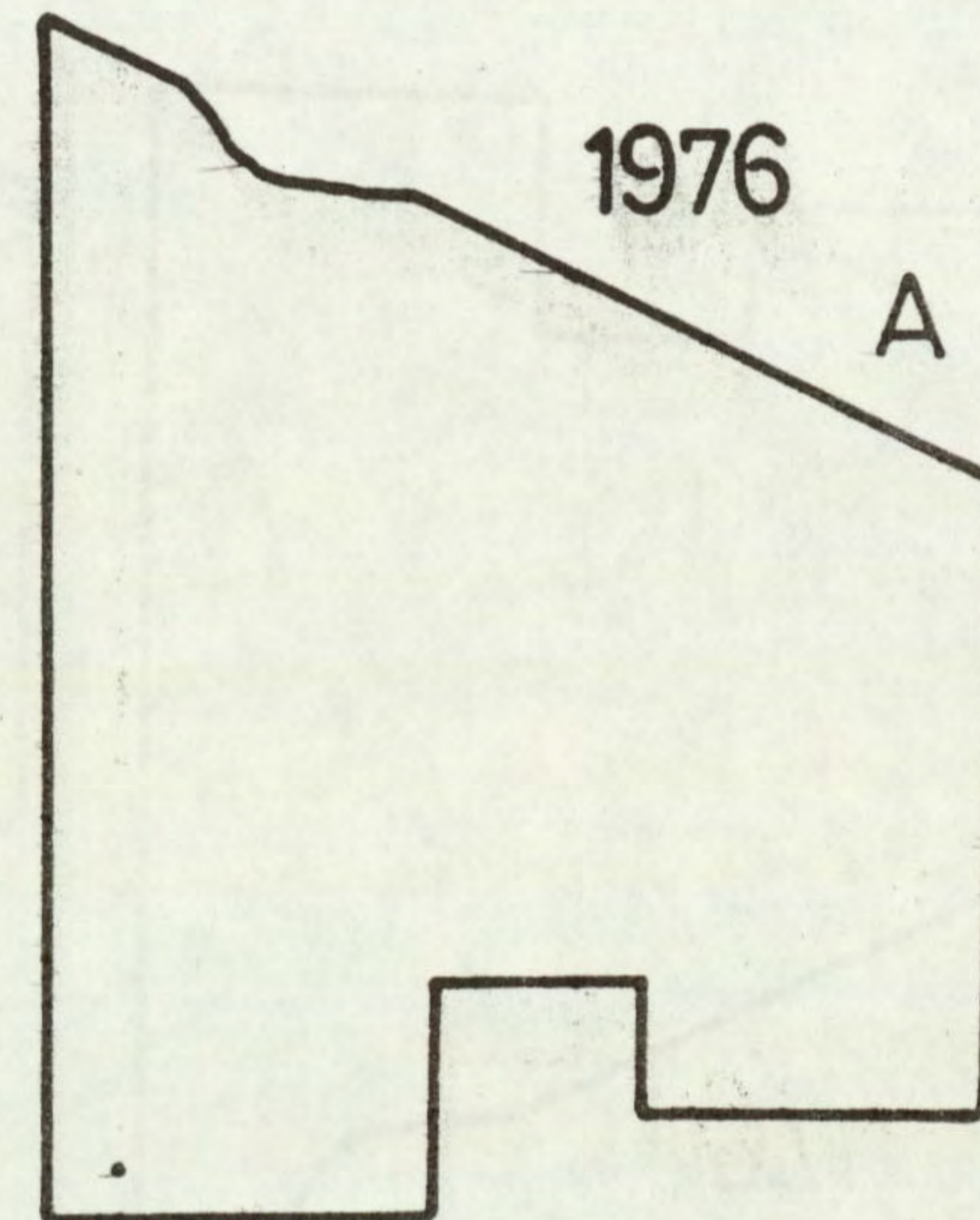
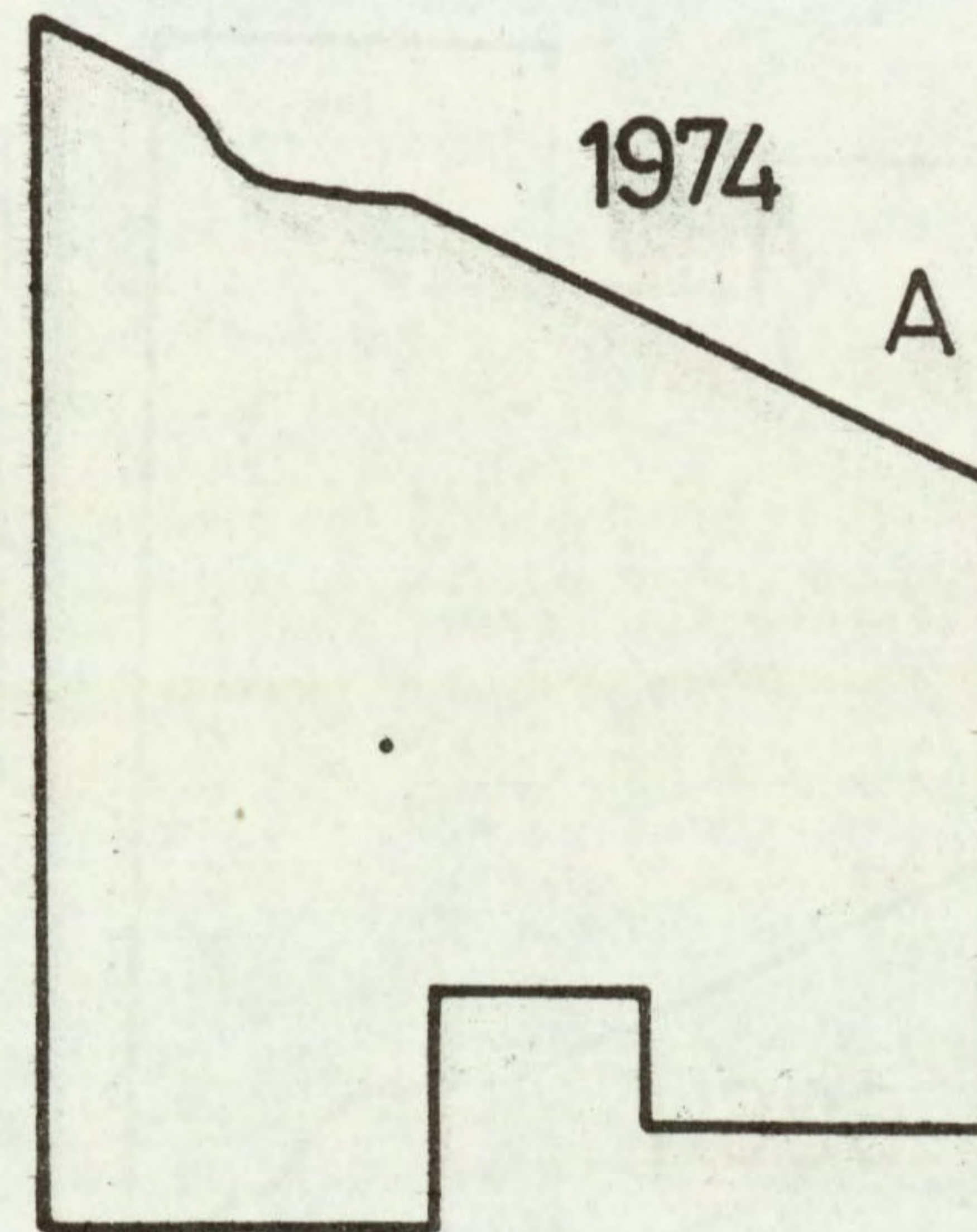
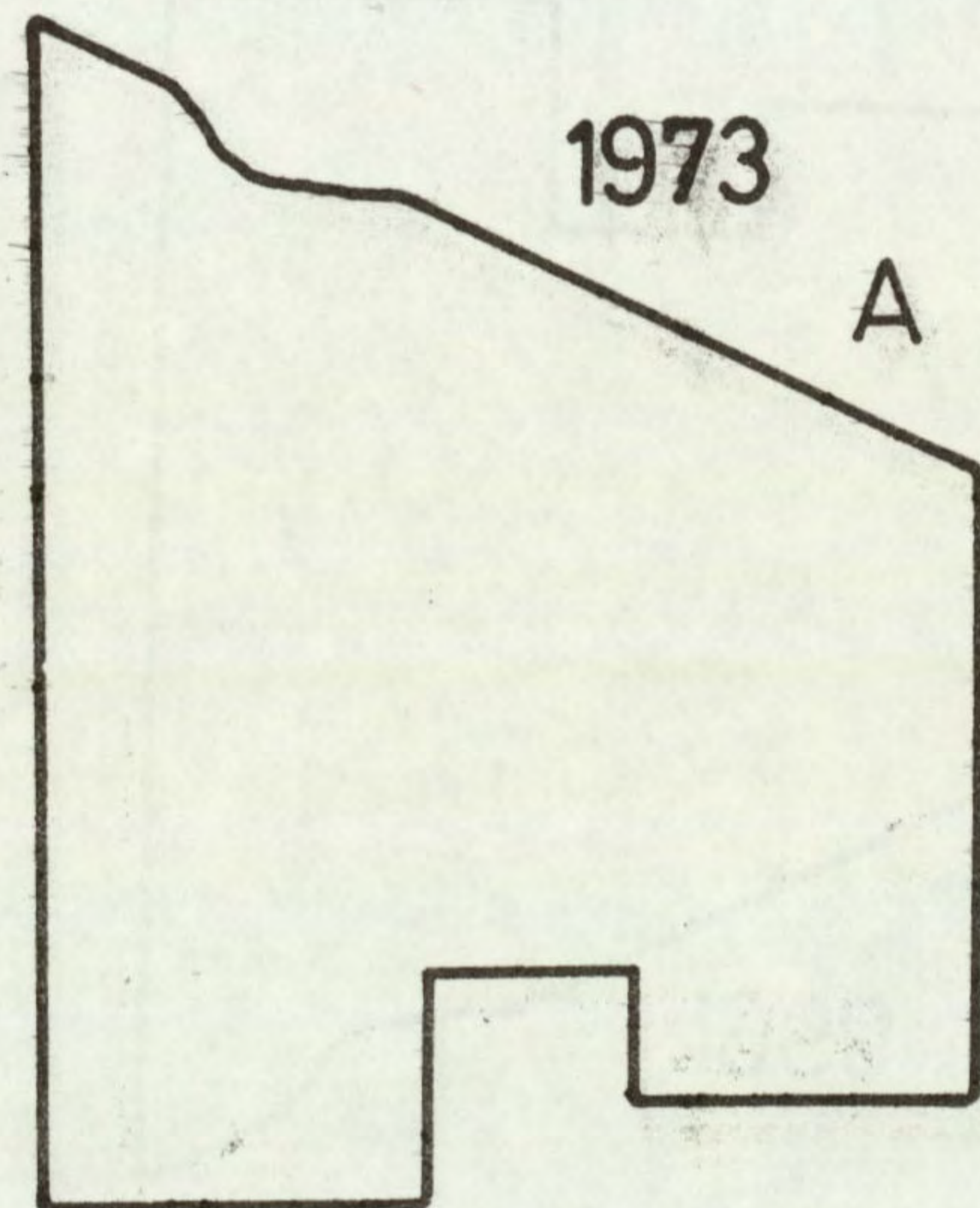
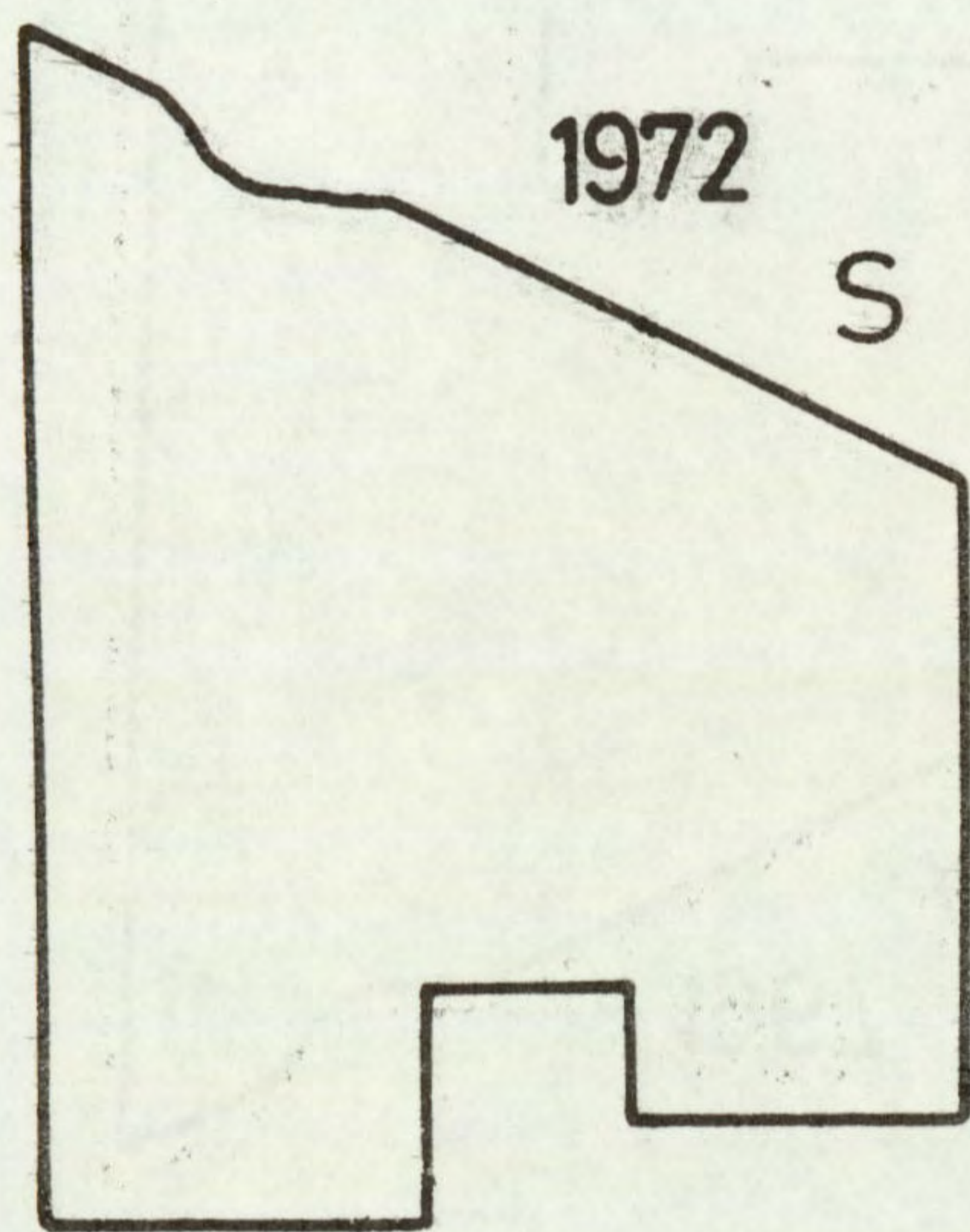




