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COMMUNITY RECONSTRUCTION AND
FUNCTIONAL CHANGE FOLLOWING
A DISASTER IN JAPAN*

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INTRODUCTION

Within a society, the seeds of change germinate, grow, fortify themselves, and finally bear fruit by altering the social system. In that a society is the necessary result of the conditions of its own existence and the action of these seeds, the seeds take on the character of unavoidable "inner drives" that direct the course of social change. In addition to these inner drives, a social system is subject to the constant influence of external forces, some of which are touched off by chance events and thus act as shock factors that perturb and change the system.

The internal and external factors leading to social change do not necessarily function independently. For example, a social system that is undergoing a process of maturation through internally stimulated change may exhibit strong resistance to external forces opposing this change, and develop a sort of immunity when the same external force is applied repeatedly; while a social system that is in a period of decline is more vulnerable to the effects of external factors, and its decline may be accelerated by external shocks. The relation between internal and external forces can be shown in diagram form by defining these forces as directed quantities. Their direction can be positive (acting to preserve the existence and functioning of the system) or negative (acting in the opposite direction). Their size indicates the strength of their influence (the amount of potential modification of the system). The overall change in the system can then be considered in terms of their vector sum. The characteristics of social systems and directions of change resulting from various combinations of these internal and external forces are shown in Figure 1.

		External forces	
		Positive	Negative
Internal forces	Positive	Development	Recovery
	Negative	Prolongation	Decline

Fig. 1. Features of a Society Affected by
Internal and External Forces

When the internal and external forces are both positive, the growth and development of the social system are accelerated. If the external positive influence is continuous, the social system is likely to undergo rapid development.

When the internal drives are negative, the existence of the system may still be prolonged by strong positive external forces. In this case, the decline of the system is temporarily arrested.

Let us next consider the case in which negative external forces act on a social system whose internal drives are positive. Aside from cases in which the external forces so completely outweigh the internal ones that they overwhelm them and obliterate the system, there is a substantial possibility that the society may be able, by dint of its positive internal drives, to compensate for the loss of function inflicted on it by the outside world, repair the damage, and recover. Frequently the system will show active substitution behavior and strengthen its capabilities by replacing some or all of the components that were damaged or rendered non-functional with new components, so that if its performance before and after the operation of the external influence is compared, significant improvement will be found to have occurred. The recovery of the defeated countries (Japan and West Germany) after the Second World War may be an appropriate example here.

Finally there is the case in which both the internal and external forces are negative. The negative factors added from the outside will in this case accelerate the decline of the system and hasten its collapse. Even when the direct impact of the external forces is not that large, the system is likely to be seriously affected by them.

In general, a natural disaster is a source of negative influence on a social system (although there are exceptional cases in which a disaster has a positive effect: for example, a disaster experienced by one of two mutually hostile societies may be a boon for the other). After a society has suffered a disaster, it may follow one of two main paths, the one leading to recovery and the other to disintegration. It may be hypothesized that the internal drives of the social system constitute the main factor determining which of these two paths it follows.

Even if this hypothesis is correct, it does not mean that the system will always be able to recover on its own. In some cases it will be impossible for the social system to recover without assistance from the surrounding social system. The relation between the disaster and the affected society may be summarized as shown in Figure 2.

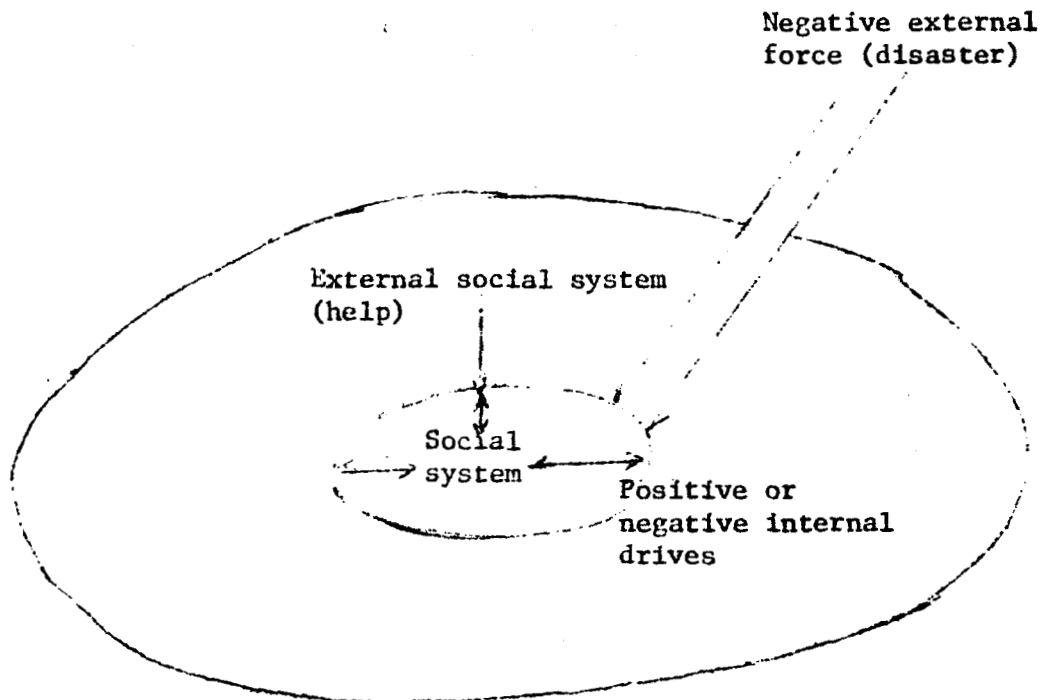


Fig. 2. Disaster and Community Response

Three factors influence the process of recovery of the disaster-stricken community. The first is the scale (size) of the disaster. The second is the vigor or resilience of the community (its positive internal drives). The third is the amount of help given by the surrounding social system for community reconstruction.

Let R represent the degree of recovery of the damaged system, S the scale of the disaster, P the positive vigor of the community, and H the amount of help given by the external society. These four variables can be connected in a causal diagram as shown in Figure 3. This diagram expresses the following causal relations (Blalock, H. H., Jr., 1971; Duncan, O. D., 1975; Asher, H. B., 1976): (1) The scale of the disaster has both a direct and an indirect effect on the progress of recovery. The direct effect [1] is negative in that the larger the disaster, the more the recovery process will be hindered. The indirect effect [2], however, is positive in that the larger the disaster, the more outside help will be given to aid the recovery process. The fact that the direct and indirect effects of the scale of the disaster operate in opposite directions has fairly important implications. (2) Community vigor also exerts its effect through a direct route and an indirect route. The direct effect [3] is that the stronger the community vigor the faster it will be able to recover by its own efforts. The indirect effect [4] is that the more vigorous the community the greater its importance to its external society, and hence the more help it will receive.

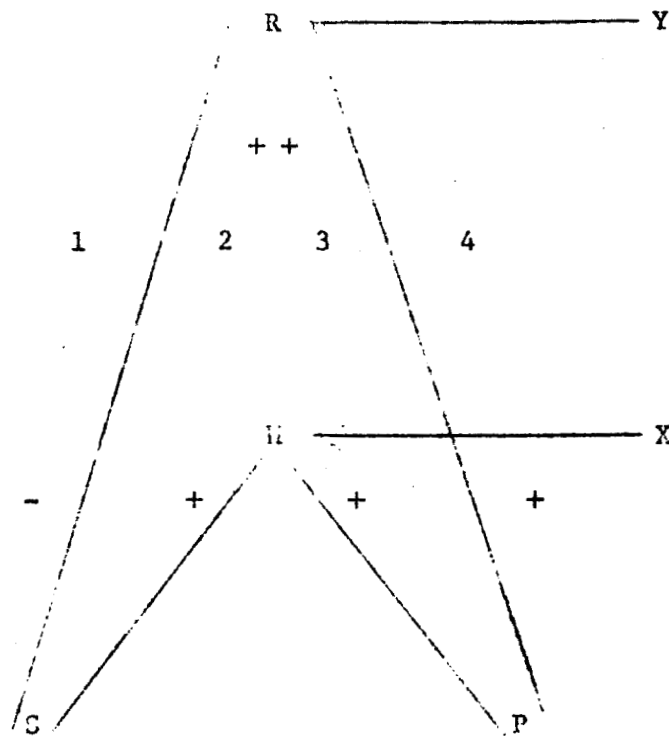


Fig. 3. Causal Diagram for the Process of Recovery from Disaster

Where: R = index of progress of recovery

H = amount of help given by outside society

S = scale of disaster

X = sum of forces (financial strength of external society, etc.) affecting amount of aid but not included in model

Y = sum of forces (weather, new disasters, etc.) affecting progress of recovery but not included in model

Let us now imagine what happens when a major disaster strikes a community. Acting through route [1], the scale of the disaster will pose a major obstacle to recovery. Through route [2], on the other hand, it will promote recovery, but route [2] is an indirect path (Duncan, O. D., 1966; Blalock, H. M., Jr., 1971), and since its effect must be conveyed through two subpaths ($P_{HS}: S \rightarrow H$ and $P_{RH}: H \rightarrow R$), its effect will be weaker than the effect of that exerted through [1]. Ignoring other factors, we can therefore say that the size of a large-scale disaster has a negative effect on the recovery process.

If the community possesses sufficient vigor, however, the positive effect of the influence operating through routes [3] and [4] may be more than enough to cancel the negative effect of the size of the disaster, so that the overall effect is to promote the recovery of the system. This can be expressed in terms of path analysis (Wright, S., 1934, 1960; Duncan, O. D., 1966) by saying that recovery will be promoted when $|P_{RS}| < |P_{HS} \cdot P_{RH}| + |P_{RP}| + |P_{HP} \cdot P_{RH}|$, where the vertical lines denote the absolute values of the effect exerted through the paths described within them.

If the vigor of the community is weak, the positive influence exerted through routes [3] and [4] will be inadequate to cancel the negative effect of the scale of the disaster. The overall effect will then be to inhibit the recovery process. Again using path analysis notation, this relation can be expressed as $|P_{RS}| > |P_{HS} \cdot P_{RH}| + |P_{HP} \cdot P_{RH}|$.

The argument of Dacy and Kunreuther (1969) that a disaster brings economic benefits to the place where it occurs was presented chiefly with reference to path [2], with the donation of resources from the external society through path [4] being simultaneously included. Hass et al. (1977) describe how a city that is in a period of rapid growth recovers quickly from a disaster, while a city in a period of stagnation either recovers extremely slowly or falls into rapid decline. Their argument can be restated in terms of Figure 3 as a comparison of the effects of the disaster through route [1] with the amount of self-reconstructing energy available through [3]. Their finding thus concerns the absolute value difference between the effects exerted through these two routes.

With the relations among the factors affecting the recovery process sorted out in Figure 3, we shall proceed to examine, through a case study, the features of a society after recovery from a disaster. Bates et al. (1963) have argued that a disaster accelerates change in a social system, bringing about rapidly that which would occur slowly in its absence. The author would like in this thesis to address the question of how the role of a society in its external environment is changed by the occurrence of a disaster.

THE ERUPTION OF MT. USU

The Disaster

On August 7, 1977, Mt. Usu, a volcano in Japan's northern island of Hokkaido, awoke from thirty years of dormancy with a major eruption that sent smoke 1,200 meters into the sky. Sixteen more eruptions of various sizes followed during the next six days, depositing several tens of centimeters of ash on Toyako-Onsen, a hot-spring resort situated directly beneath the mountain. Most of the residents were evacuated to places of safety designated by the town authorities or to the homes of friends or relatives in other towns and villages. Except for maintenance personnel left at the inns and hotels, Toyako-Onsen became a ghost town.