Trifolium repens

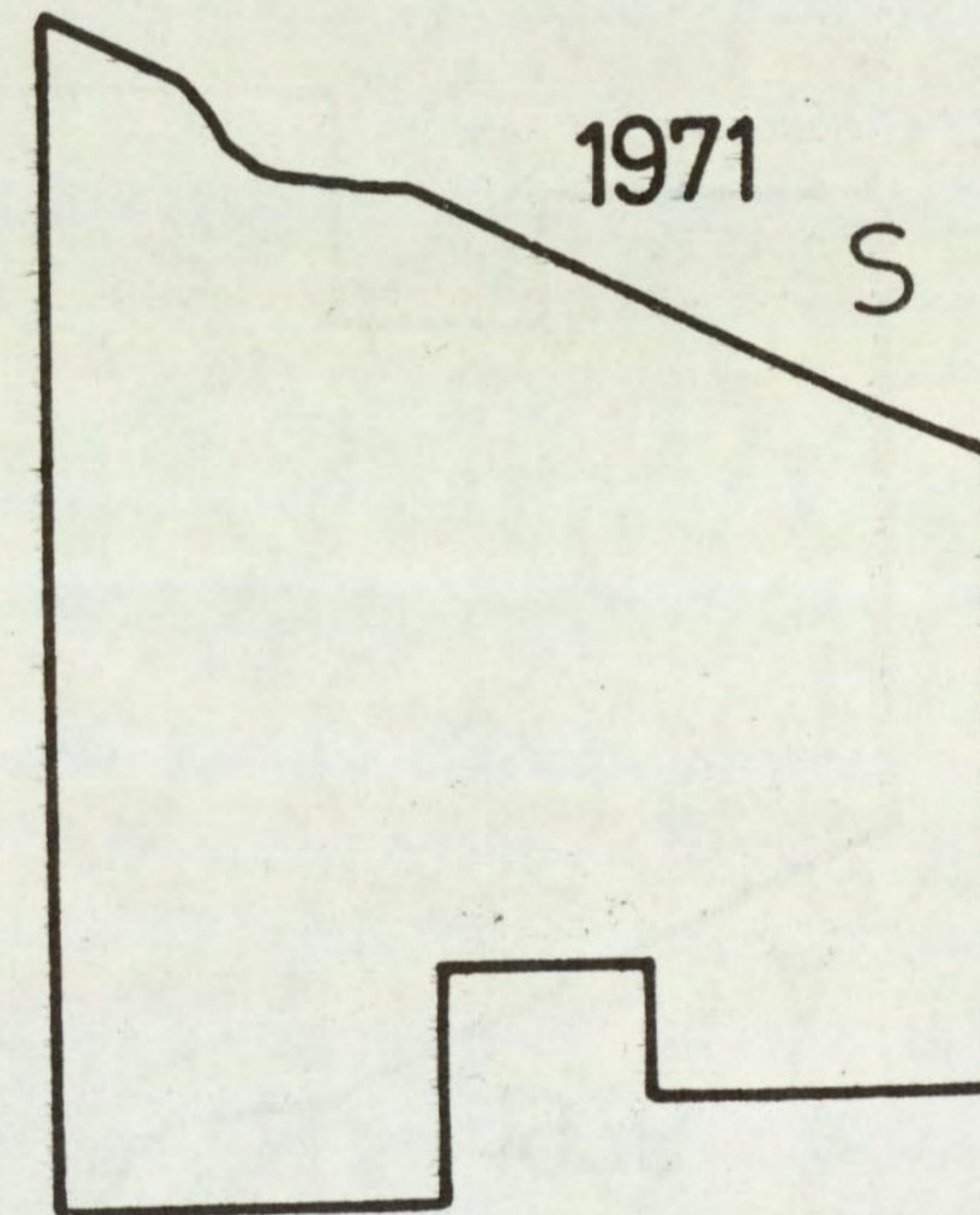
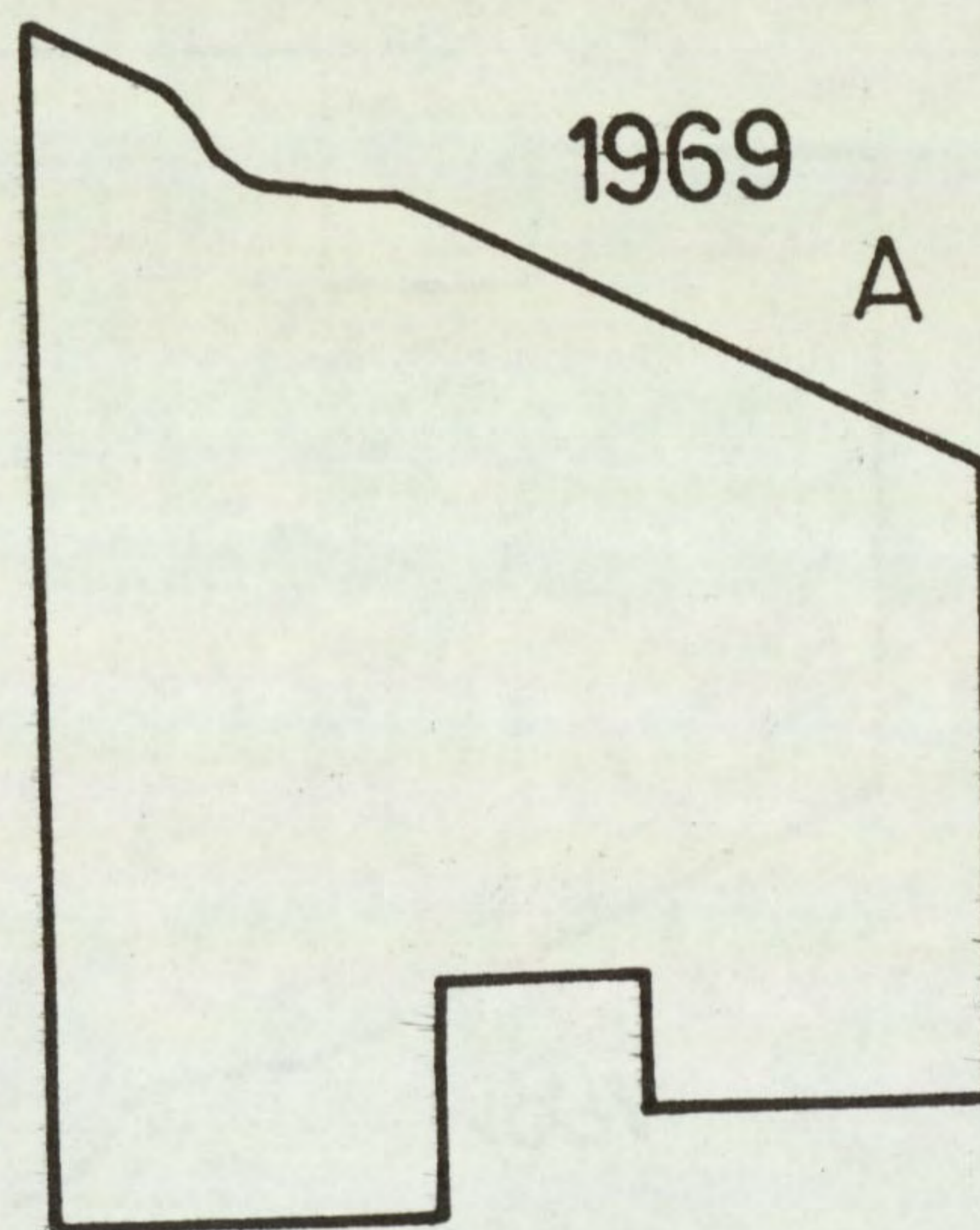
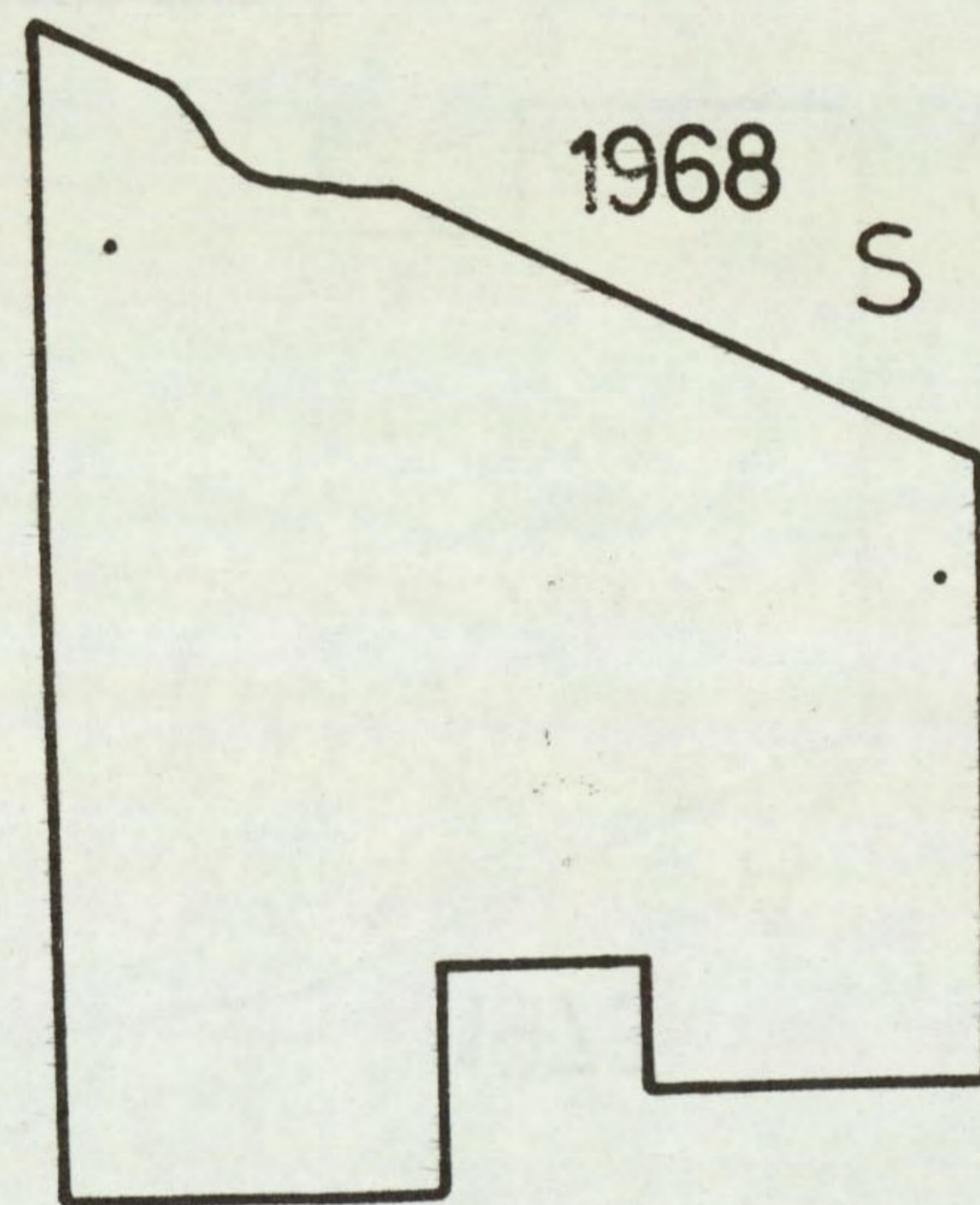
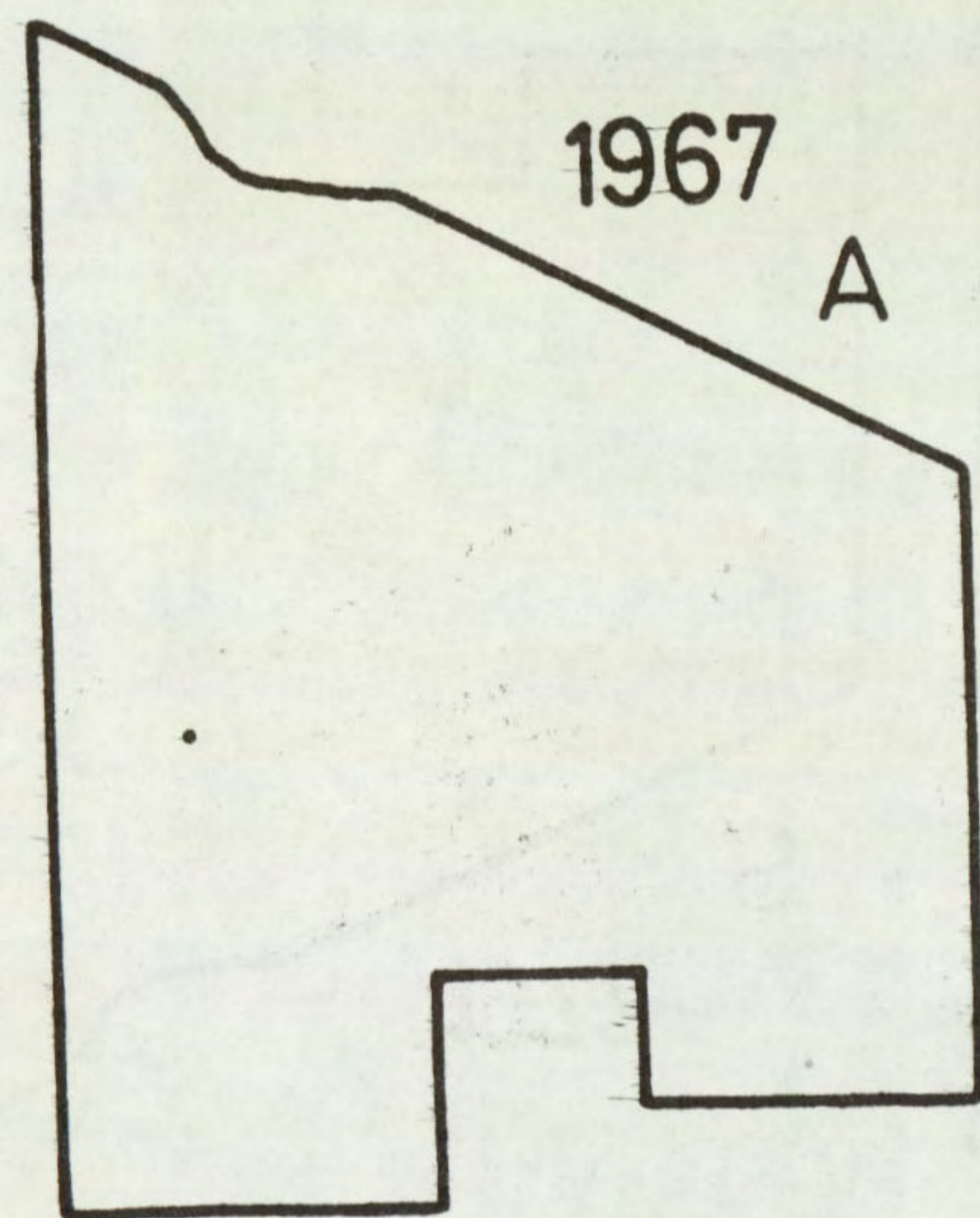
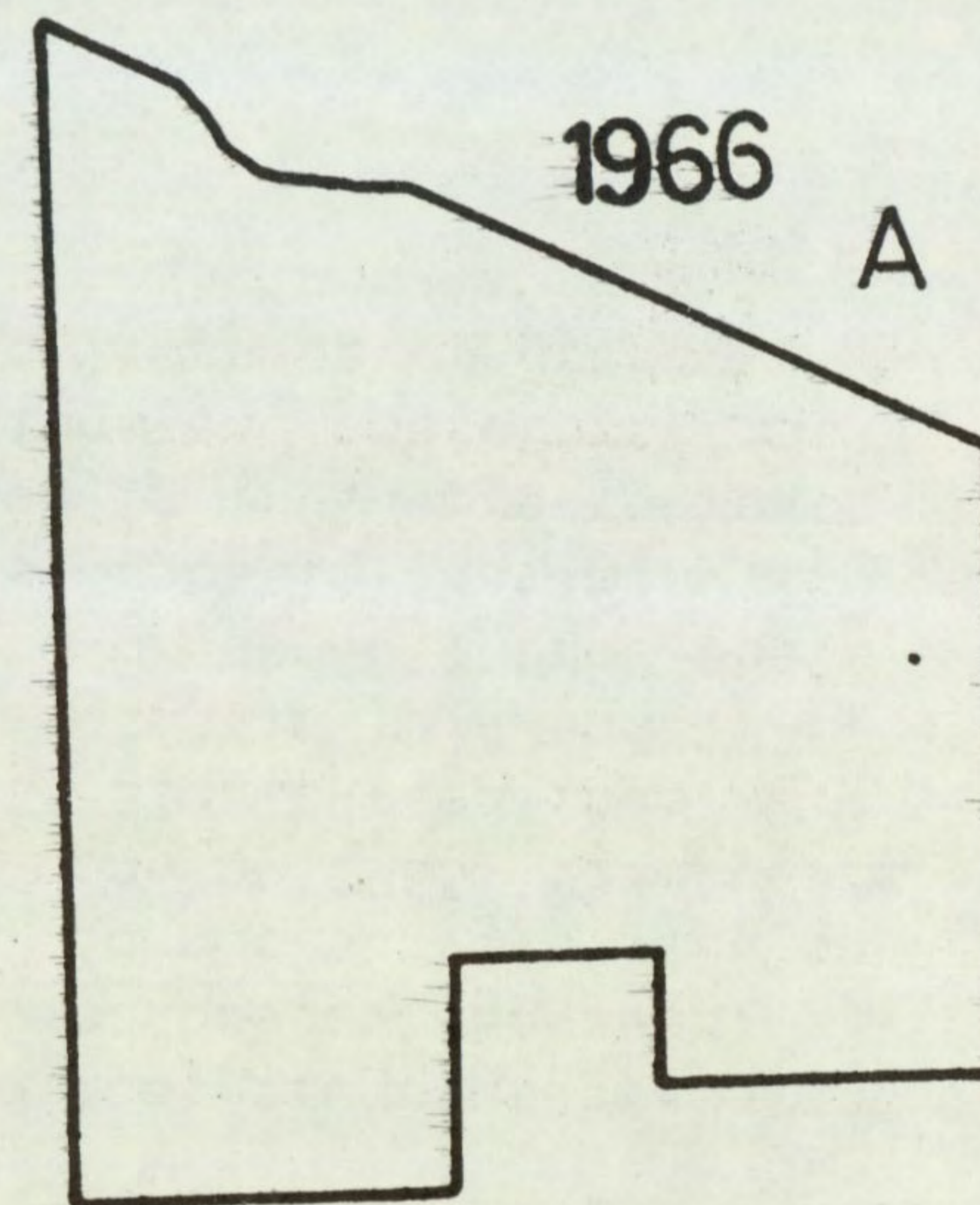
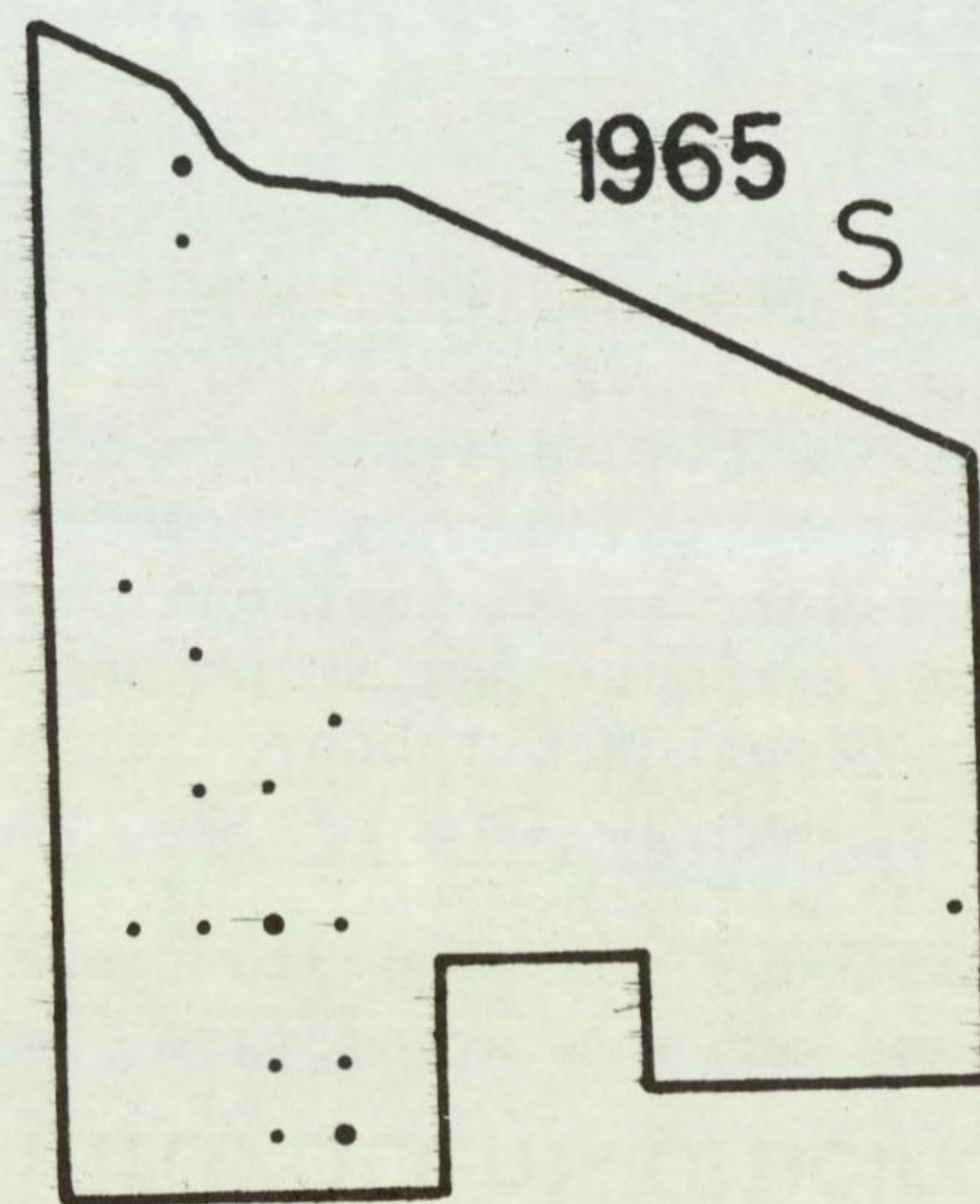
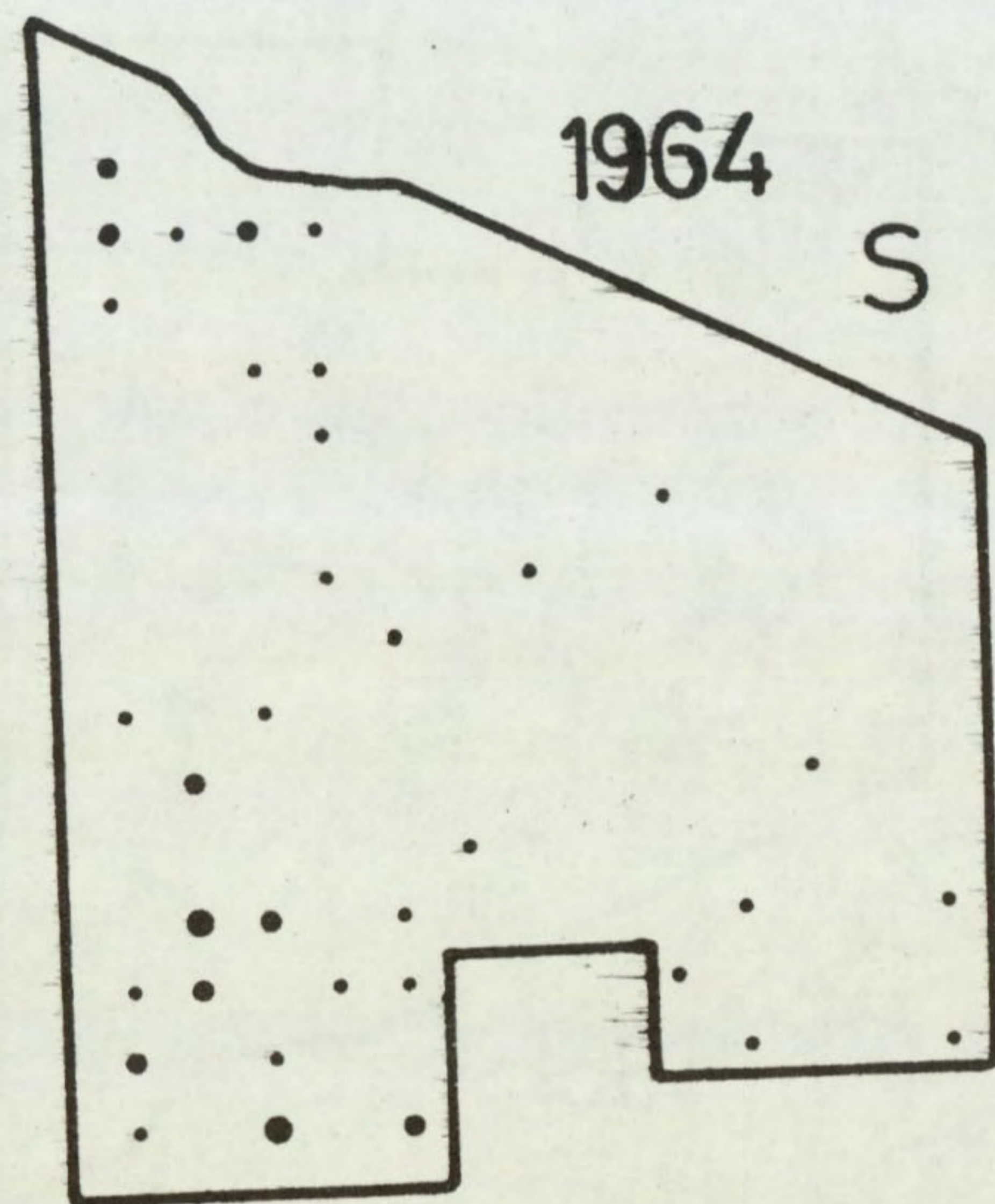
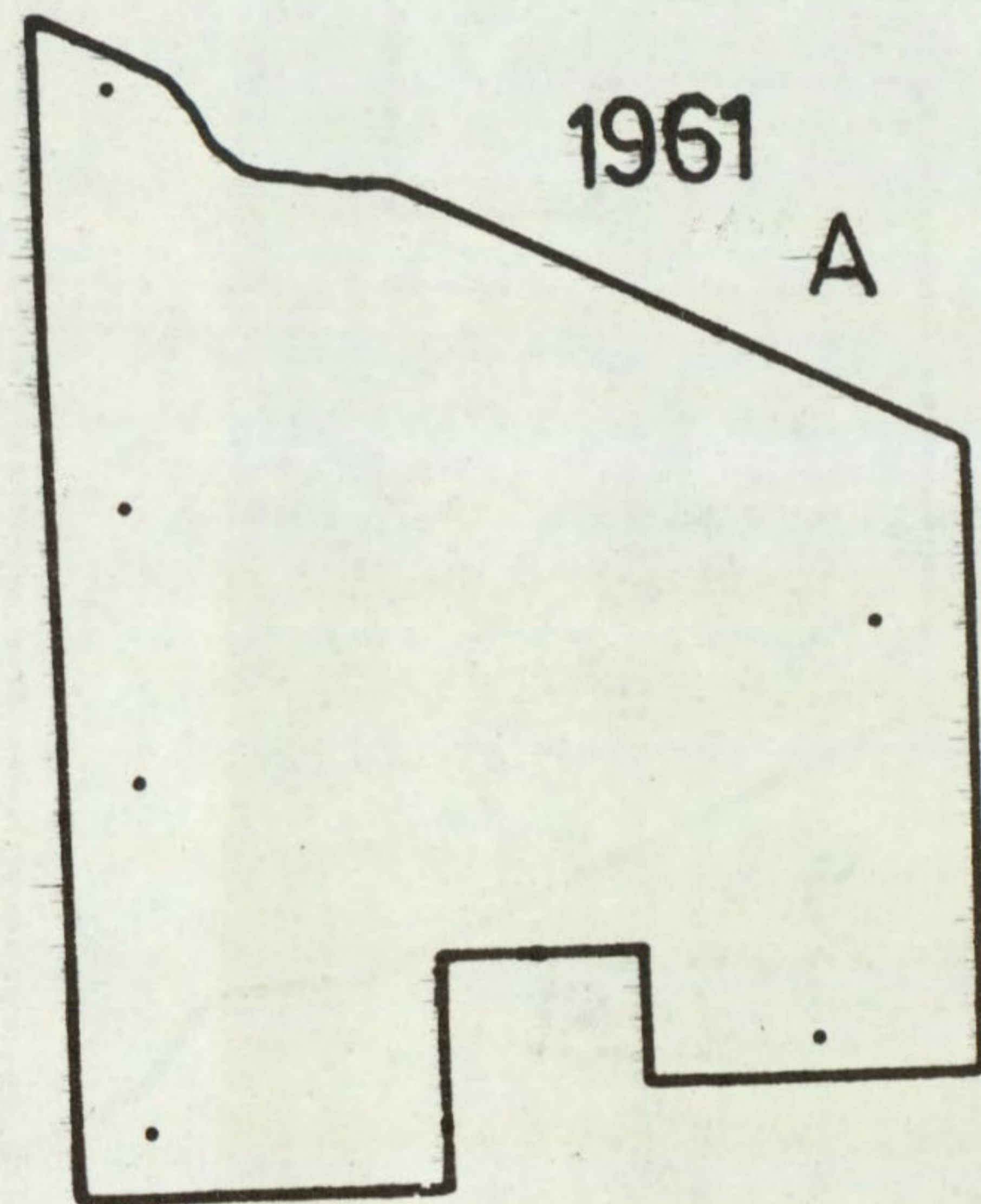
T. repens was the third most frequent grassland weed in 1961, the year after the field was ploughed out of grass. It was the only grassland plant whose seeds survived the full twenty years of cultivation, for several seedlings were recorded in 1981. The long survival of hard seeds of this species is well known. Its seeds germinate mainly in spring and early summer and seedlings were consequently most frequent in the spring crops of 1964 and 1965.

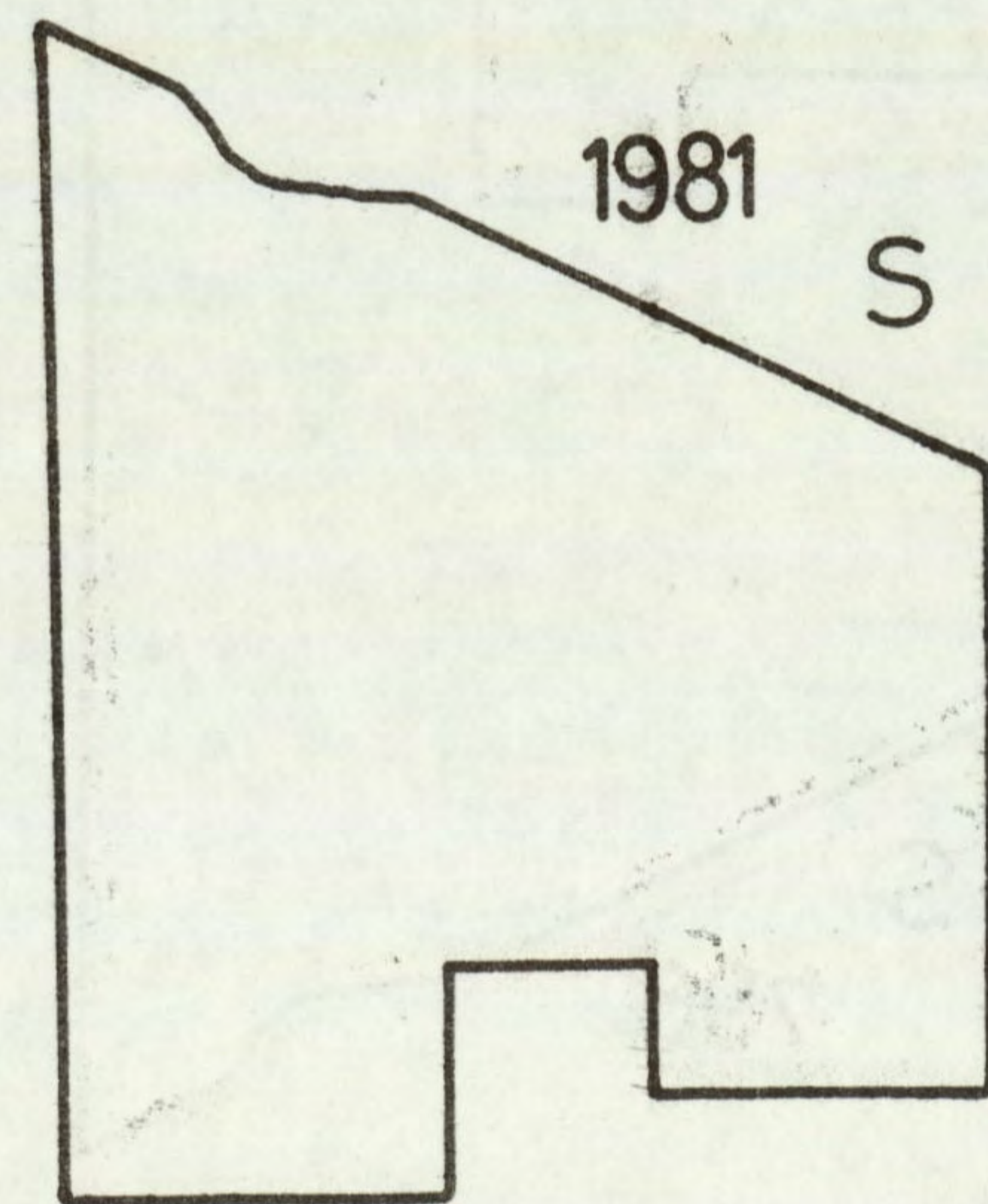
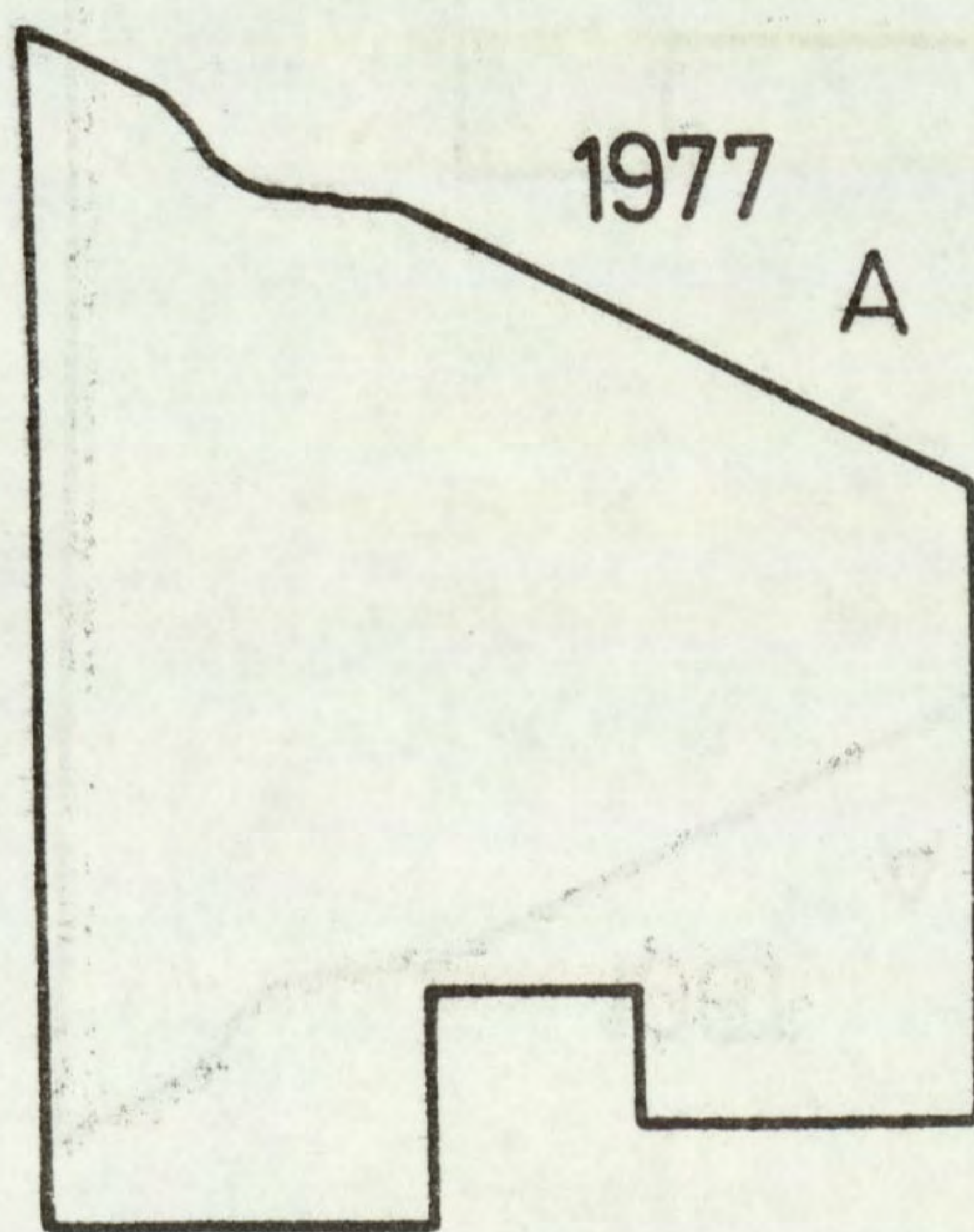
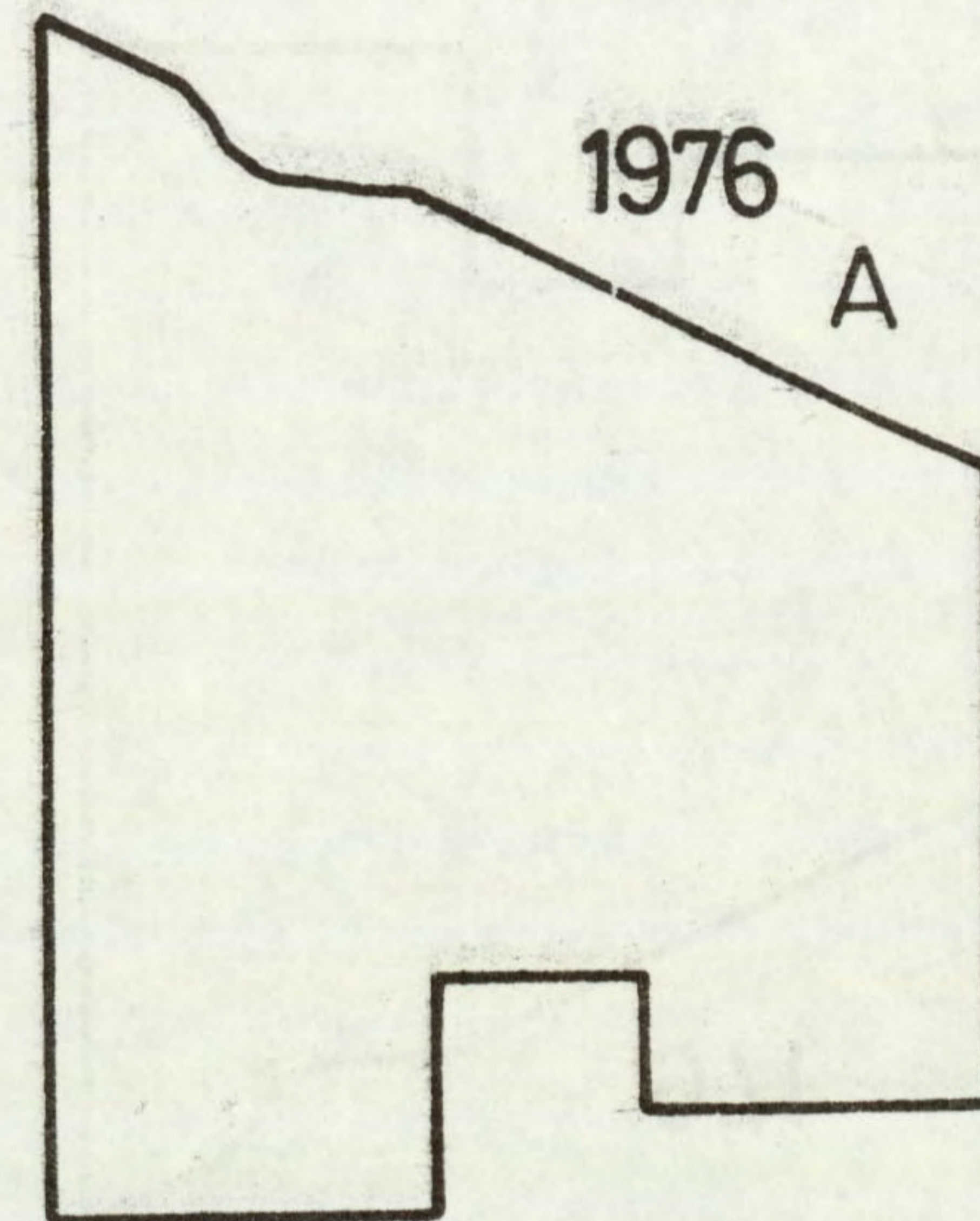
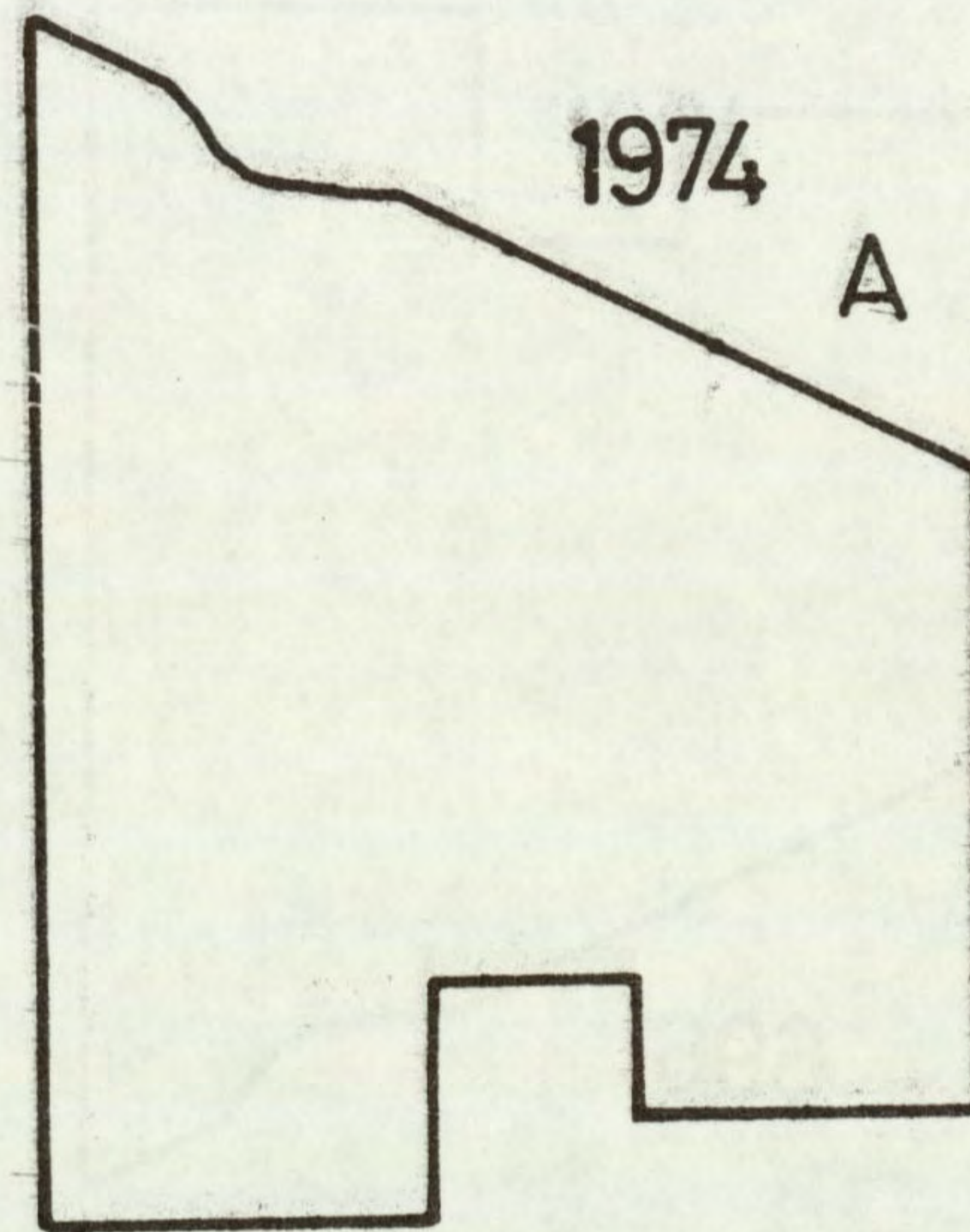
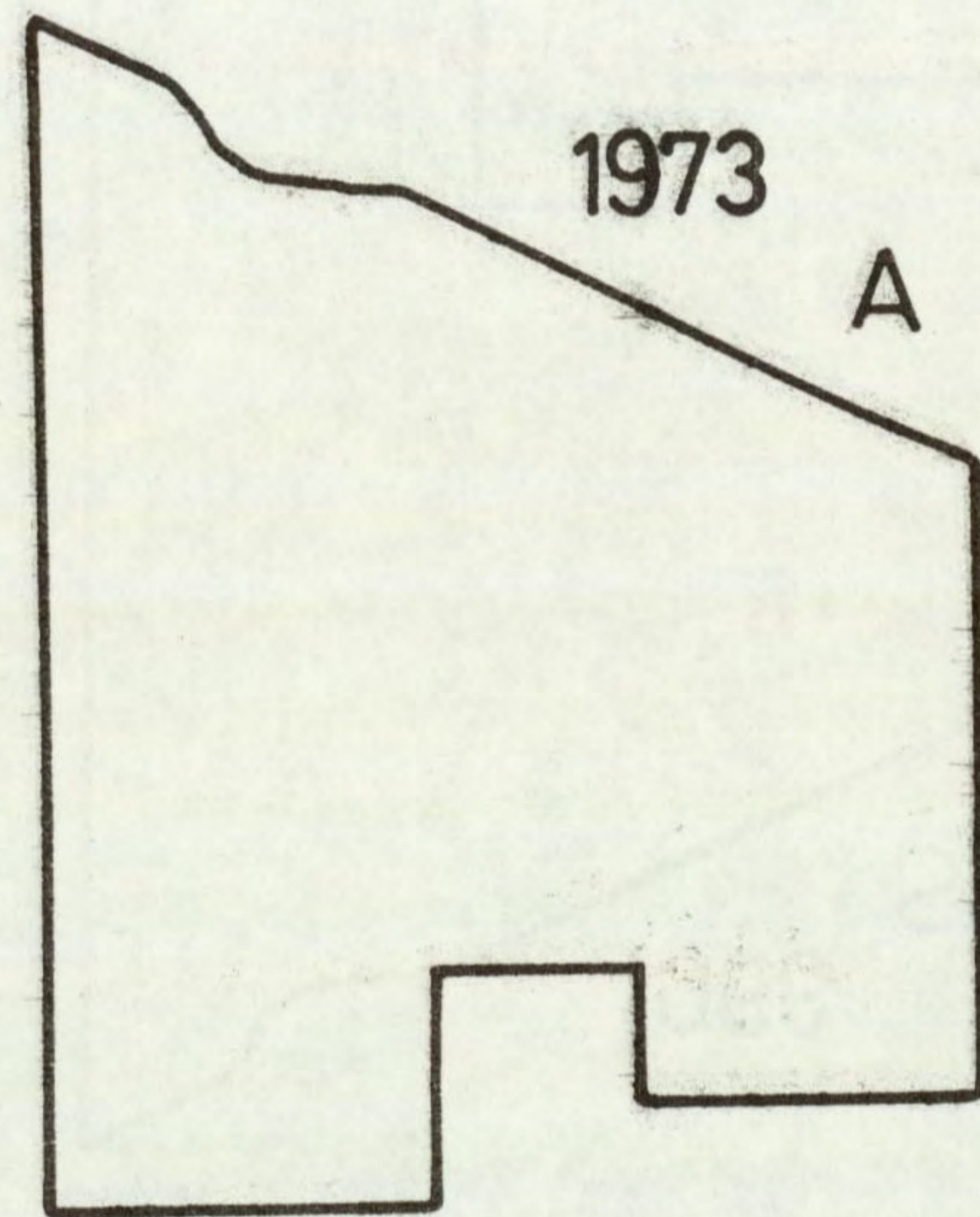
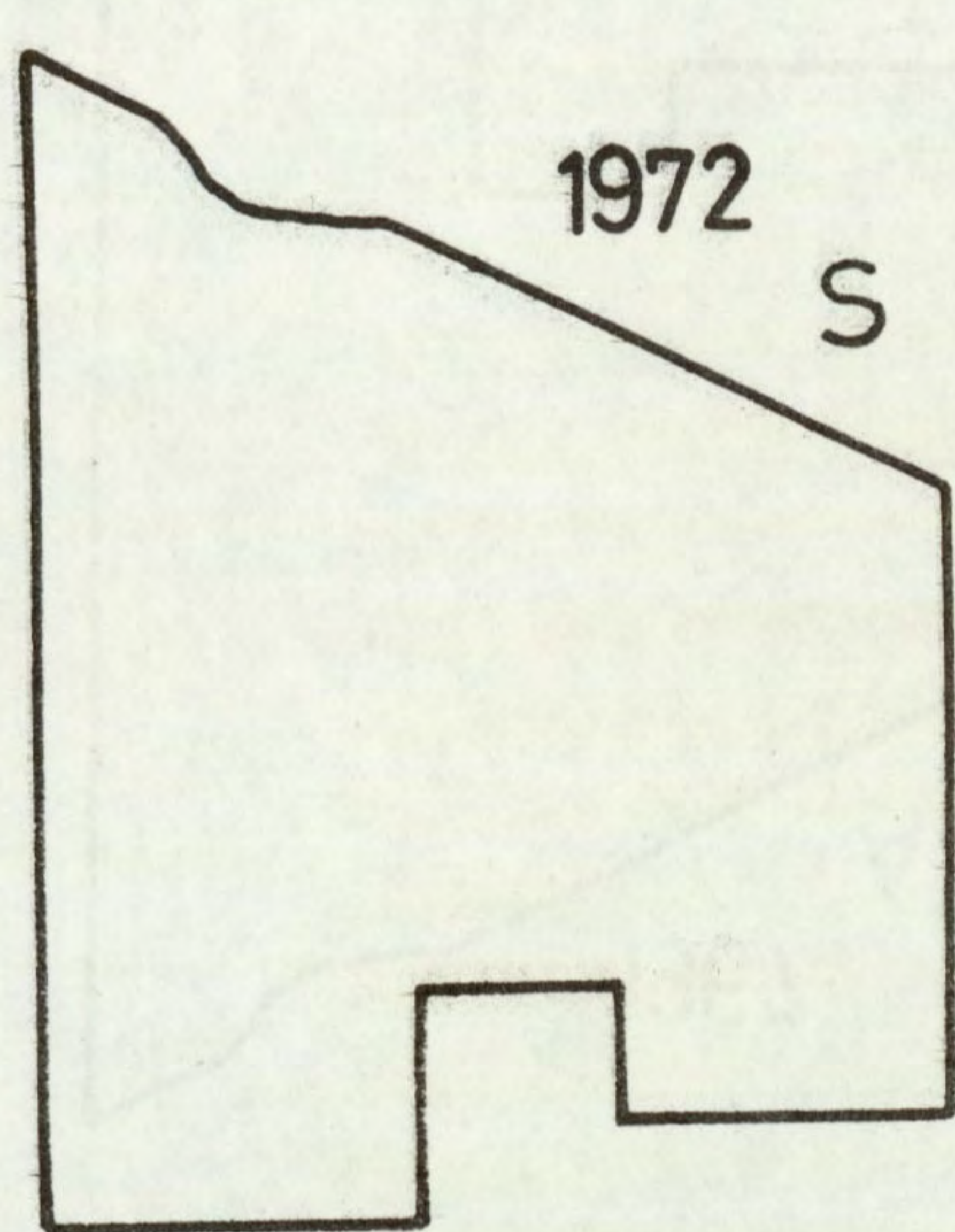