Since Toyako-Onsen had been one of the most frequented hot-spring resort areas in Hokkaido (as measured by the number of overnight and day visitors who used inn and hotel facilities), the eruption came as a severe blow to the tourist industry there. With the end of the summer tourist season approaching and the businesses that depended on tourists claiming that further continuation of the evacuation order would ruin them, the mayor of Abuta (the town which includes Toyako-Onsen) rescinded the order for the daytime hours (from 8:00 to 17:00) on August 23. There was, however, a disagreement between the town of Abuta, which wanted the evacuation order lifted as quickly as possible, and the police and prefectural authorities, who held that it was still too early and cited in support the view of the Volcanic Eruption Early Warning Group* that the danger was not yet over. The town authorities dealt with this by lifting the evacuation order by stages. On August 29, residents of certain areas were allowed to remain at home at night, and on September 7, a month after it had been issued, the evacuation order was finally completely rescinded. The police, however, who had been critical of the lifting of the order from the outset, continued to restrict traffic in the area, so that tourism was not viable even with the evacuation order rescinded. The town authorities, pleading the cause of the inn- and shopkeepers, repeatedly asked the police to relax the traffic restrictions, and the police finally agreed on the condition that adequate safety facilities be provided in Toyako-Onsen. Tourism resumed on September 23, after what had been a difficult month and a half. (Hirose et al., 1978; Hirose, 1979; Watanabe, 1981)

* A liaison committee of volcano researchers authorized by the national government to conduct and publish observations of volcanoes during normal times and to predict the occurrence and scale of volcanic activity.

Toyako-Onsen after the Disaster

Hokkaido as a whole suffered losses totaling ¥67.9 billion from the eruption of Mt. Usu, with the city of Date and the towns of Abuta and Sobetsu bearing the greatest damage. The effect on Toyako-Onsen had been particularly severe, but under the leadership of the mayor of Abuta, the town authorities set to work to accomplish a speedy recovery and turn the calamity to their advantage. Within a year of the eruption, two new tourist attractions, a Museum of Volcano Science and a Pheasant Park, were opened in Toyako-Onsen. and in 1980 work began to equip an "adventure park" with facilities for field athletics. In addition to these efforts to renovate Toyako-Onsen as a resort town, a project has been undertaken to fill in a 20-meter wide, 1.8-kilometer long section of Lake Toya (from which Toyako-Onsen derives its name), plant trees and shrubs, and create a promenade ground. The first stage of this project will be completed in FY 1982, and the second in FY 1987. Since this promenade has been designated by the prefecture of Hokkaido as an emergency bypass route, the prefectural government will bear one-third of the ¥4.1 billion construction costs and the national government the remaining two-thirds, thus sparing the town of Abuta any financial burden whatsoever. This promenade construction project is currently being accompanied by a project to improve the town roads, for the stated purpose of securing safe evacuation routes, with three-fourths of the ¥1 billion costs being paid by a grant from the national treasury and the rest being borrowed at low interest rates, with no fear of straining the town's finances.

Work is also proceeding on new sewage facilities to treat the sewage which the annual 2.5 million tourists discharge into Lake Toya. When the first stage of construction is finished in 1985, Toyako-Onsen will have a complete sewer system, and in the second stage of construction, which is scheduled to start in 1986, purification facilities will be built. At present, very few lakeside tourist areas anywhere in Japan can boast a sewer system with sewage treatment equipment, a fact which serves to highlight Toyako-Onsen's ambition to reestablish itself as a modern tourist resort. Over 60% of the cost of building the new sewage facilities will be borne by the national government in the form of disaster recovery assistance, and most of the rest will be available from the national government in low-interest loans. The town itself will have to put up only one-tenth of the total costs.

Improvements to schools and other educational and cultural facilities are also under way. Since they are used as evacuation centers, they are being moved to safer locations and rebuilt in concrete instead of wood.

Measures to prevent further natural disasters are being put into effect. In October 1976, a year and two months after the volcanic eruption, a heavy rainfall caused a mud flow that took the lives of three people. Now a slit dam has been built upstream of the erosion control dam that is intended to check mud flows, to prevent the latter

from being destroyed by rocks and boulders, and three mud-flow canals are under construction. Remote-controlled television cameras have been set up to monitor two key marshes to give warning of danger. Aerial seeding has been carried out to stabilize the soil and keep mud slides from occurring, and this program is gradually beginning to show effects.

Toyako-Onsen is thus recovering from its disaster with remarkable celerity, making extremely effective use of the reconstruction grants and low-interest loans provided by the national and prefectural governments. In appearance, it is being reborn as one of the most modern tourist towns in the whole of Japan. Next we shall go behind the appearance and examine the recovery process by means of data.

Adjacent to the town of Abuta but almost untouched by the volcanic eruption is the town of Toyoura. Before the eruption, the two towns were approximately equal in the scale of their municipal finances. Figure 4 compares their annual revenue trends before and after the eruption. In FY 1975 and FY 1976, the two towns were at roughly the same annual revenue level, but in FY 1977, during which the eruption occurred, and the next year in FY 1978, Abuta's revenues were nearly double those for Toyoura. Toyoura's revenues show only the natural increment expected from taxes. What factors caused the sudden rise in Abuta revenues?

One factor is the extra disbursements received from the national and prefectural governments in the form of disaster relief and recovery assistance. The decline in Abuta's revenue level in FY 1979, the year in which the recovery process had reached a stage of initial completion, reflects a reduction in these national and prefectural disbursements. National and prefectural grants to the two towns are shown in Figure 5. During the two years prior to the eruption, Abuta and Toyoura received exactly identical amounts of assistance from these sources. After the eruption, Abuta's amount climbed steeply, while Toyoura's remained steady. It is clear that a large part of the increased revenues received by Abuta after the eruption came in the form of increased national and prefectural aid. This can be viewed as simply indicating administrative-led recovery from the disaster, but it also reflects the zeal of the town authorities to make the most of this opportunity to restore their stricken municipality.