Taraxacum officinale

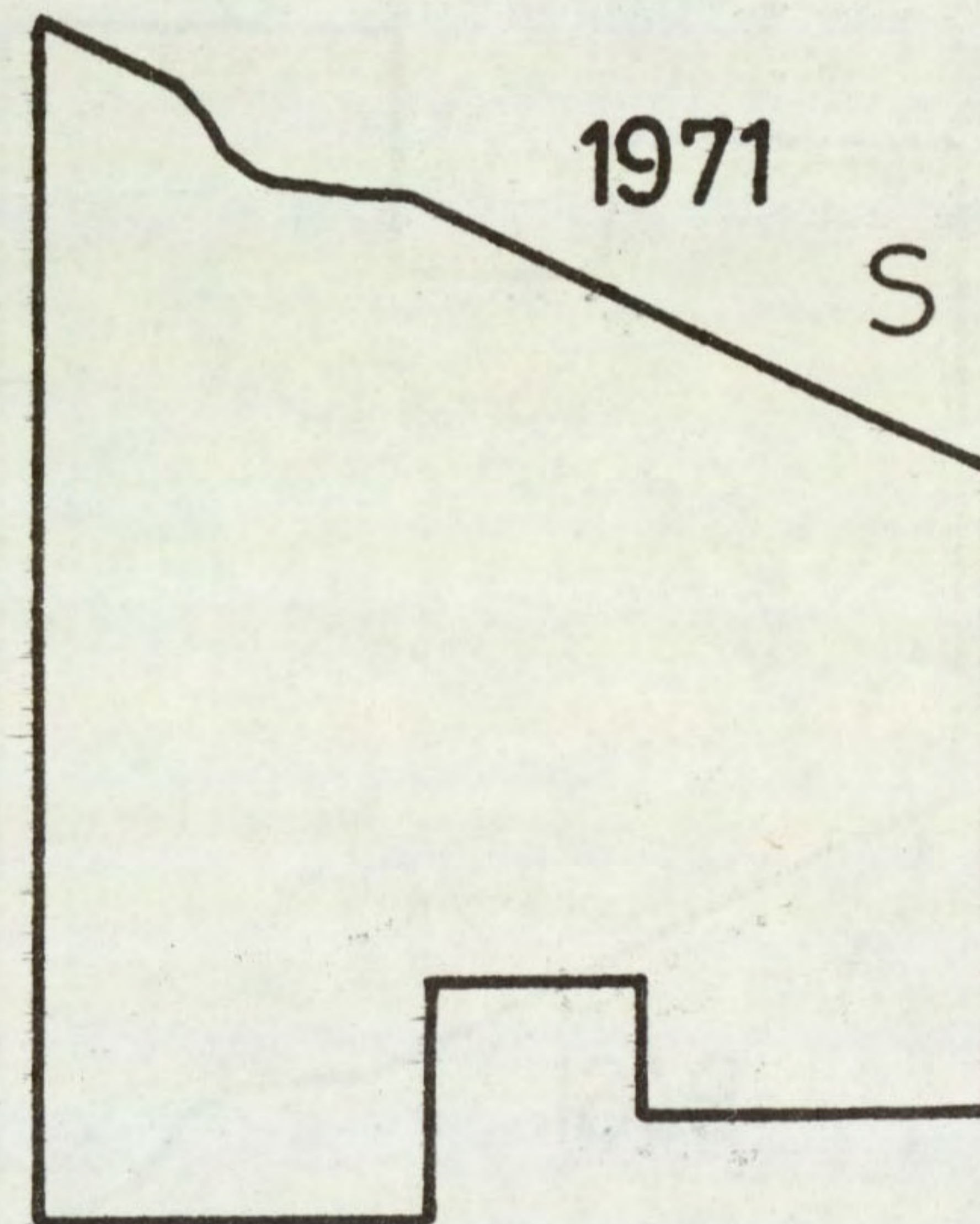
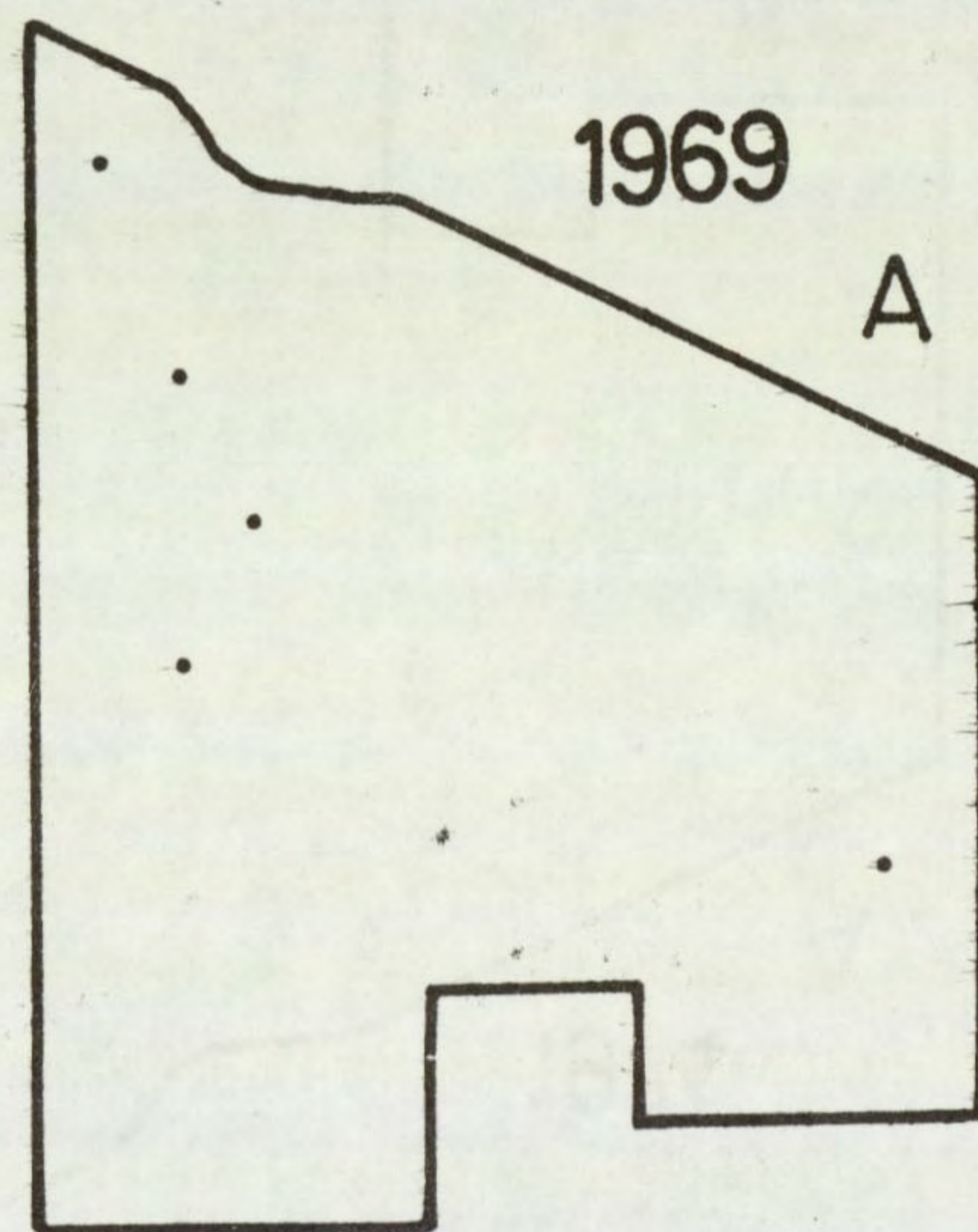
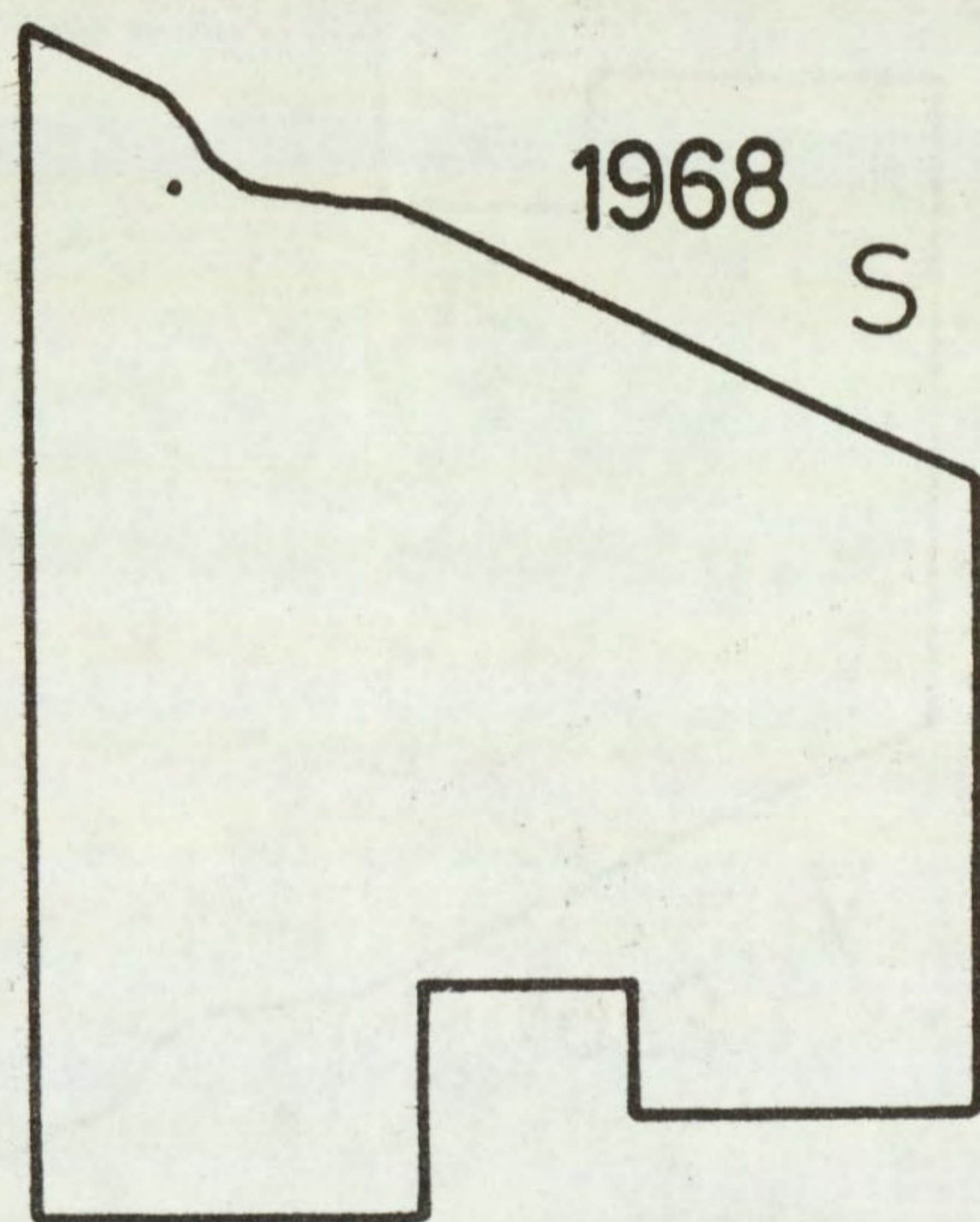
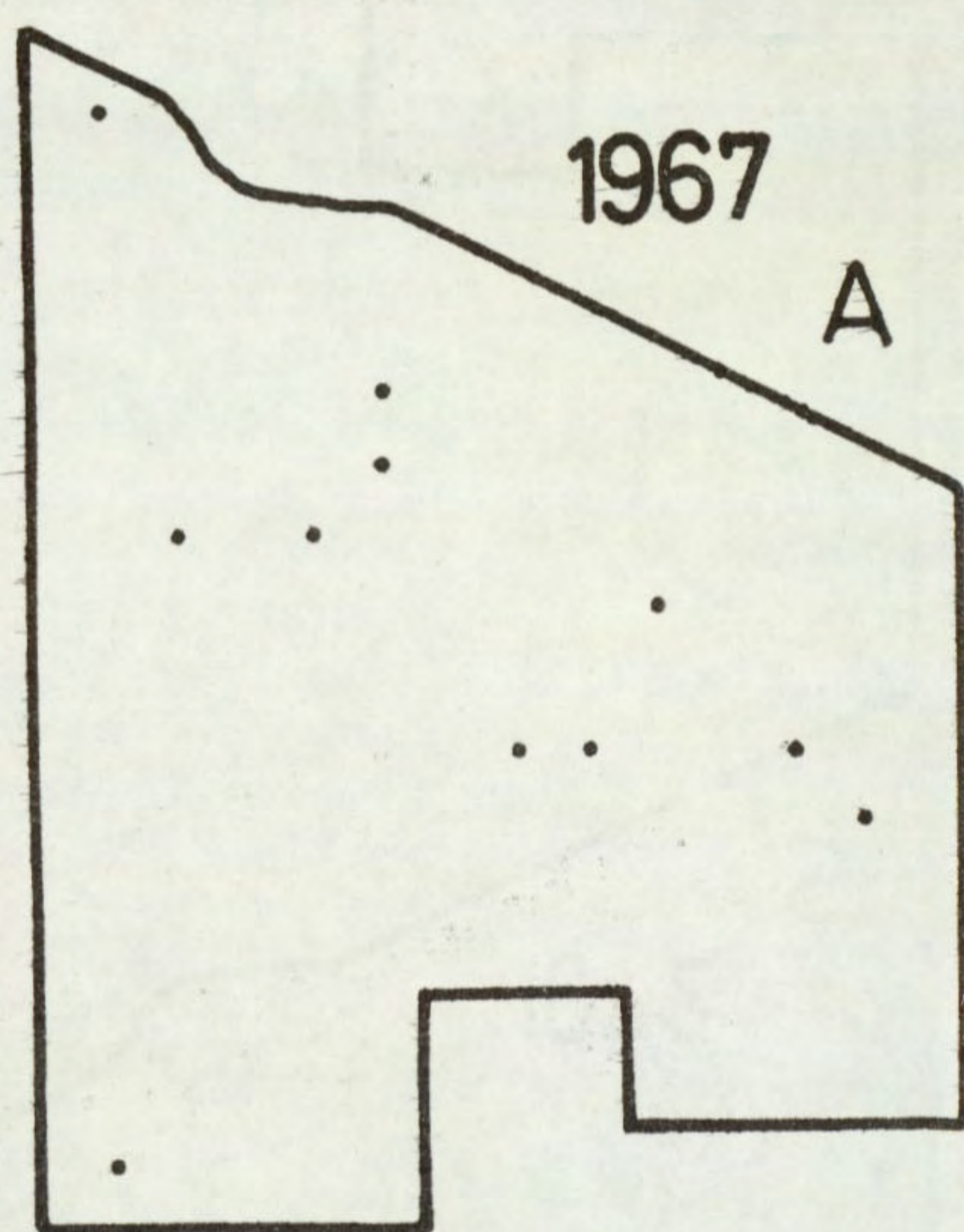
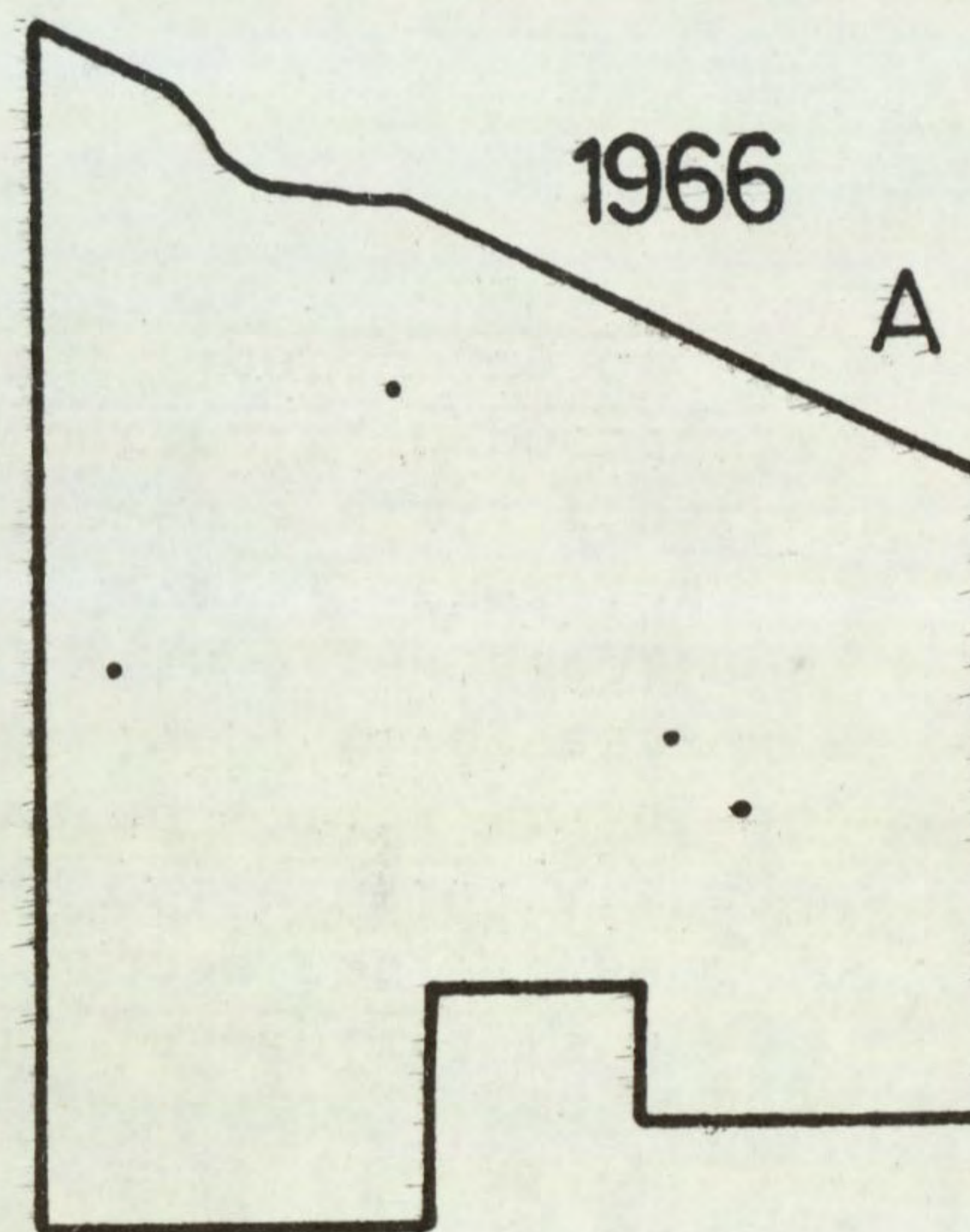
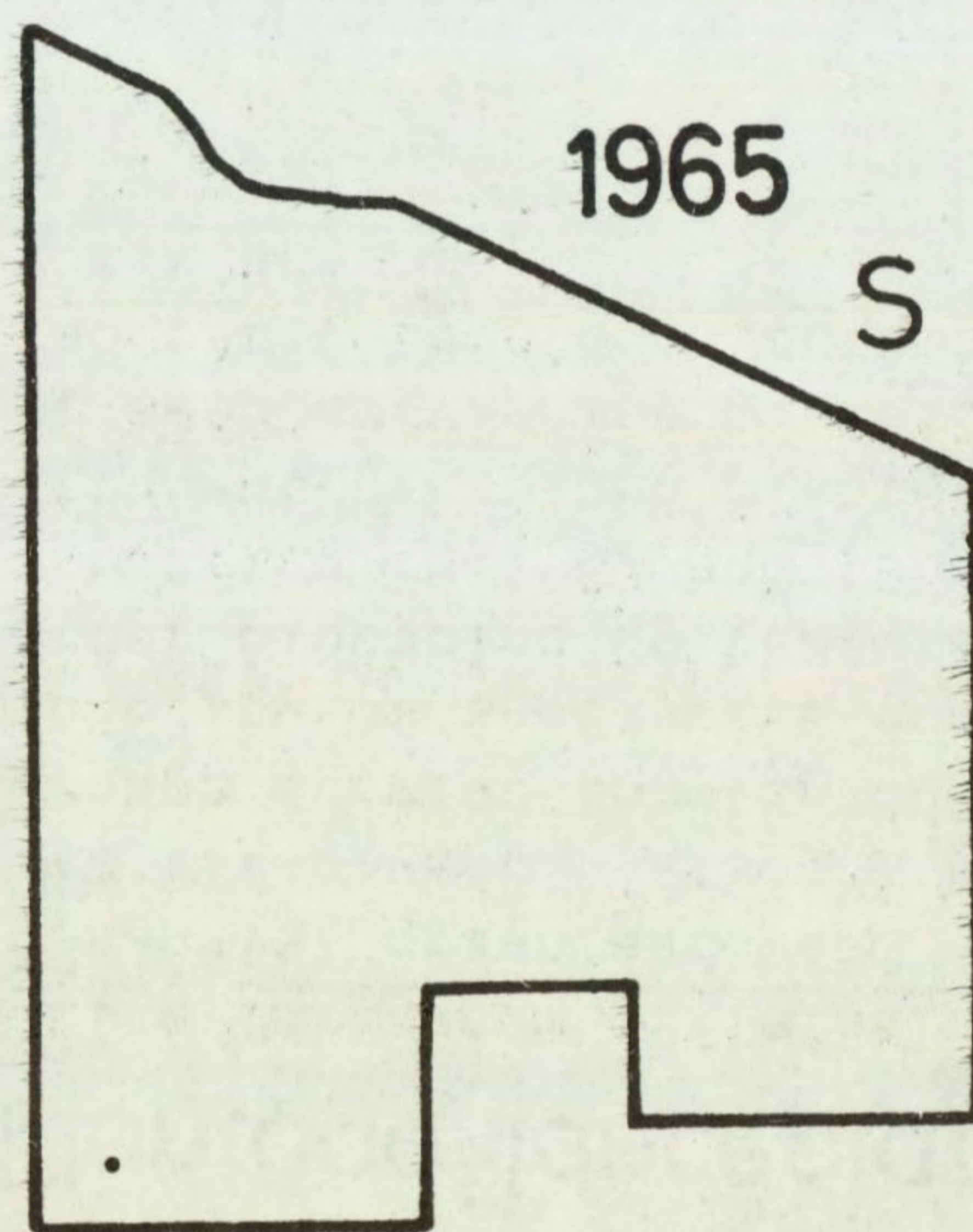
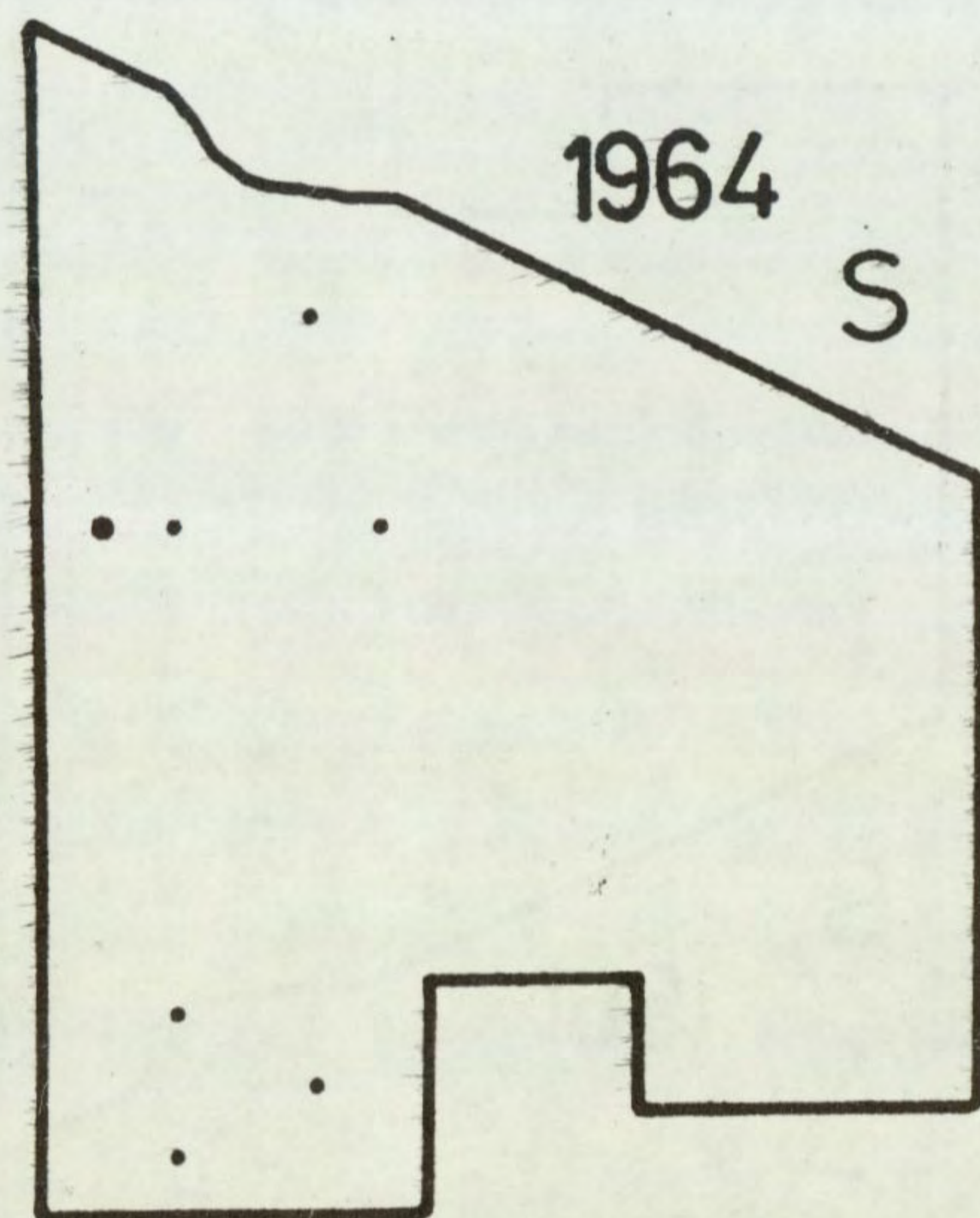
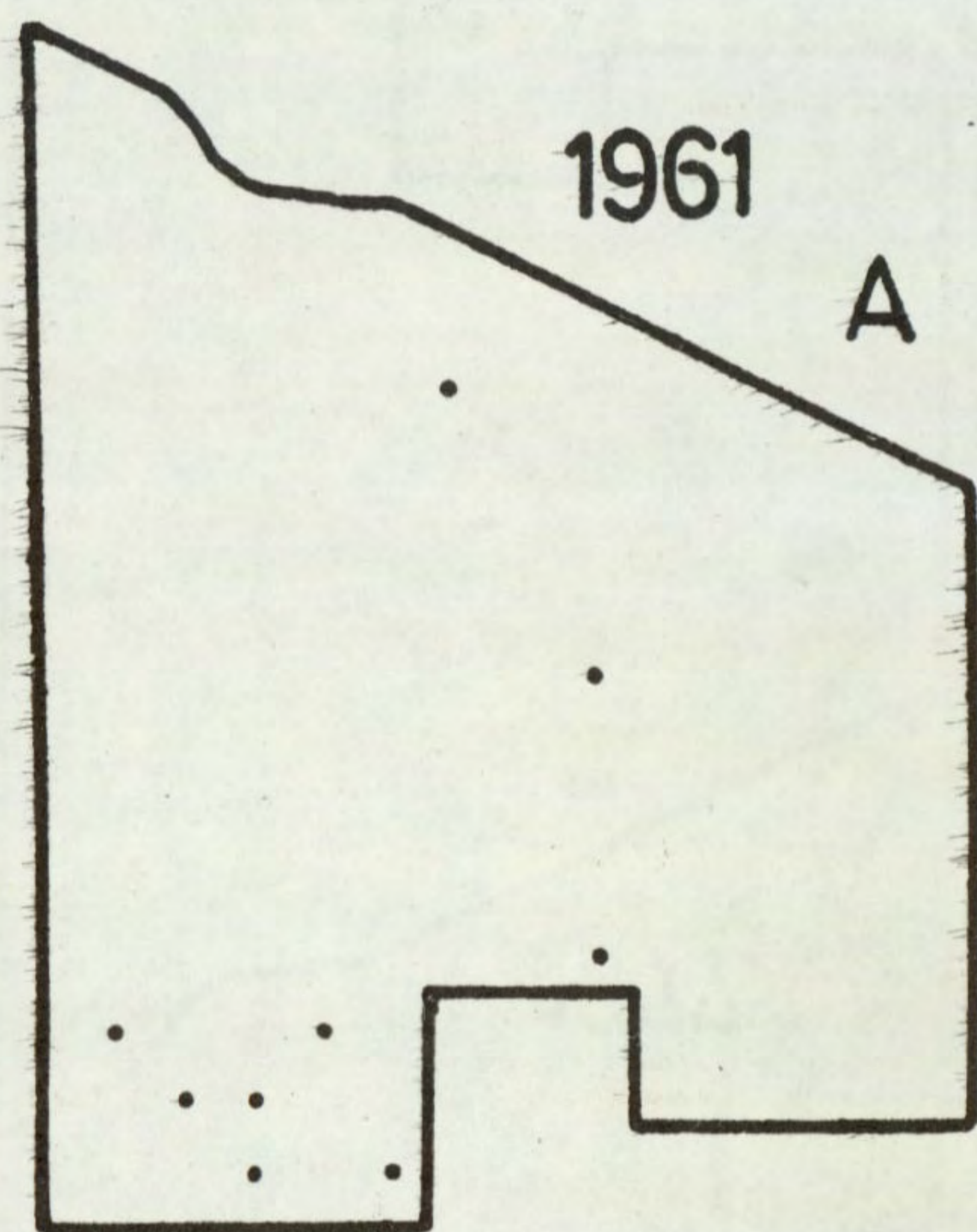
T. officinale was the second most frequent grassland weed in 1961 after Ranunculus bulbosus. However, unlike R. bulbosus its seeds did not survive long in the soil. Most of them were gone by 1965, five years after ploughing up the grass. Single seedlings were counted in 1966 and 1967 and again in 1974 and 1976, but the last two at least were presumably from seeds blown in from outside. It is probable that many if not most of the plants counted in 1961 were regrowth from tap roots and not seedlings and therefore that the number of seeds in the soil was never great.

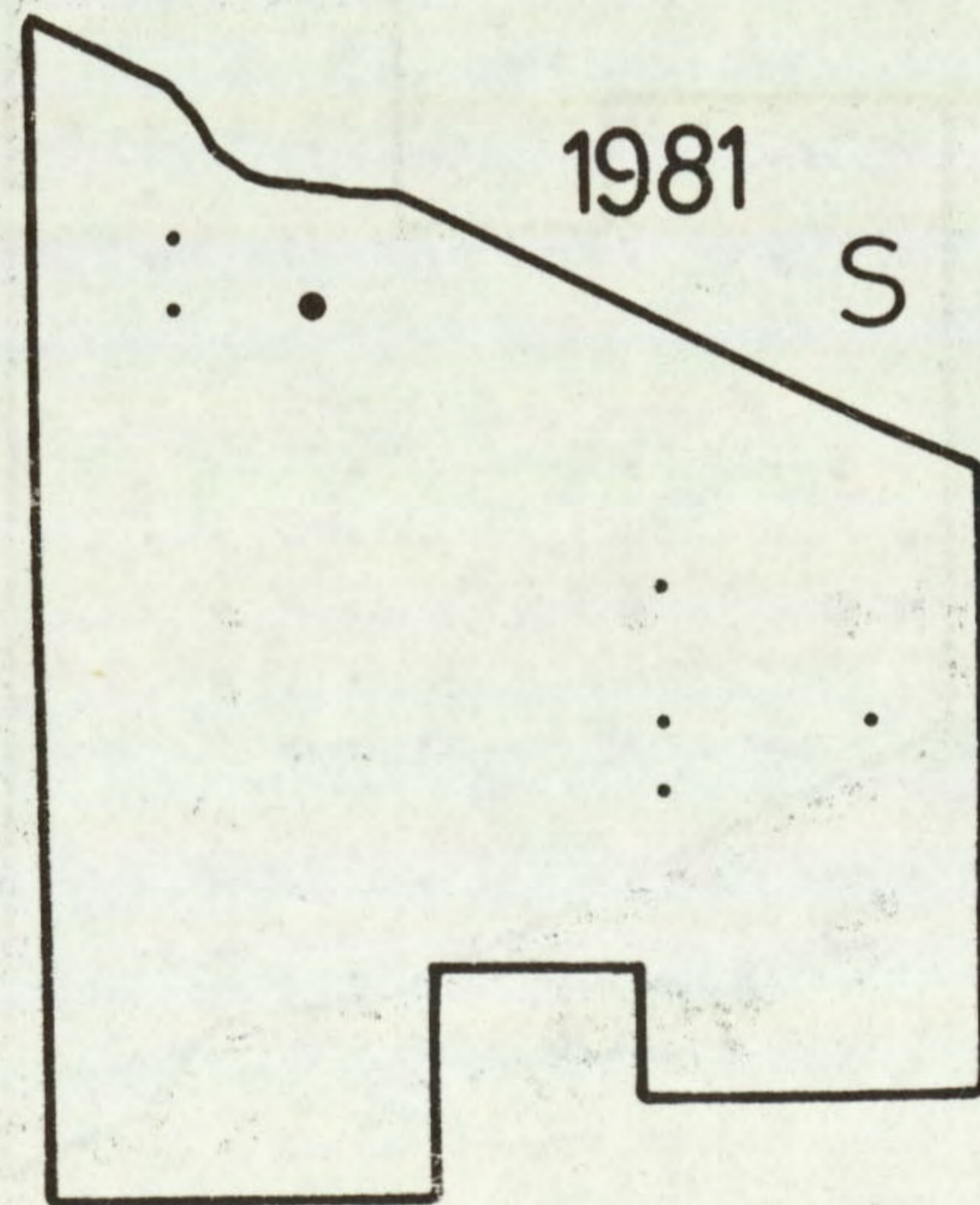
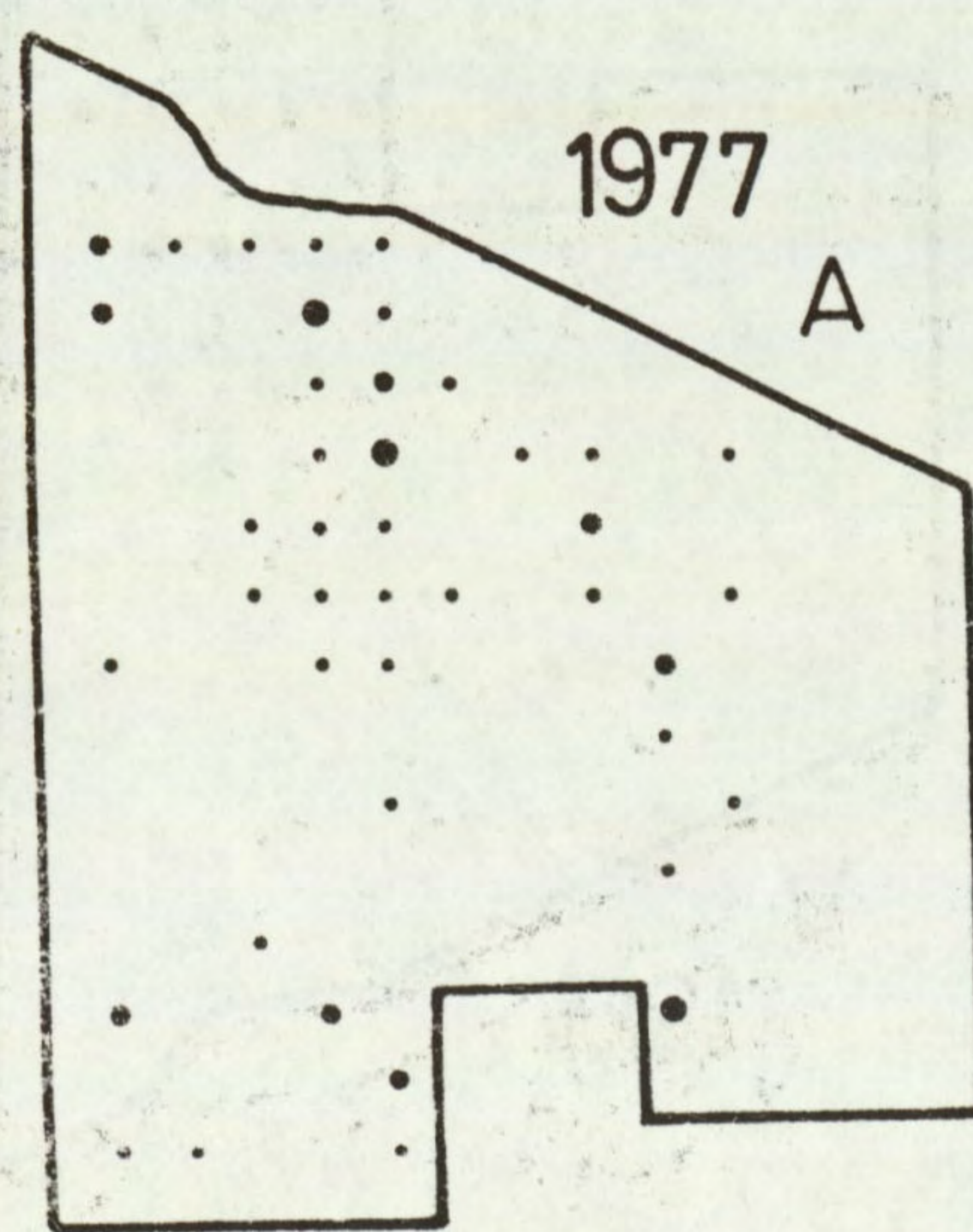
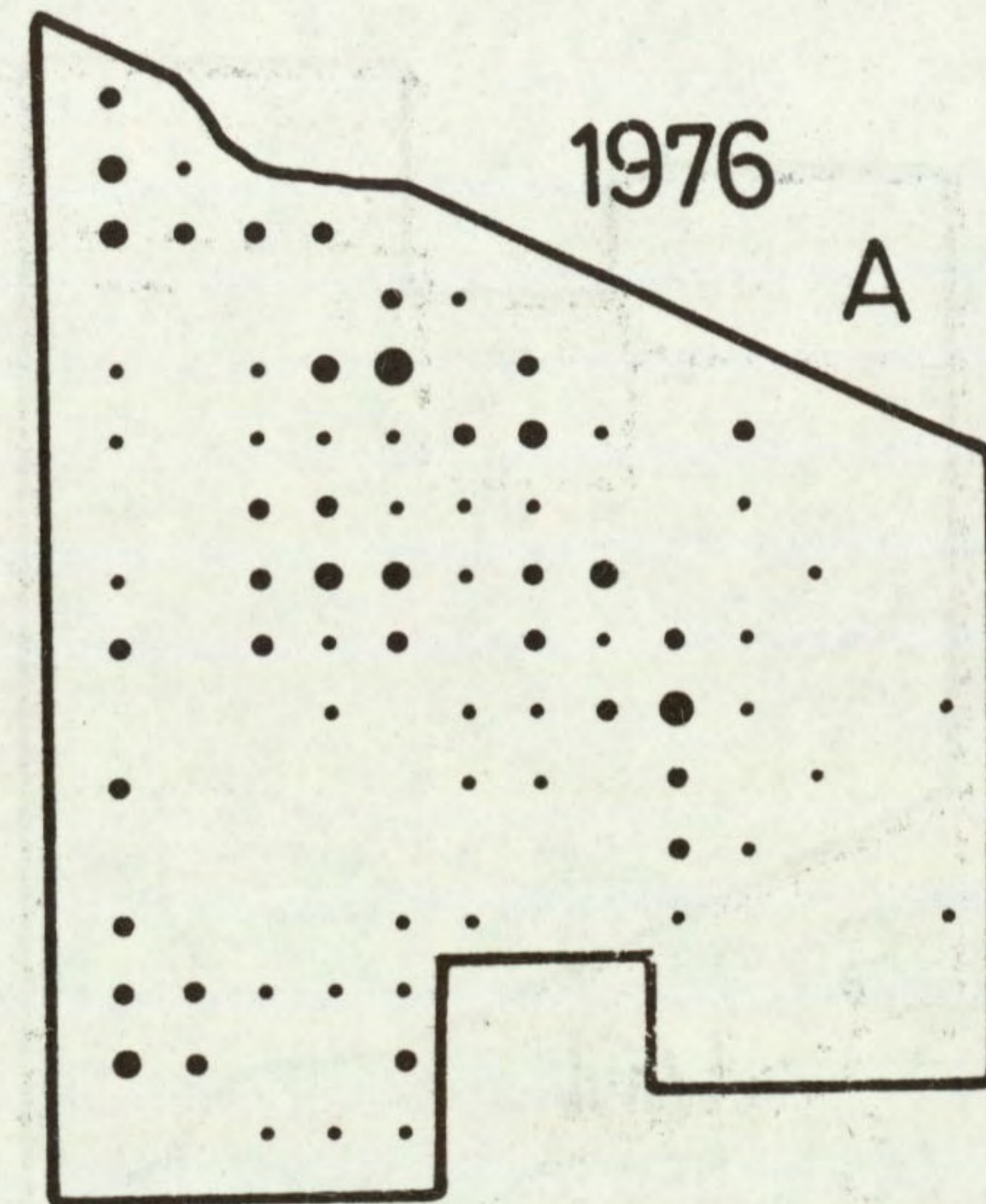
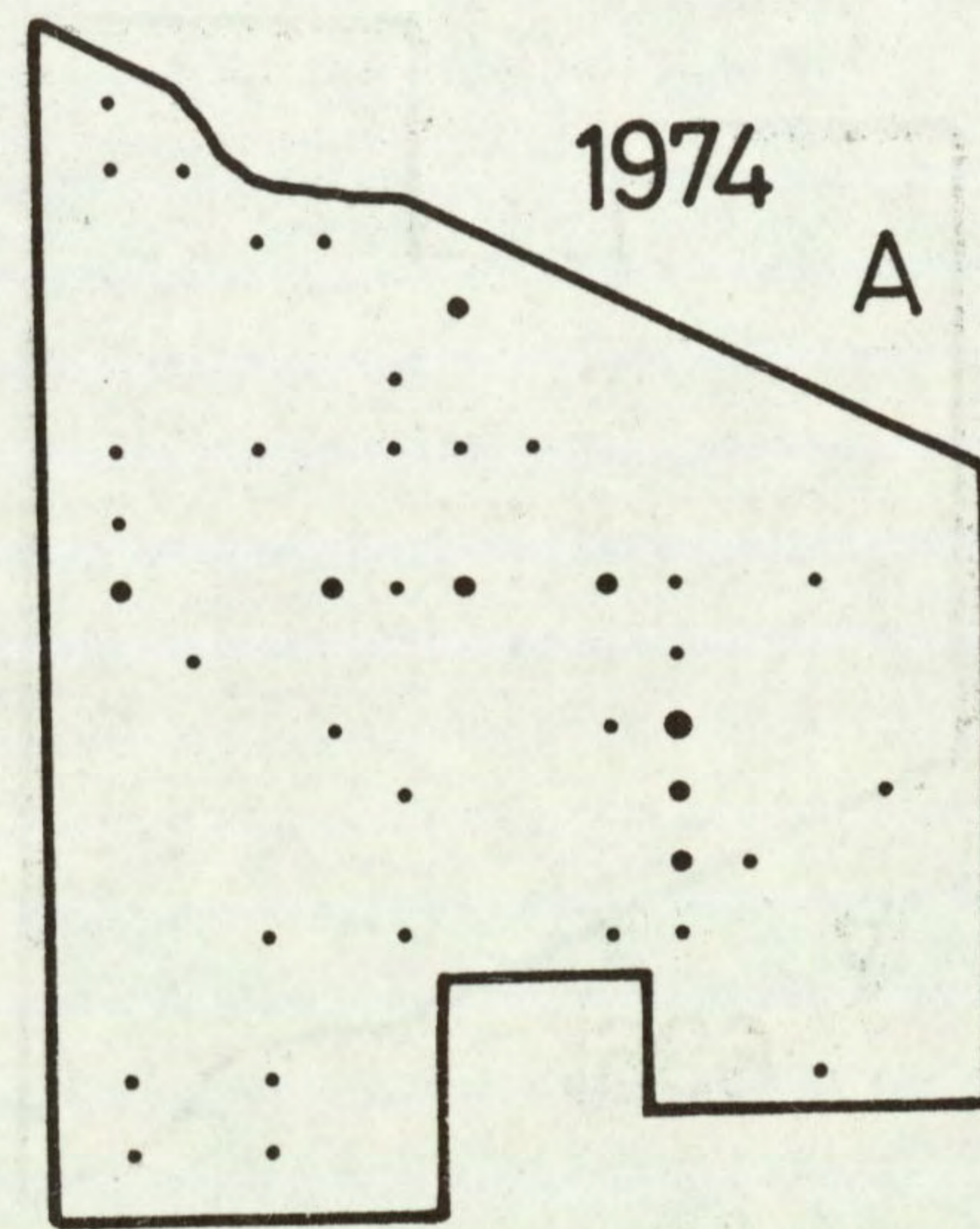
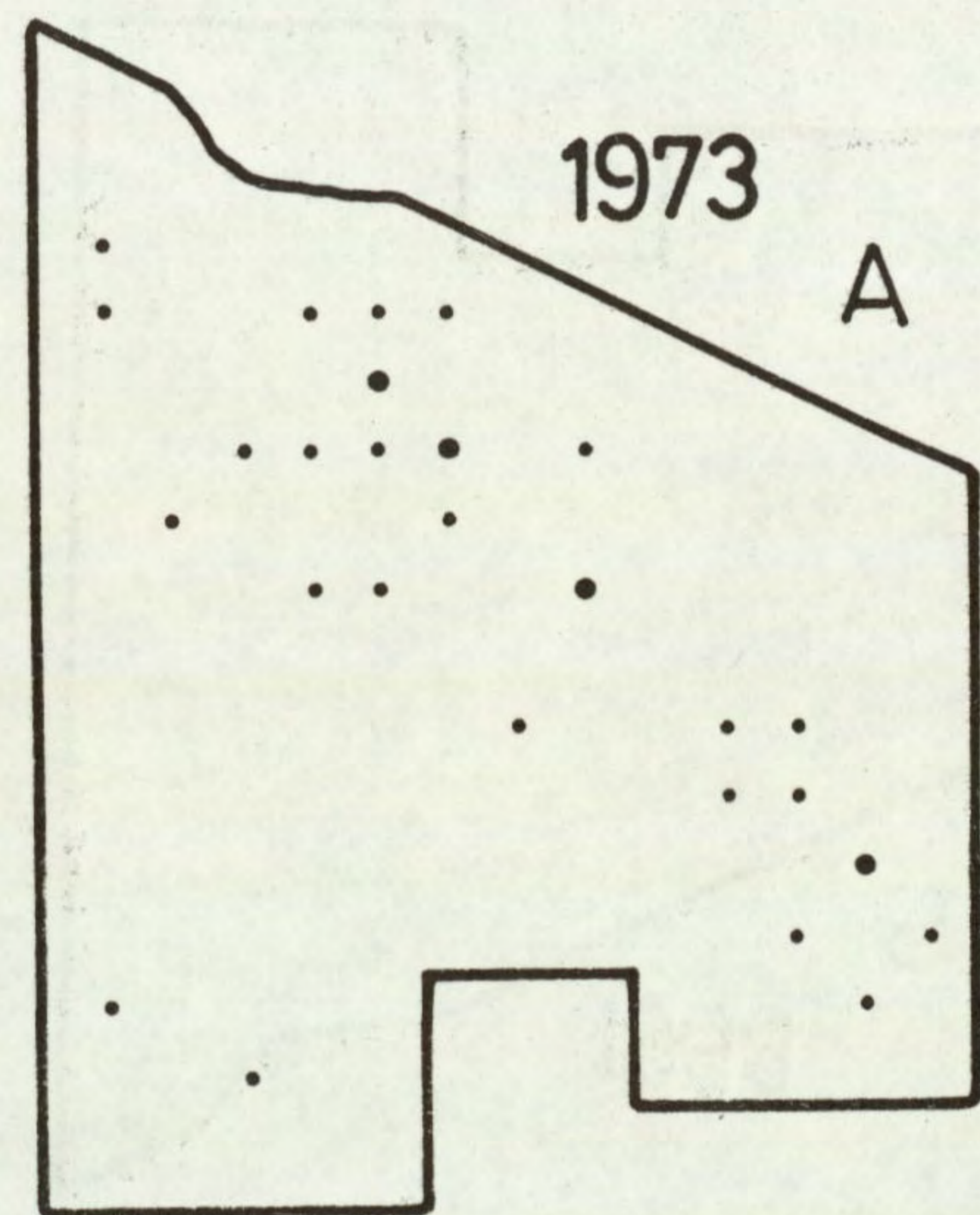
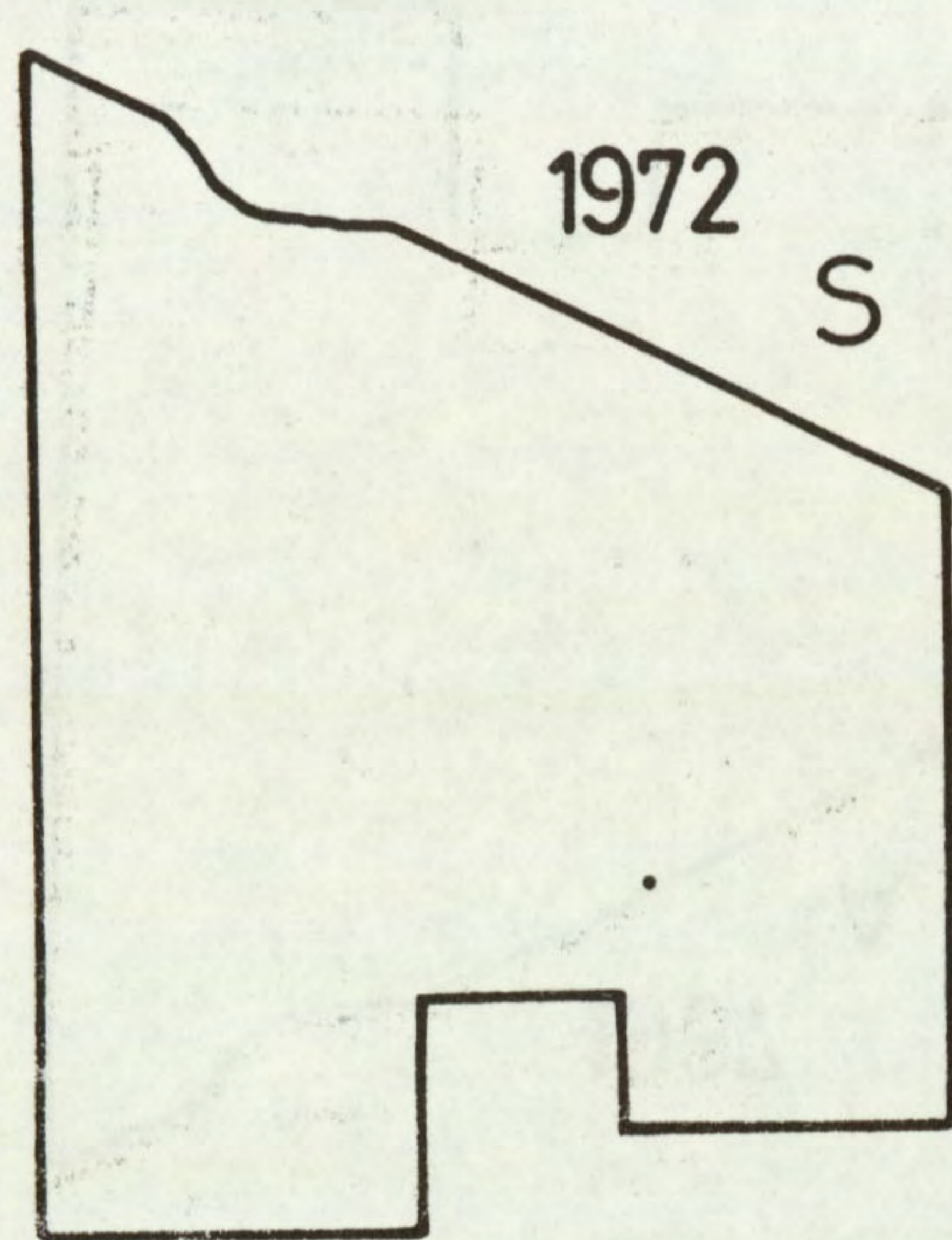