What holds for annual revenues also holds for annual expenditures. The trends in annual expenditures for Abuta and Toyoura are shown in Figure 6. After the eruption, Abuta's expenditures rose sharply, while Toyoura's rose only slightly.

An itemized breakdown of expenditures reveals a notable rise in forward-investment expenditures by the town of Abuta after the eruption. Investment expenditures by the two towns are compared in Figure 7. For Toyoura, the trend is nearly flat. Abuta was at a lower level than Toyoura through FY 1976, but during the next three years it shot ahead of its neighbor to be almost double in terms of absolute amount. Abuta's positive outlook toward the future is apparent here as well.

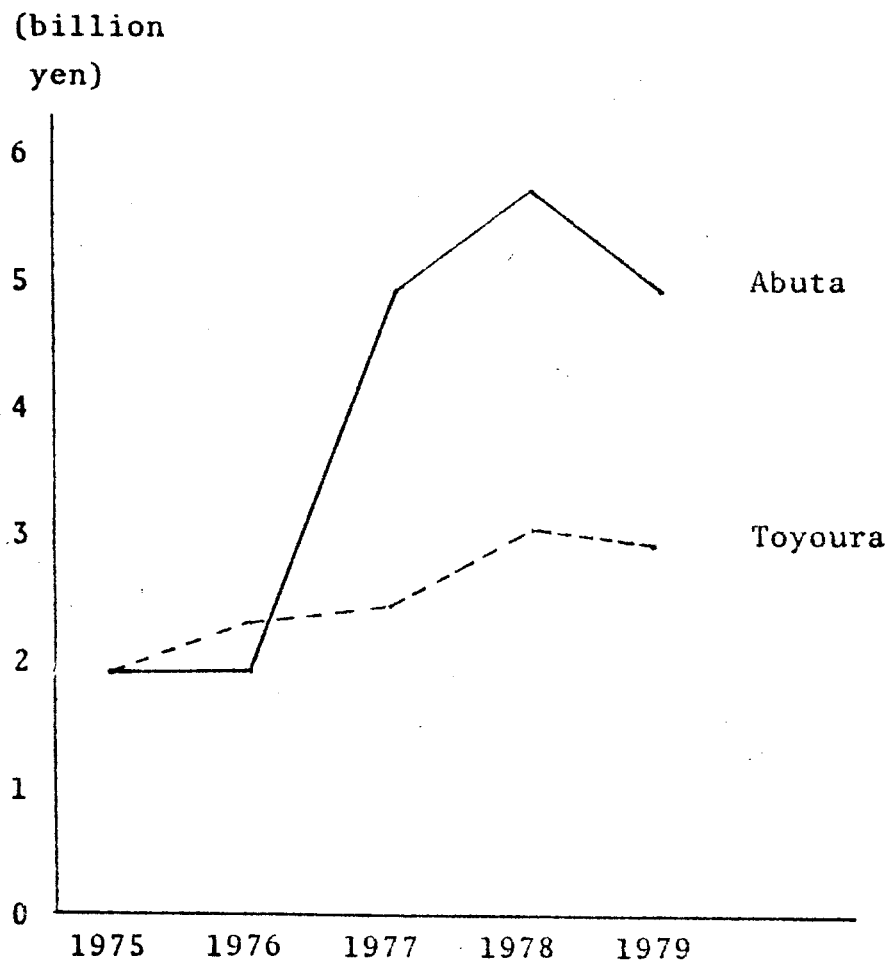


Fig. 4. Annual Revenues. for Abuta and Toyoura

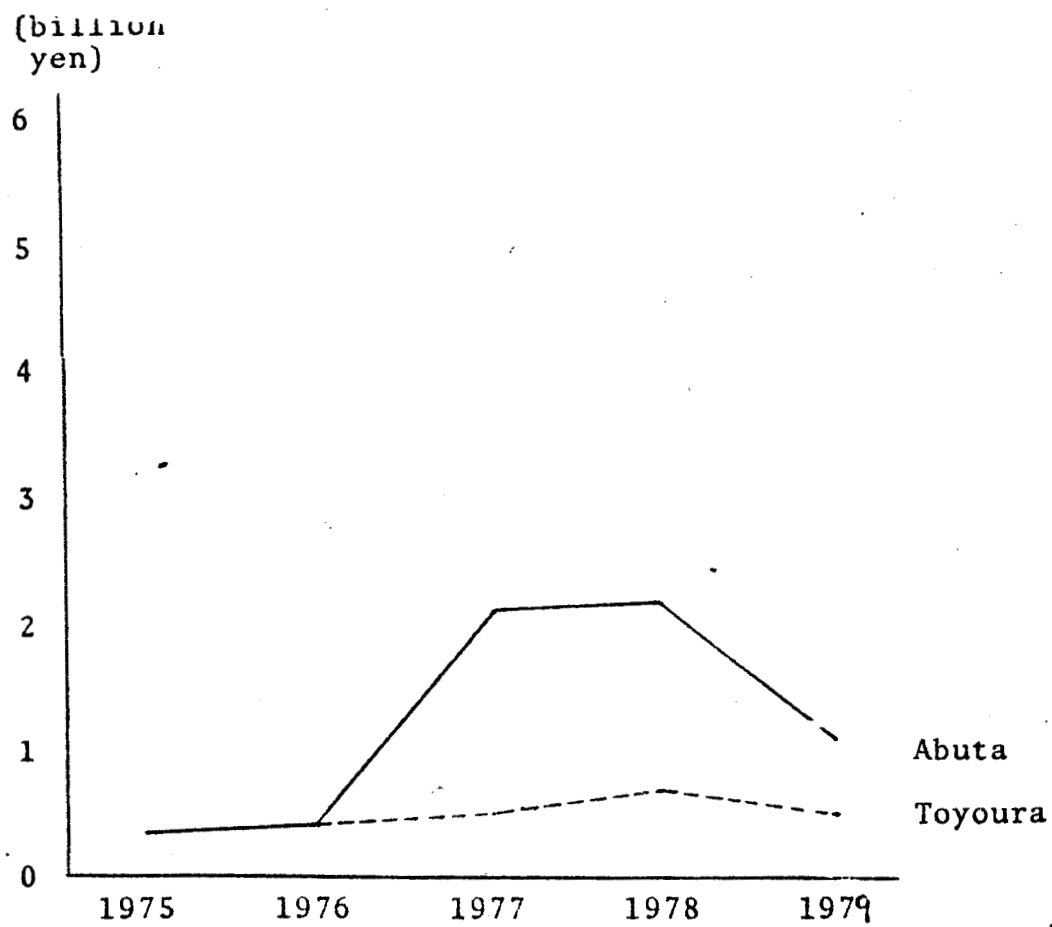


Fig. 5. Annual Disbursements from National and Prefectural Governments

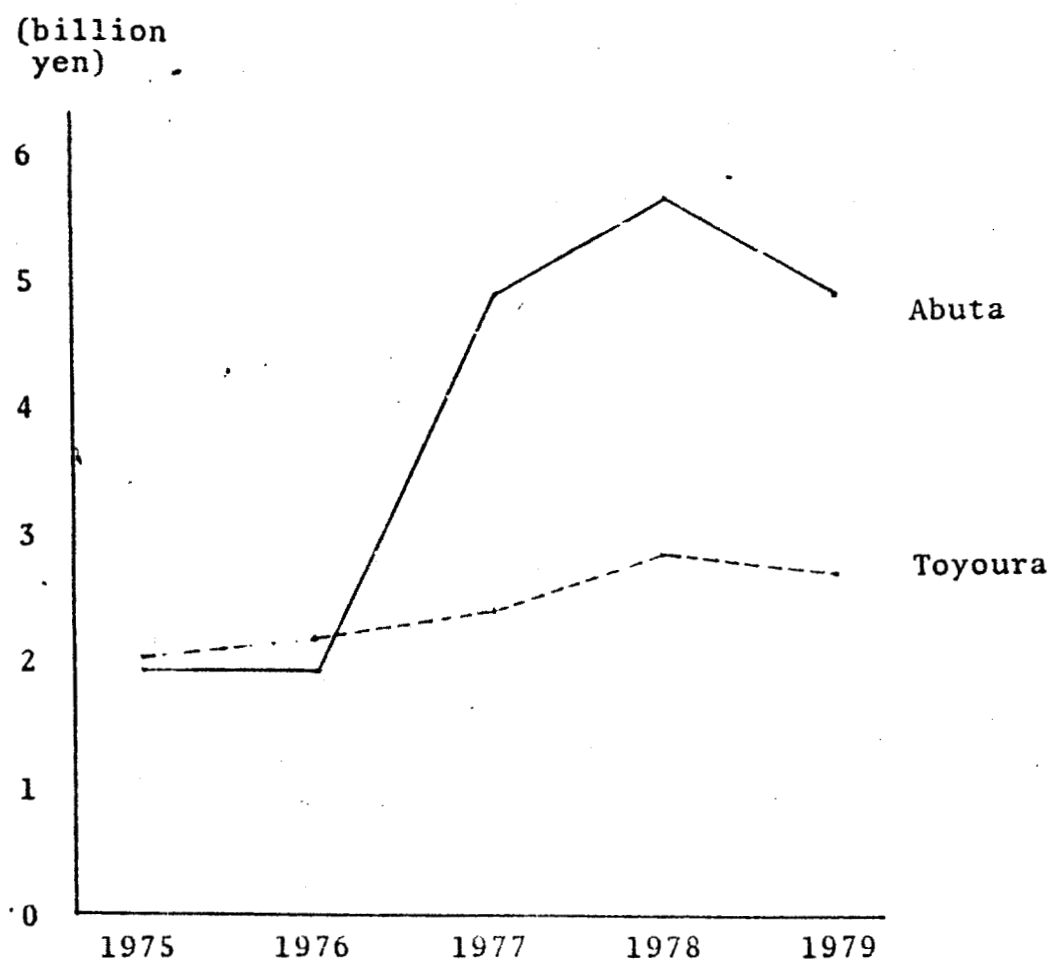


Fig. 6. Annual Expenditures for Abuta and Toyoura

(billion
yen)