Plantago lanceolata

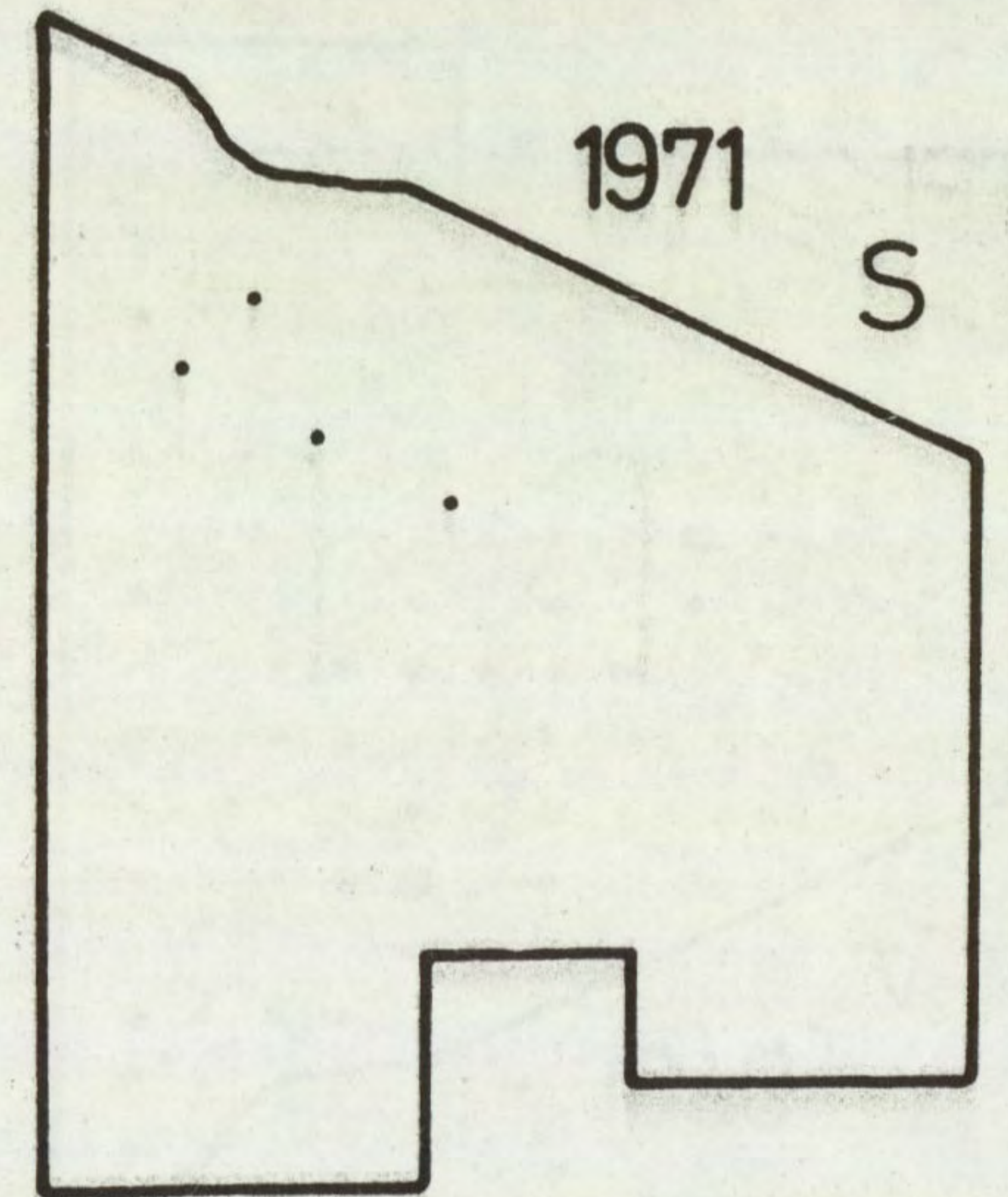
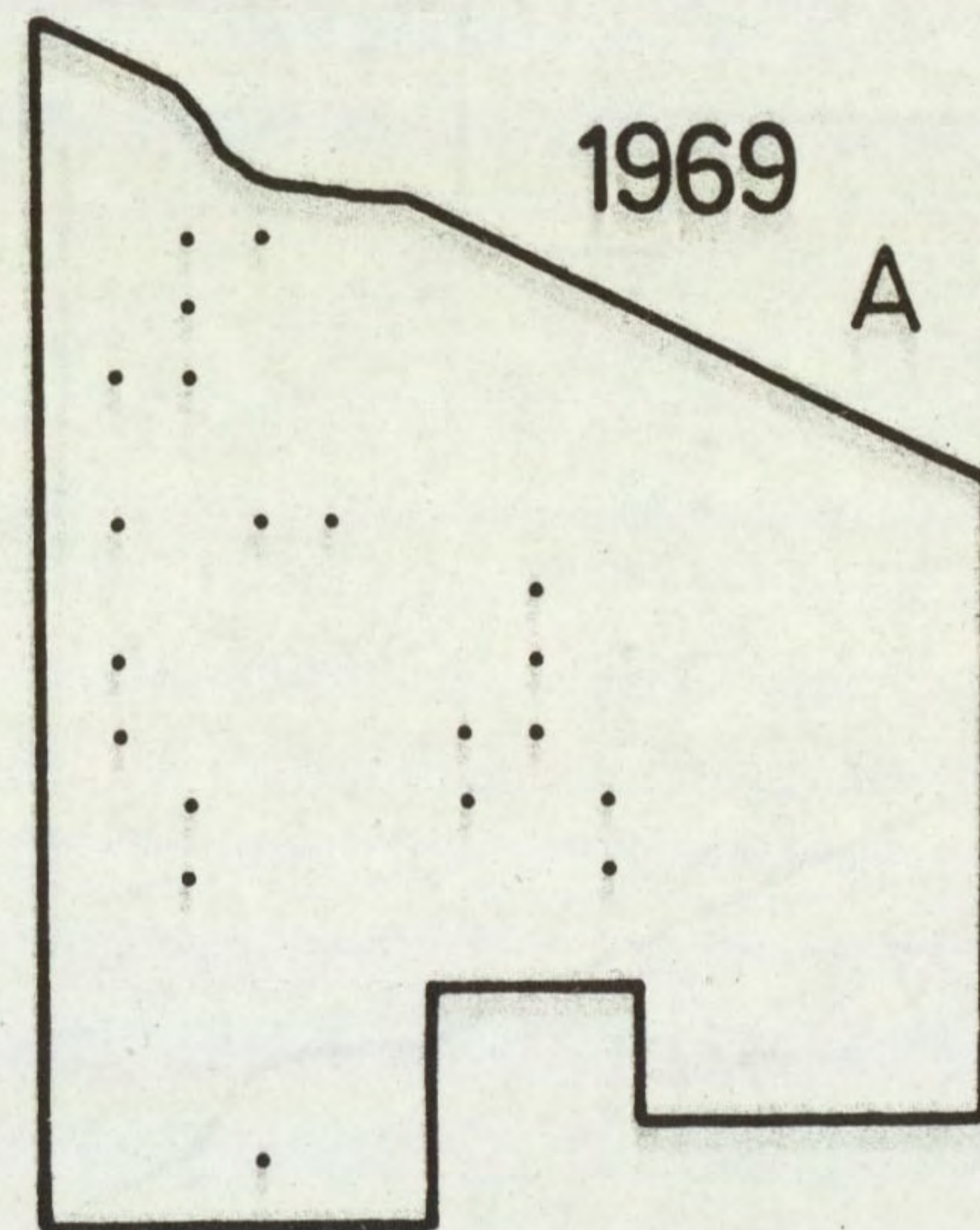
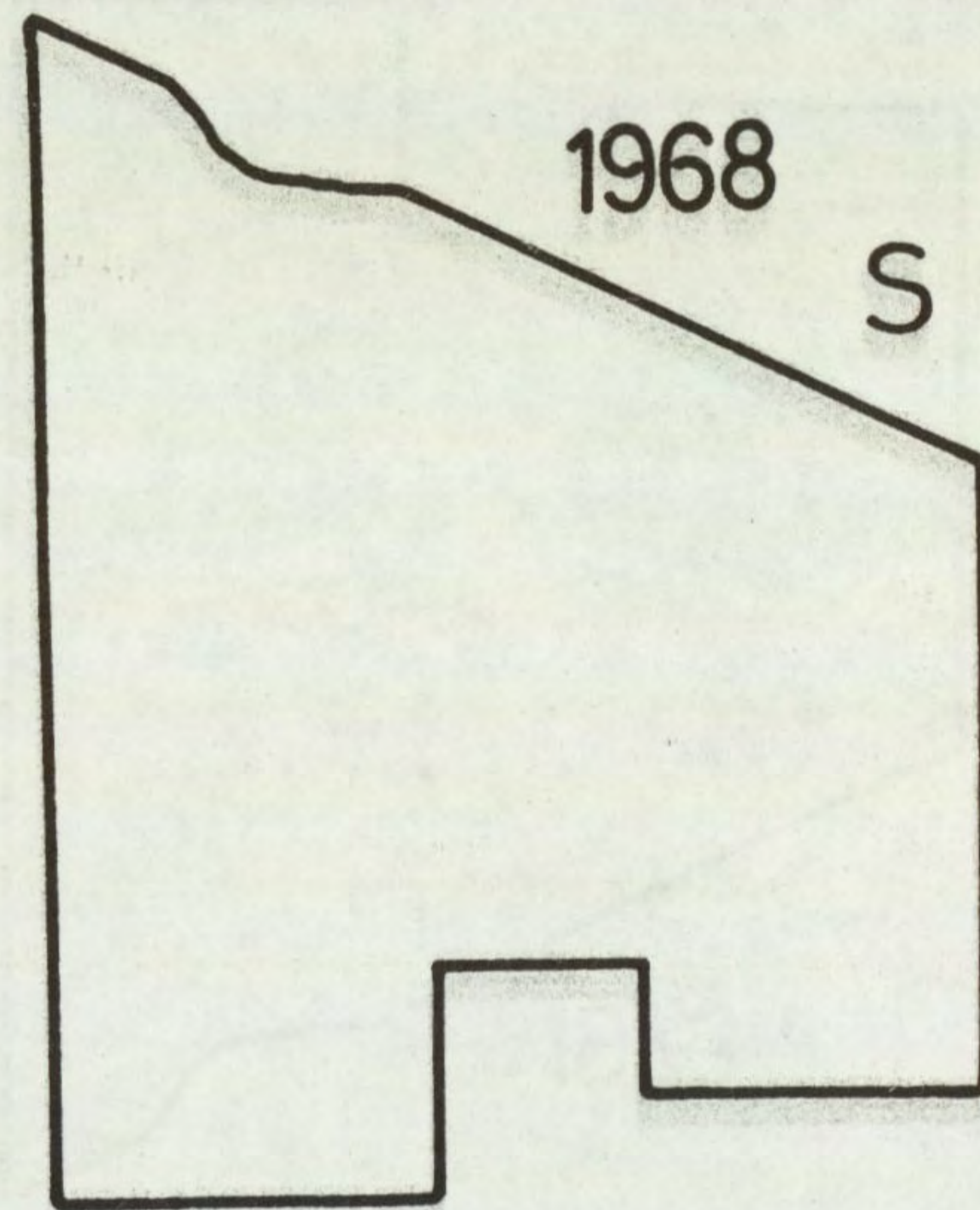
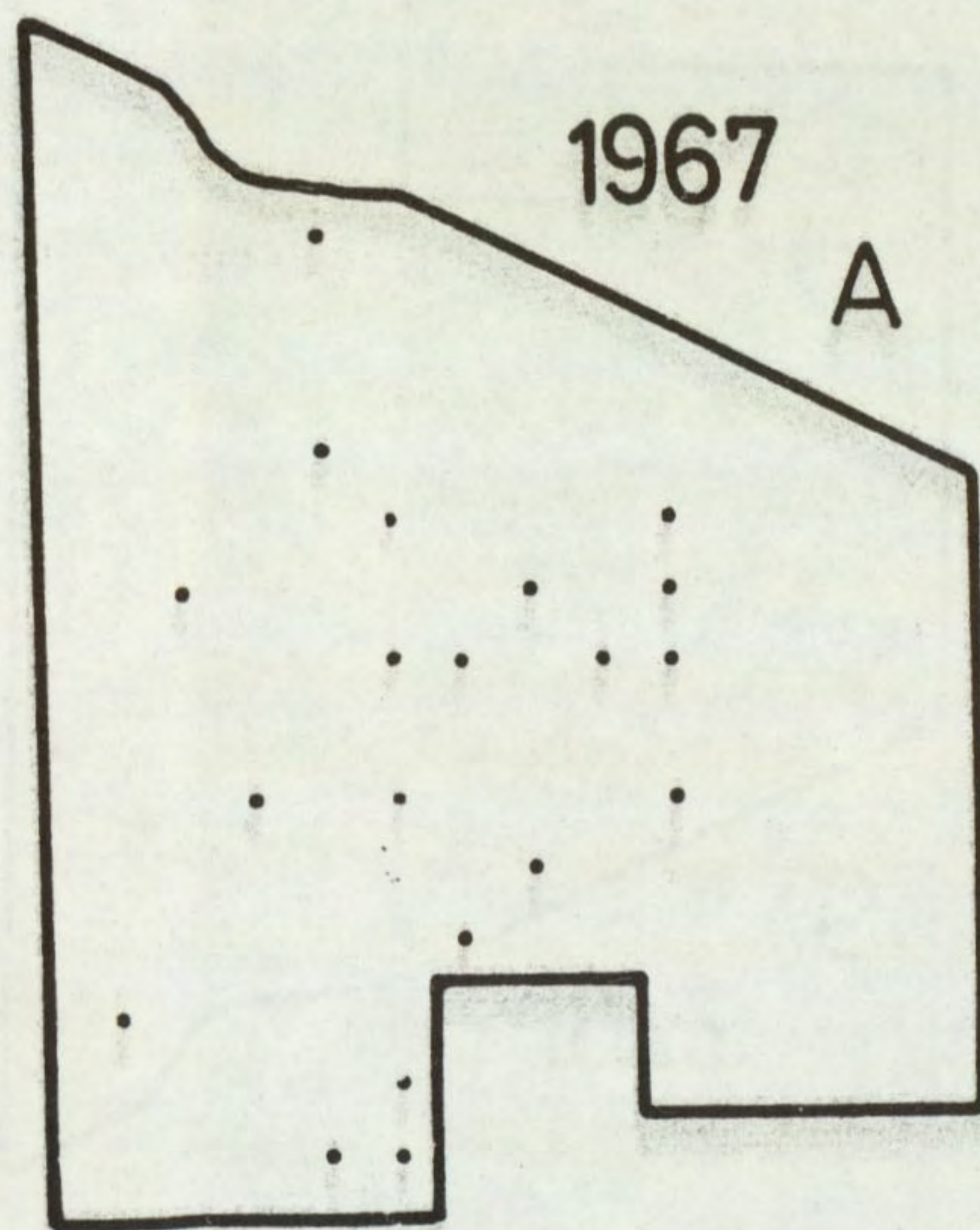
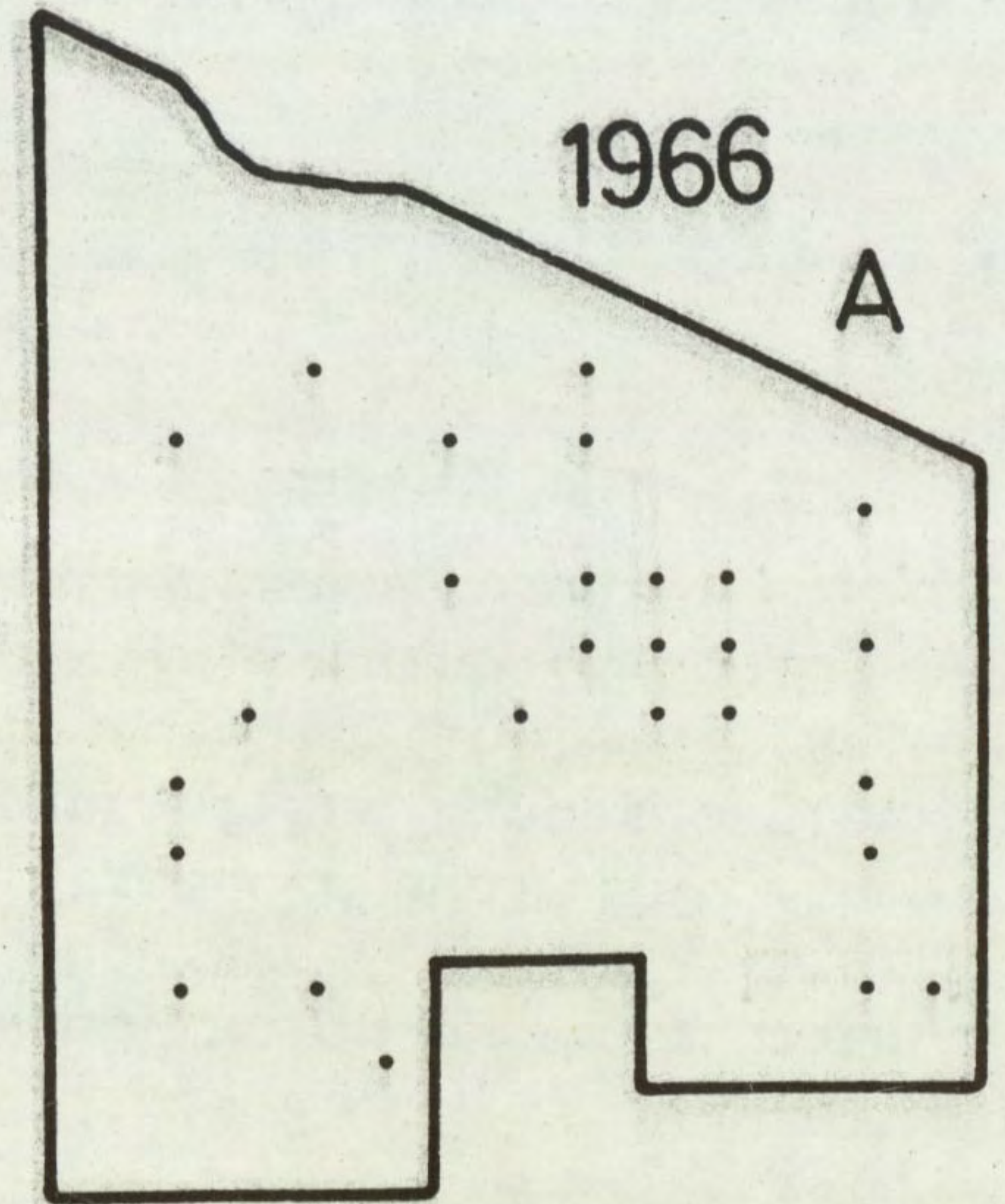
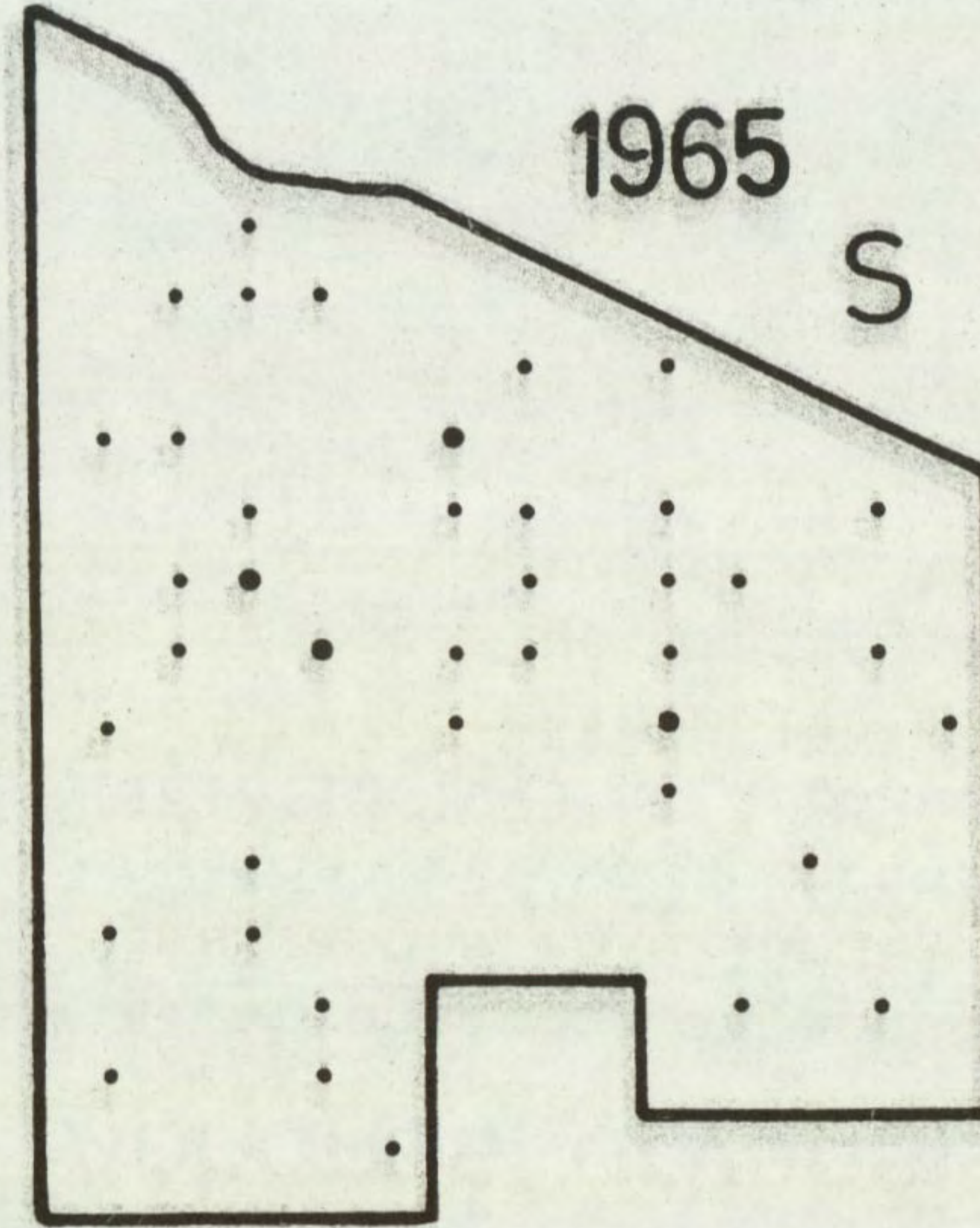
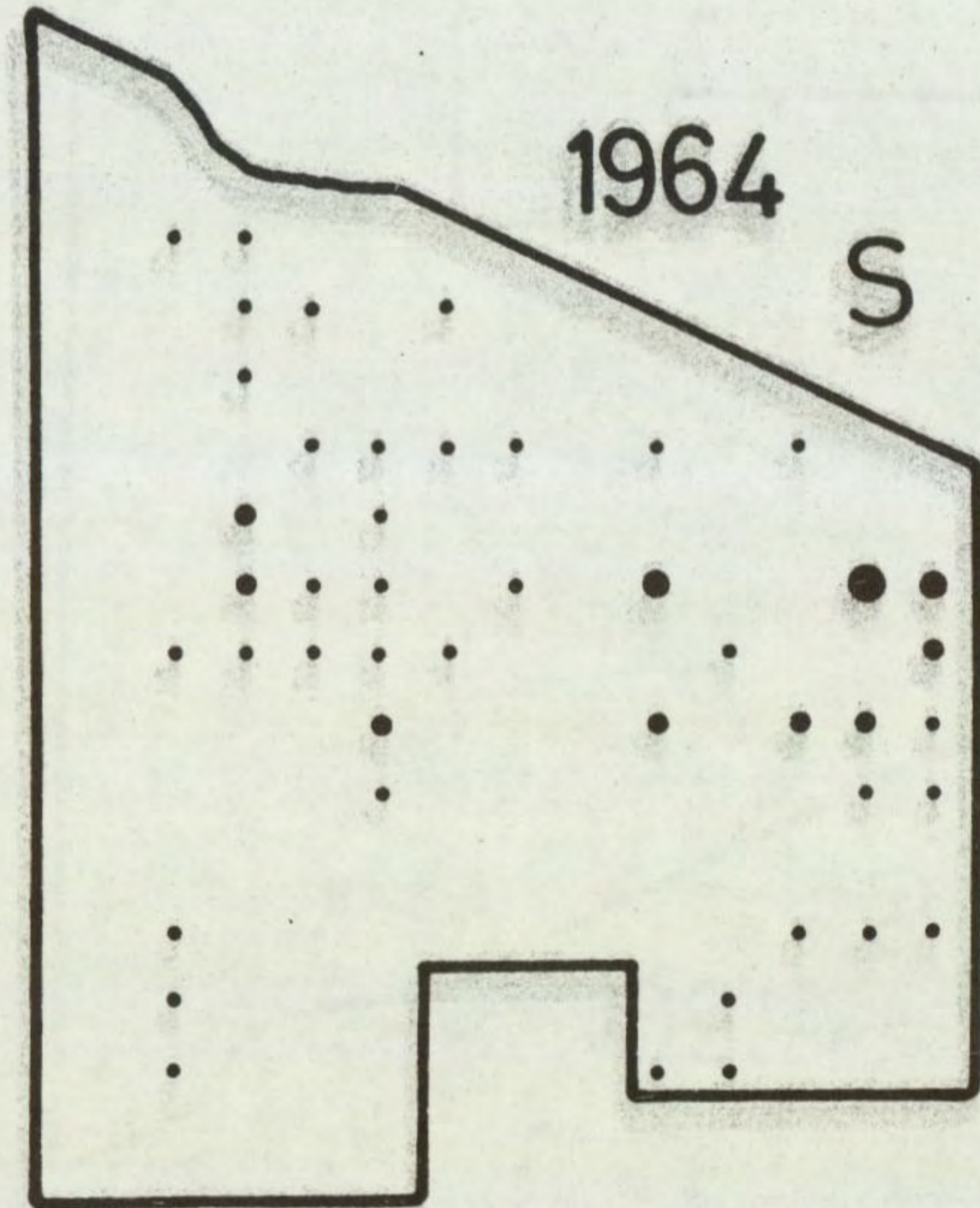
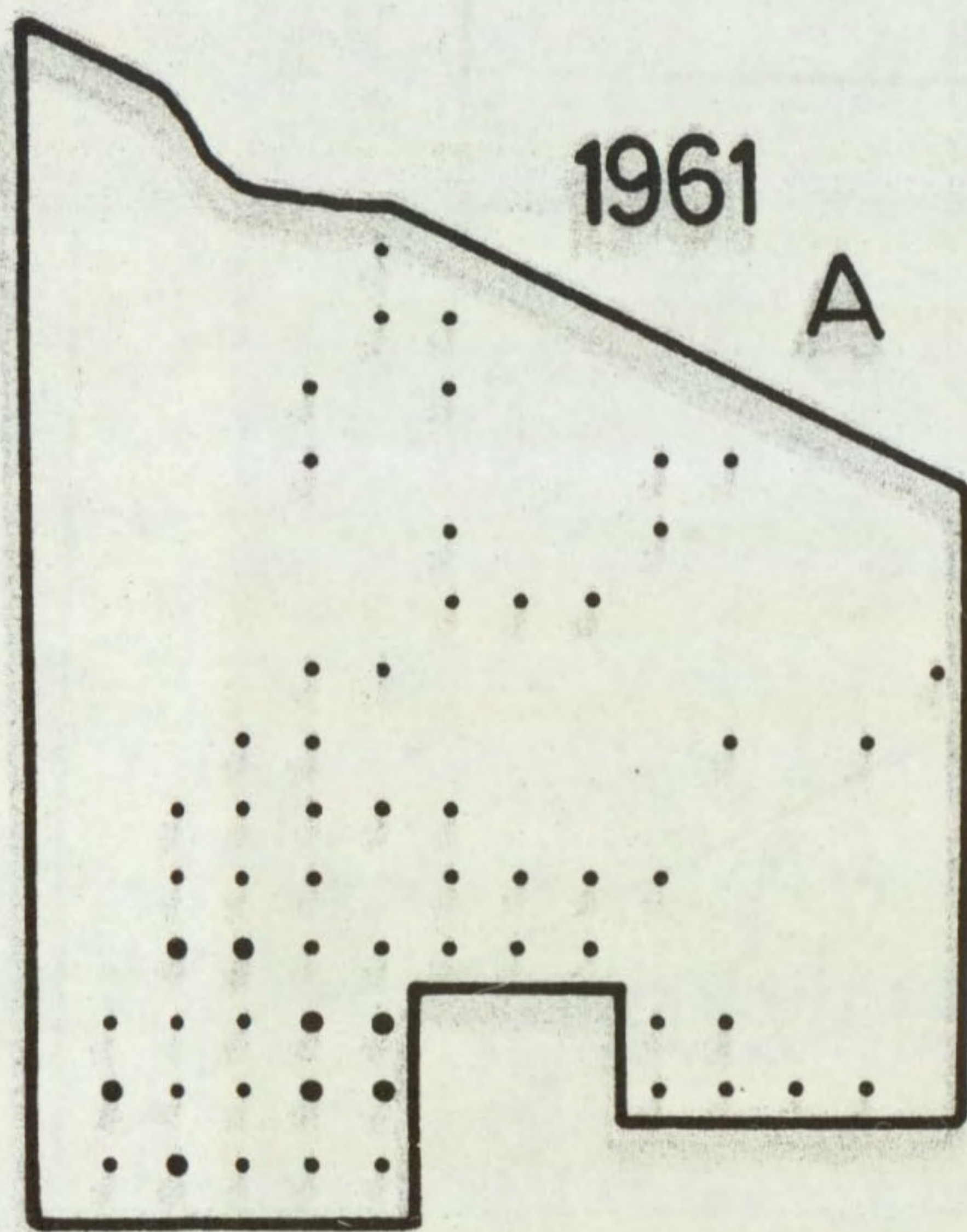
Like Taraxacum officinale, P. lanceolata is a perennial grassland weed which does not set seed in its first year. Also, like T. officinale, its seeds do not survive long in cultivated soil. The great majority of seeds were gone by 1965, five years after ploughing up the grass, with a few seedlings appearing in 1967 and 1968. Several other less frequent grassland plants followed a similar pattern of seed survival e.g. Bellis perennis, Hypochaeris radicata, Leontodon autumnalis, Plantago major and Rumex acetosa.