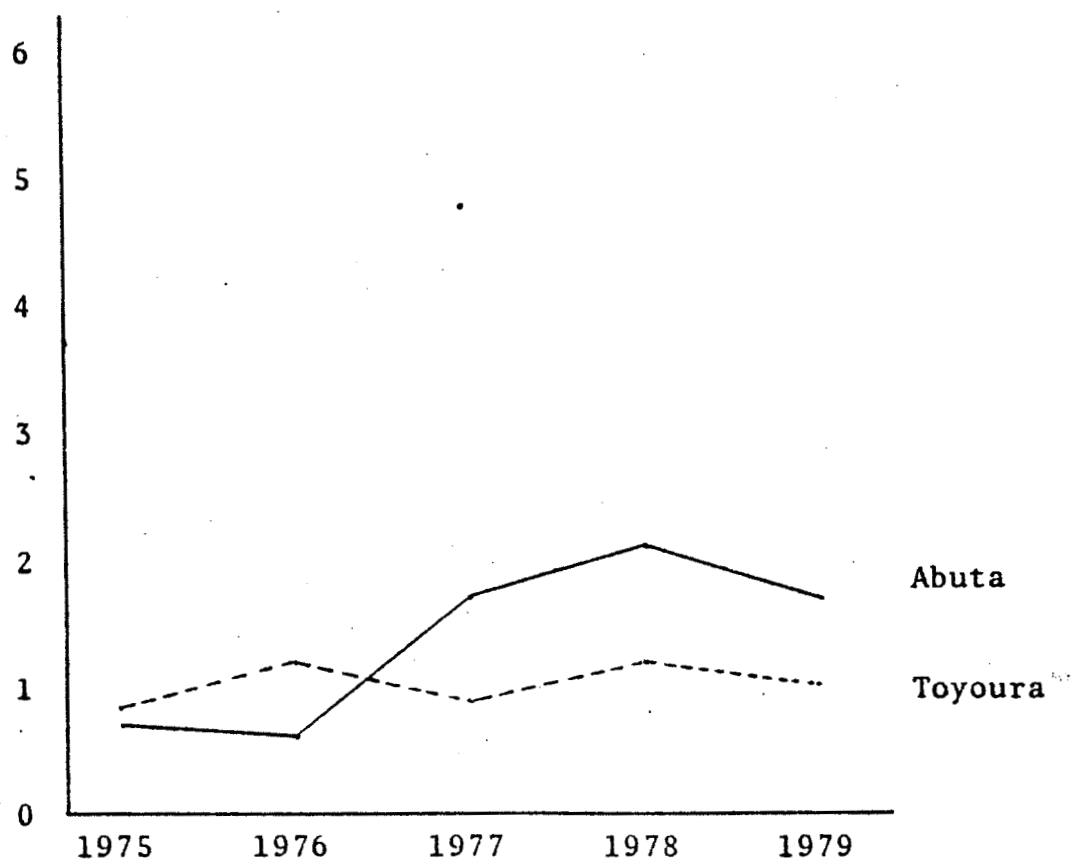


Fig. 7. Investment Expenditures by Abuta and Toyoura

Society after the Disaster

The proceeds of community recovery includes more than the external face-lift represented by a temporary construction boom. The disaster brings about changes in the community's social environment, and how it reacts to these changes is also important. It is too early for a complete assessment of the long-term effects of the eruption of Mt. Usu on Toyako-Onsen, but their general outline can be sketched with a fair degree of certainty.

Figure 3 shows the annual number of visitors (counting both day and overnight visitors) to Toyako-Onsen from FY 1963 to FY 1980. Through FY 1970 the figure was steady at about 2.5 million, but then it began to rise, peaking at well over 3 million in FY 1973 and FY 1974. This peak was followed by a slight downturn, then a major drop in the eruption year of 1977. After that, the curve shows signs of recovery, but by FY 1980, three years after the disaster, the number of visitors had yet to regain its 1970 level.

The question is not only of a decline in the number of visitors. Visitors to Toyako-Onsen from within Hokkaido predominate over those from outside Hokkaido by a ratio of roughly 2:1, and most of these Hokkaido visitors come from the Sapporo area, the administrative and economic center of Hokkaido. This area is about 120-130 kilometers from Toyako-Onsen. Due to road improvements, it is becoming increasingly easy to make day excursions from there, and the number of day visitors to Toyako-Onsen is rising while the number of overnight visitors is decreasing. A more serious problem is the dangerous reputation Toyako-Onsen gained among the many people, including teachers leading groups of graduating schoolchildren,* who had to cancel their reservations during the 40 days after the eruption in which entry by visitors was forbidden. Adding to this reputation have been continued volcanic activity and crustal movements and the danger of mud flows such as the one that killed three people in 1973. The idea has grown up among tourists and travel agents that, while Toyako-Onsen is a good place to go to view an active volcano, it would be better to spend the night somewhere safer.

This has naturally meant economic difficulties for hotels and inns. A struggle between the large hotels and the small inns has begun for larger pieces of the shrinking tourist "pie." The dog-eat-dog situation in the Toyako-Onsen tourist industry described by Hirose et al. (1973) a year after the eruption has become even more serious today.

Most of the hotels and inns are using funds intended for recovery or operating capital to pay off debts to the government or banks.

* It is customary in Japan for students in their last year of primary, junior high, and senior high school to be taken on a two- or three-day group trip by their teachers.

(million)

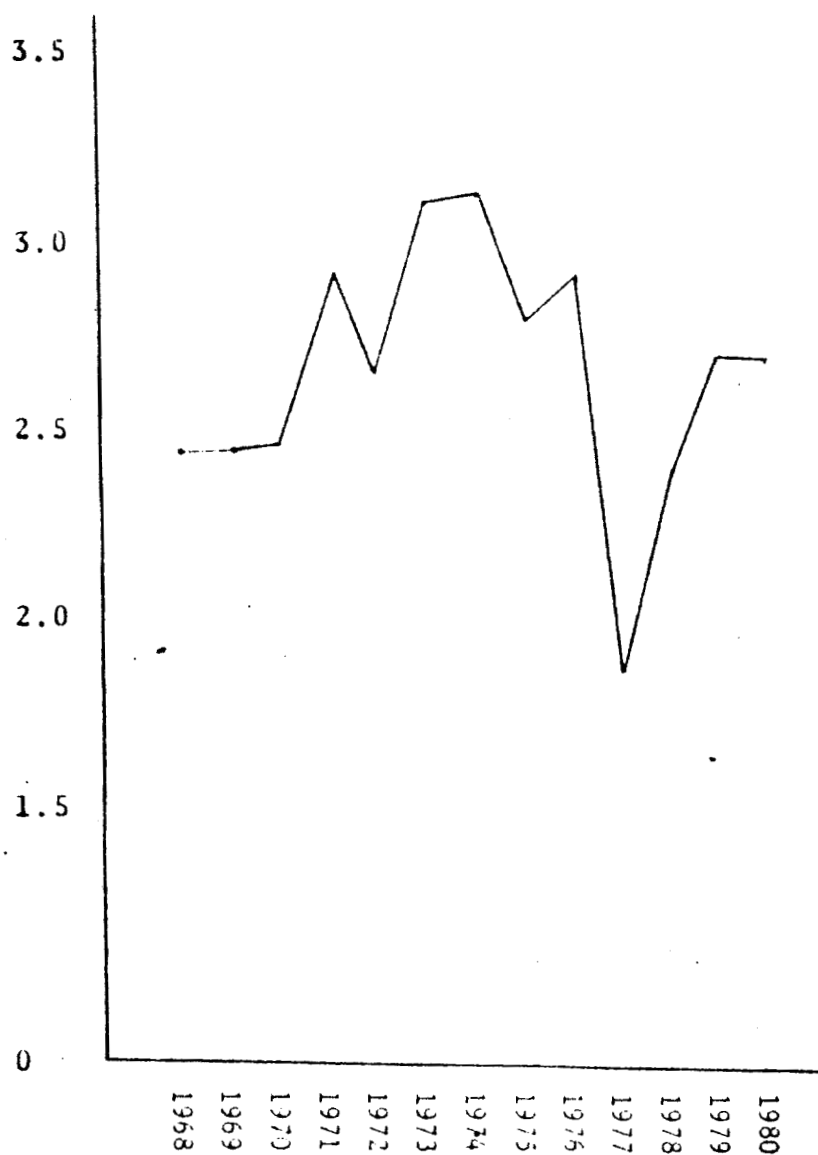


Fig. 8. Annual Number of Visitors to Toyako-Onsen

Source: Compiled from data provided by Hokkaido Prefectural Office.

Large hotels and inns are said to be generally about ¥200 million in debt. Repayments began to fall due this year, following the three-year grace period after the eruption. Some small inns that have lost their school-group clientele to larger establishments and are in a particularly tight economic squeeze have resorted to rate-cutting. To increase their profits, large hotels and inns have been expanding their souvenir-shop and restaurant facilities, which adversely affects business at independent small souvenir shops and restaurants.

Figure 9 records the fluctuations in population for Toyako-Onsen from January 1977 to August 1981. Data are unavailable for the period from July to September 1977, as the town was too disrupted by the volcano for the authorities to keep accurate track of the population. Small seasonal variations are visible in the curve, but the main trend is a steady downward one. A large segment of the Toyako-Onsen population consists of employees of hotels, inns, souvenir shops, restaurants, night clubs, bars, and the like. The down-sloping curve of Figure 9 indicates a steady departure of these people for greener pastures elsewhere.

A realignment of the tourist industry at Toyako-Onsen is already in progress. The Toyako-Onsen Tourism Association, sensing that their town had arrived at a turning point, asked a large consulting firm for advice on future policy, and received a draft report in September 1980. To redevelop Toyako-Onsen into a modern resort area, the report recommended four basic measures: (a) construction of attractive lodging facilities suited for a diversified clientele; (b) addition of a hot-spring pool, tennis courts, nature walks, and other sports and recreational facilities so that visitors would not lack for activities; (c) creation of a warm, hospitable atmosphere befitting a hot-spring resort; and (d) provision of facilities combining the hot spring with modern medicine. Although there was some criticism of the report as being an unrealistic pastiche, the Tourism Association has taken the position that there is no other effective way to halt the decline in overnight visitors that has continued since the eruption.

Social Change in a Forgotten Town

One index of the degree of general public interest in a subject is the extent to which it is taken up by the mass media. This is usually measured from newspapers, since radio and television are somewhat inconvenient to quantify. The frequency and amount of coverage relating to the eruption of Mt. Usu in a local, regional, and national newspaper are shown in Figure 10. The local newspaper is the Muroran Jimpo, which covers events in the county that includes Toyako-Onsen. The regional newspaper is Hokkaido Shimbun, which has an extensive readership throughout Hokkaido. The national newspaper is Japan's top-ranked Asahi Shimbun. Figure 10 shows the frequency of coverage on Mt. Usu in these three newspapers in semi-monthly periods. The reason that the graph shows less reporting in the first half of August in 1977 than the second is that the eruption occurred on August 7 and there

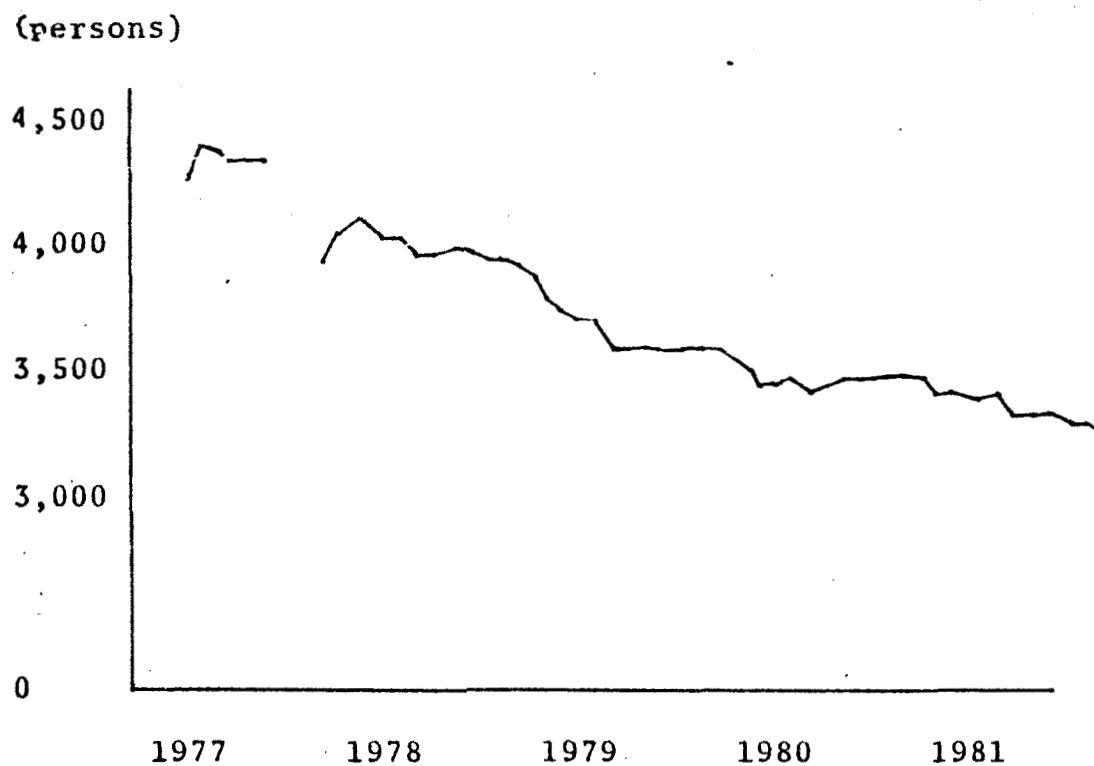


Fig. 9. Population of Toyako-Onsen by Month

Source: Toyako-Onsen Branch of Abuta Town Office.