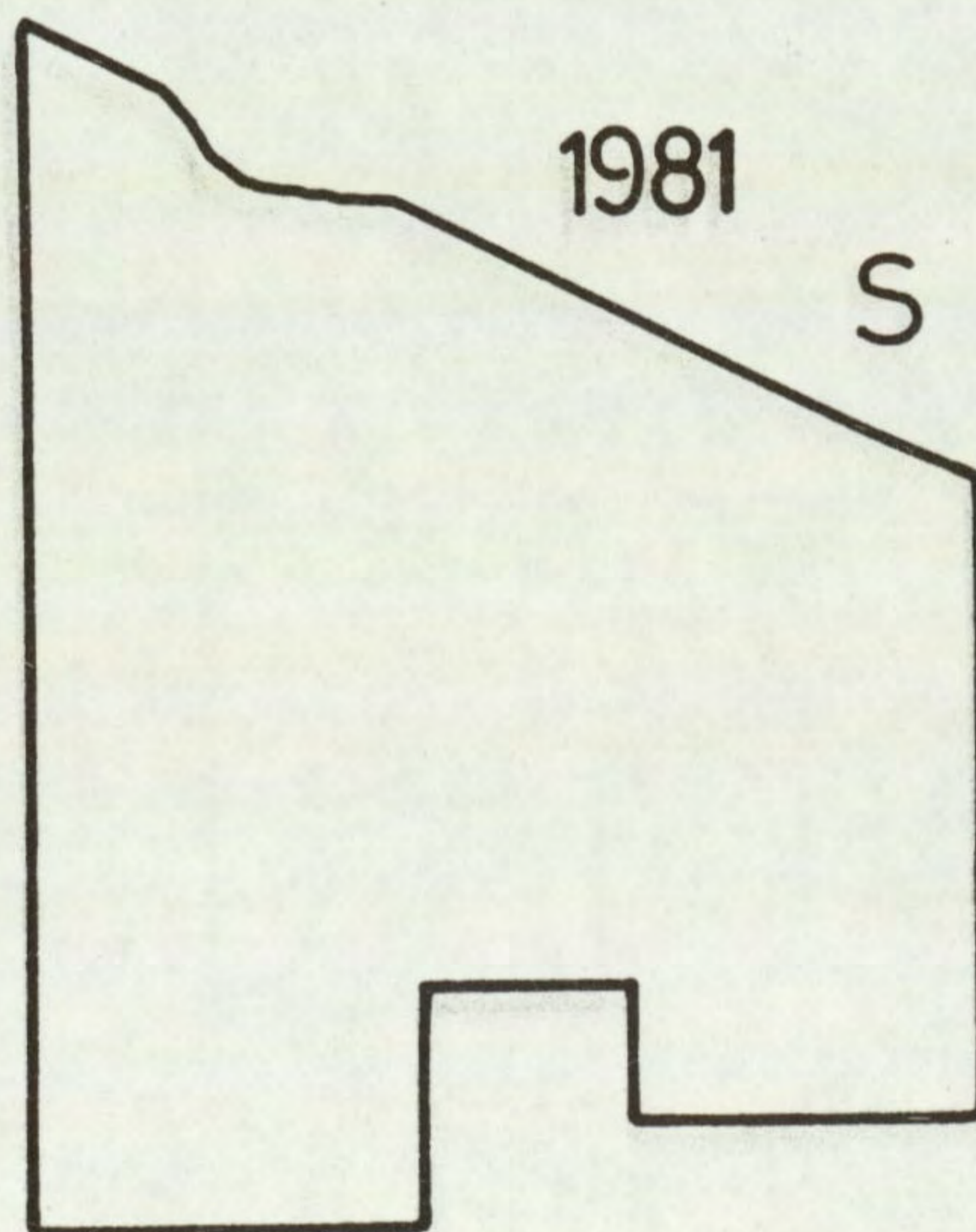
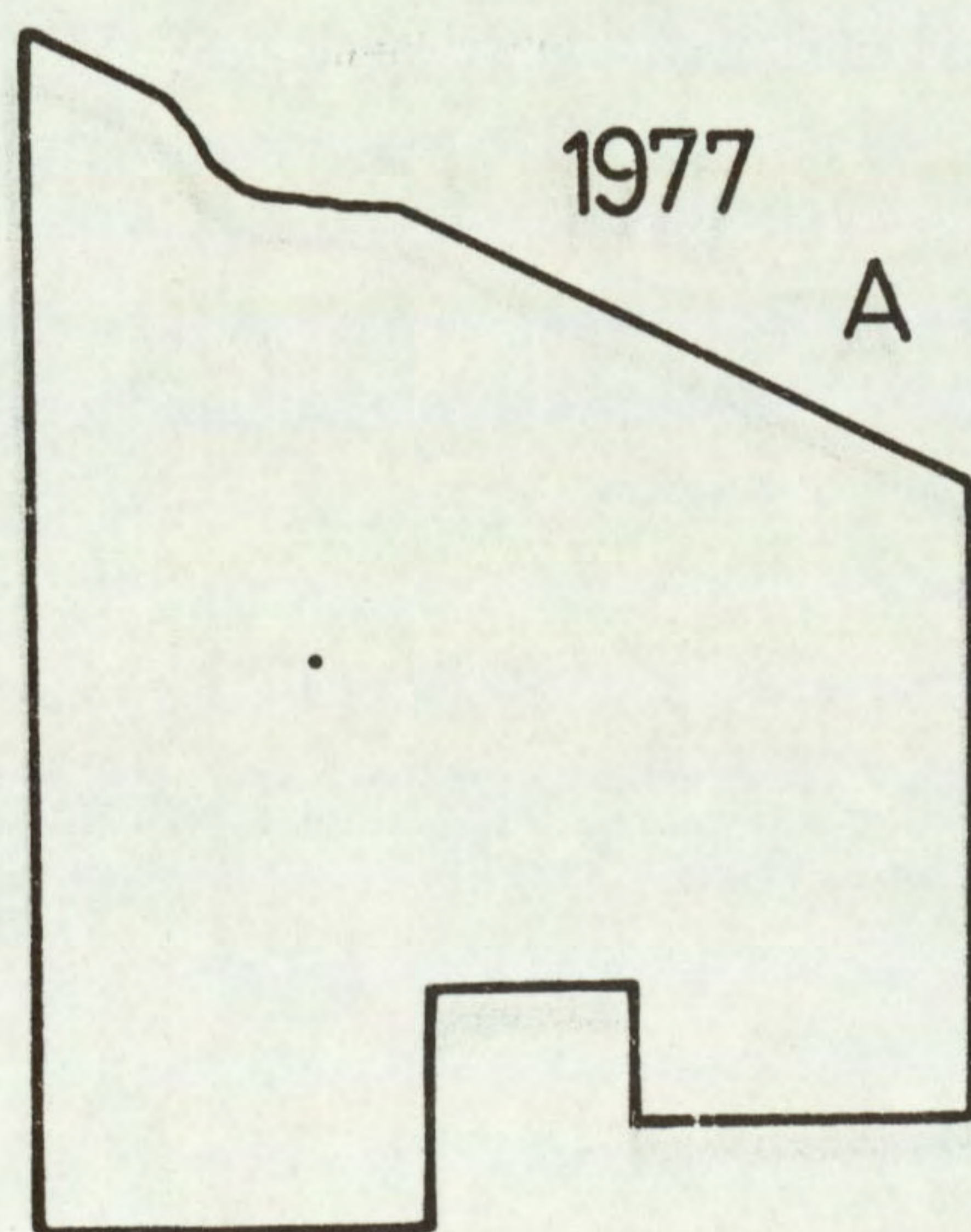
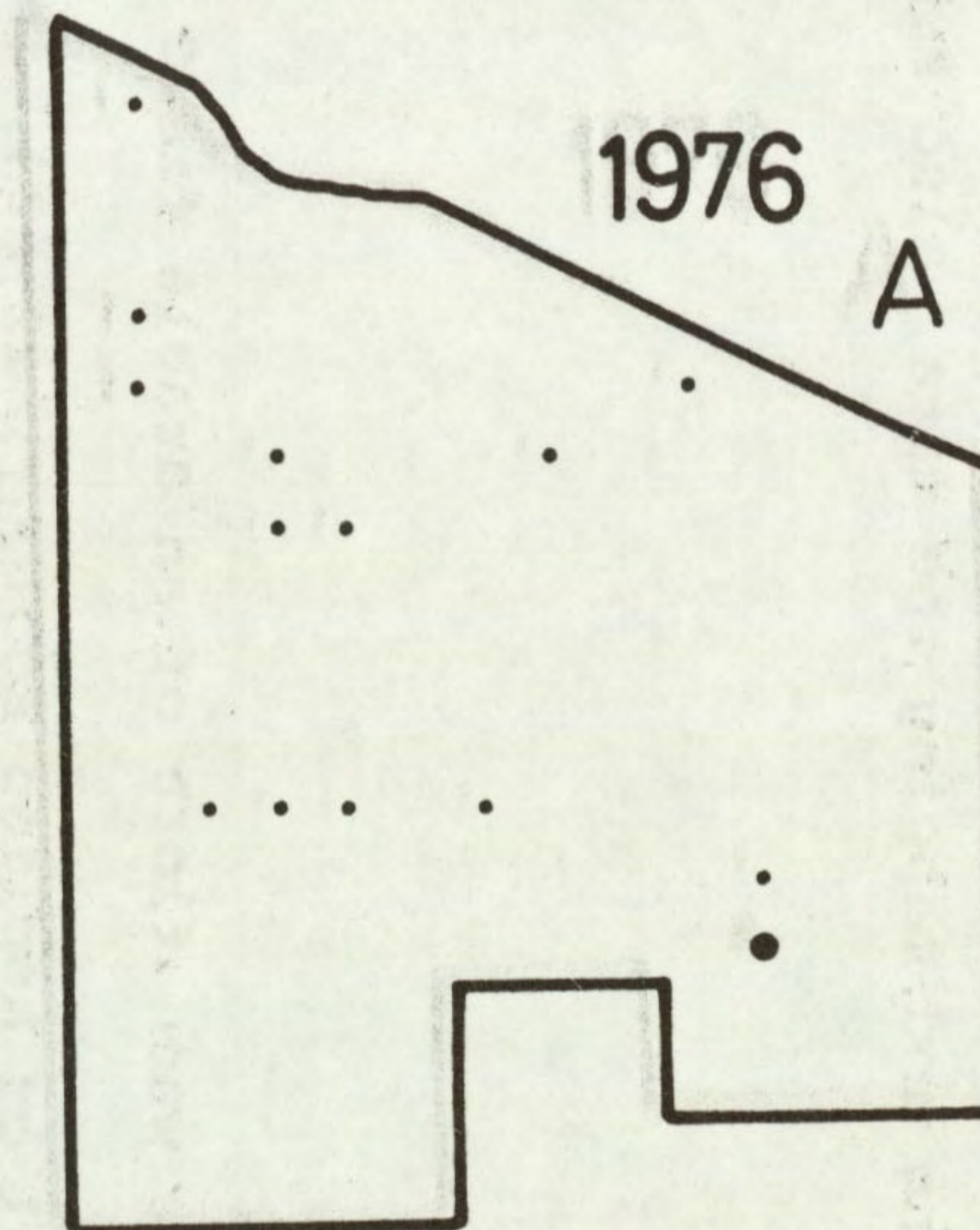
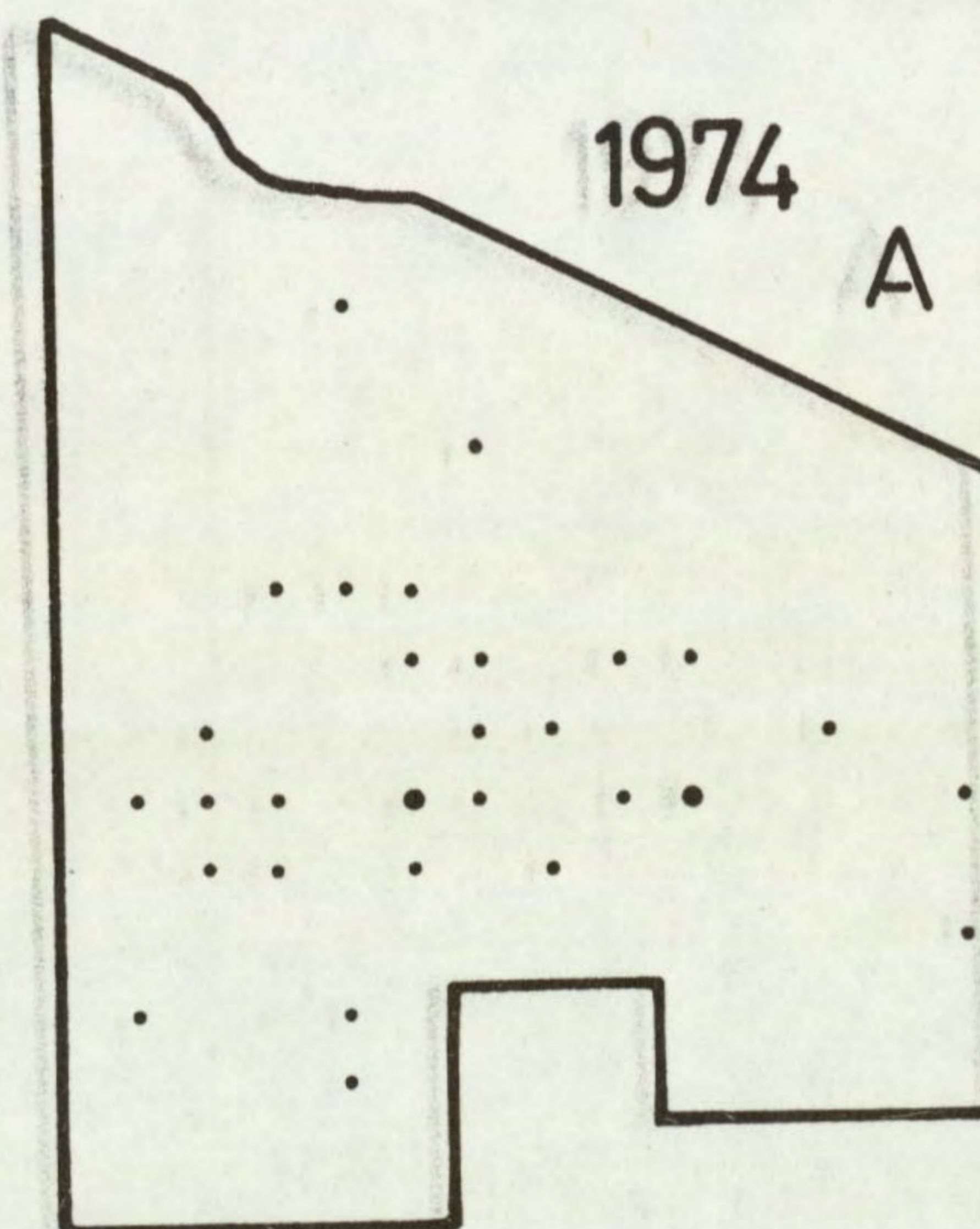
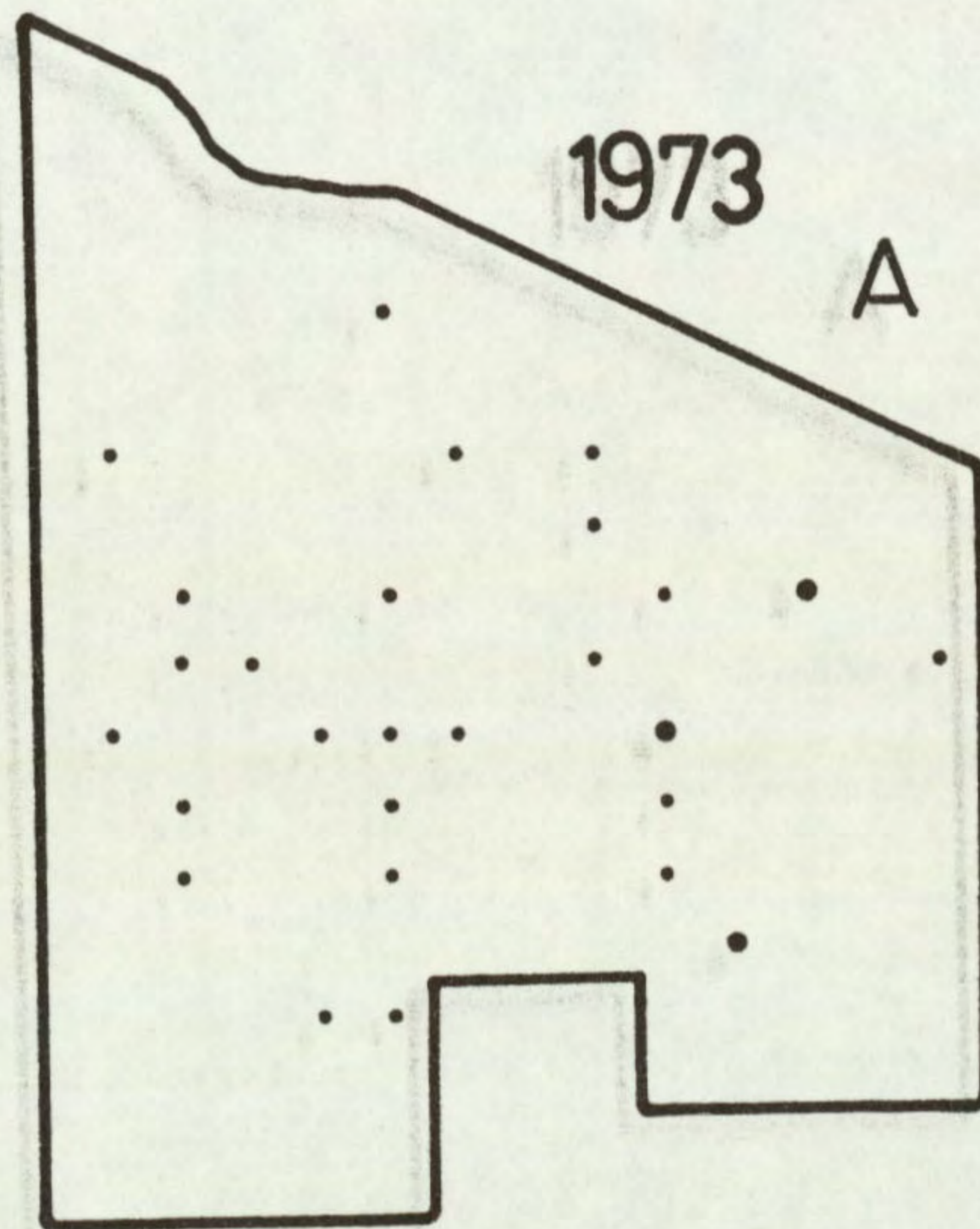
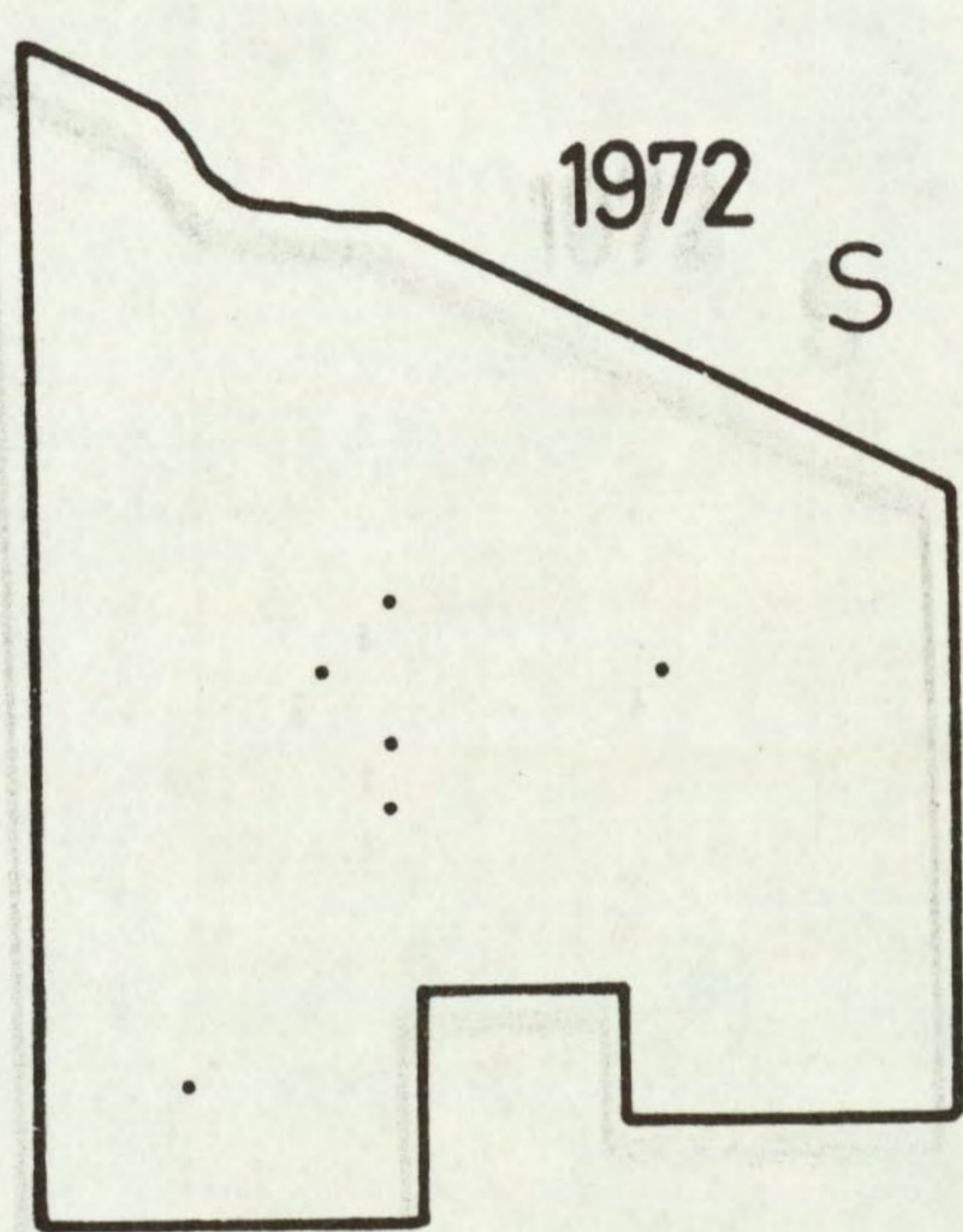




Aphanes arvensis

A. arvensis is an annual weed, which grows in both grass and arable land. It occurred from 1961 onwards, but was probably introduced again into the field in 1973 as a contaminant of the winter barley seed. It reached its maximum density in 1976. As *A. arvensis* germinates mainly in autumn, it would have been favoured by the autumn-sown cereals between 1973 and 1977.





Cerastium fontanum

This species is similar to Aphanes arvensis, for it germinates mainly in autumn and can grow in both arable and grassland. Unlike A. arvensis, which was few in number initially and increased later, C. fontanum was frequent initially and declined later. In 1961 it was not recorded in the western segment of the field because that area was not planted to a crop until after the main autumn germination of C. fontanum was over.

ACKNOWLEDGEMENTS

I wish to thank all those who helped record the weeds, especially Mrs P.A. Simmons who also helped in sorting and mapping the data, also P.D. Smith for surveying the field.

REFERENCES

CHANCELLOR, R.J. (1985) Changes in the weed flora of an arable field cultivated for 20 years. Journal of Applied Ecology, 22 (2), in press.

ABBREVIATIONS

ångström	Å	freezing point	f.p.
Abstract	Abs.	from summary	F.s.
acid equivalent*	a.e.	gallon	gal
acre	ac	gallons per hour	gal/h
active ingredient*	a.i.	gallons per acre	gal/ac
approximately equal to*	≈	gas liquid chromatography	GLC
aqueous concentrate	a.c.	gramme	g
bibliography	bibl.	hectare	ha
boiling point	b.p.	hectokilogram	hkg
bushel	bu	high volume	HV
centigrade	C	horse power	hp
centimetre*	cm	hour	h
concentrated	concd	hundredweight*	cwt
concentration	concn	hydrogen ion concentration*	pH
concentration x time product	ct	inch	in.
concentration required to kill 50% test animals	LC50	infra red	i.r.
cubic centimetre*	cm ³	kilogramme	kg
cubic foot*	ft ³	kilo (x10 ³)	k
cubic inch*	in ³	less than	<
cubic metre*	m ³	litre	l.
cubic yard*	yd ³	low volume	LV
cultivar(s)	cv.	maximum	max.
curie*	Ci	median lethal dose	LD50
degree Celsius*	°C	medium volume	MV
degree centigrade	°C	melting point	m.p.
degree Fahrenheit*	°F	metre	m
diameter	diam.	micro (x10 ⁻⁶)	μ
diameter at breast height	d.b.h.	microgramme*	μg
divided by*	÷ or /	micromicro (pico: x10 ⁻¹²)*	μμ
dry matter	d.m.	micrometre (micron)*	μm (or μ)
emulsifiable concentrate	e.c.	micron (micrometre)* †	μm (or μ)
equal to*	=	miles per hour*	mile/h
fluid	fl.	milli (x10 ⁻³)	m
foot	ft	milliequivalent*	m.equiv.
		milligramme	mg
		millilitre	ml

† The name micrometre is preferred to micron and μm is preferred to μ.

millimetre*	mm	pre-emergence	pre-em.
millimicro* (nano: $\times 10^{-9}$)	n or μ	quart	quart
minimum	min.	relative humidity	r.h.
minus	-	revolution per minute*	rev/min
minute	min	second	s
molar concentration*	M (small cap)	soluble concentrate	s.c.
molecule, molecular	mol.	soluble powder	s.p.
more than	>	solution	soln
multiplied by*	x	species (singular)	sp.
normal concentration*	N (small cap)	species (plural)	spp.
not dated	n.d.	specific gravity	sp. gr.
oil miscible concentrate	o.m.c. (tables only)	square foot*	ft ²
organic matter	o.m.	square inch	in ²
ounce	oz	square metre*	m ²
ounces per gallon	oz/gal	square root of*	√
page	p.	sub-species*	ssp.
pages	pp.	summary	s.
parts per million	ppm	temperature	temp.
parts per million by volume	ppmv	ton	ton
parts per million by weight	ppmw	tonne	t
percent(age)	%	ultra-low volume	ULV
pico (micromicro: $\times 10^{-12}$)	p or μ	ultra violet	u.v.
pint	pint	vapour density	v.d.
pints per acre	pints/ac	vapour pressure	v.p.
plus or minus*	+ -	<u>varietas</u>	var.
post-emergence	post-em	volt	V
pound	lb	volume	vol.
pound per acre*	lb/ac	volume per volume	v/v
pounds per minute	lb/min	water soluble powder	w.s.p. (tables only)
pound per square inch*	lb/in ²	watt	W
powder for dry application	p. (tables only)	weight	wt
power take off	p.t.o.	weight per volume*	w/v
precipitate (noun)	ppt.	weight per weight*	w/w
		wettable powder	w.p.
		yard	yd
		yards per minute	yd/min

* Those marked * should normally be used in the text as well as in tables etc.



WEED RESEARCH ORGANIZATION

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