(times)

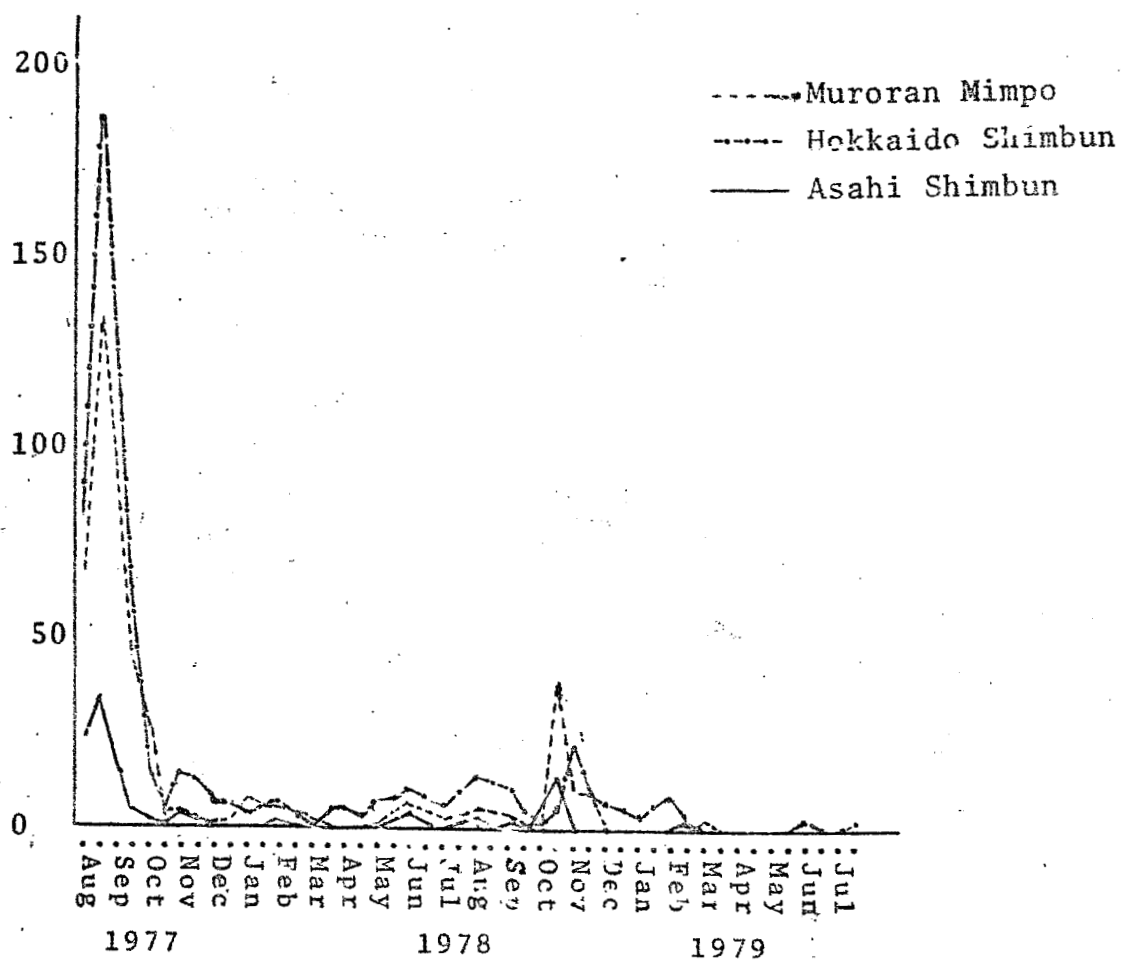


Fig. 10. Coverage of Mr. Usu in Three Newspapers

were thus only nine days in the first half of the month during which it could be reported.

At first the eruption was reported on most frequently in the Hokkaido Shimbun, next most frequently in the Muroran Mimpo, and rather less frequently in the Asahi Shimbun, but in all three newspapers the frequency of coverage declined rapidly. One year after the eruption, coverage was at a very low level, although the Volcanic Eruption Early Warning Group had not yet declared the volcano safe. A minor peak appeared in October and November 1978 due to the mud flow that killed three people toward the end of October, but coverage was almost completely absent from all three papers in 1979. The proclamation of the Volcanic Eruption Early Warning Group that "The activity of Mt. Usu is subsiding and the danger is past" came in February 1979, but the mass media and general outside interest had subsided long before the volcanic activity.

Figure 11 shows the coverage as measured in square centimeters. In contrast to the frequency graph, Figure 11 shows the Muroran Mimpo leading the Hokkaido Shimbun by a wide margin, but, as before, the amount of coverage declined rapidly in just three or four months. Soon even the local newspaper, which is extremely sensitive to local news and interests, had fallen virtually silent on the subject. The other newspapers, of course, abandoned it even more quickly.

As long as the outside society's attention remains focused upon it, a disaster-stricken community can expect to keep receiving infusions of political, economic, and other resources, but as the level of interest drops, so does the level of assistance. Another drop in outside assistance comes when the damaged community has completed the process of outward repair, as seen in Figure 5. Ultimately, the community must finish the recovery process on its own. Whether it is able to do this or not depends upon its latent vigor and collective ability.

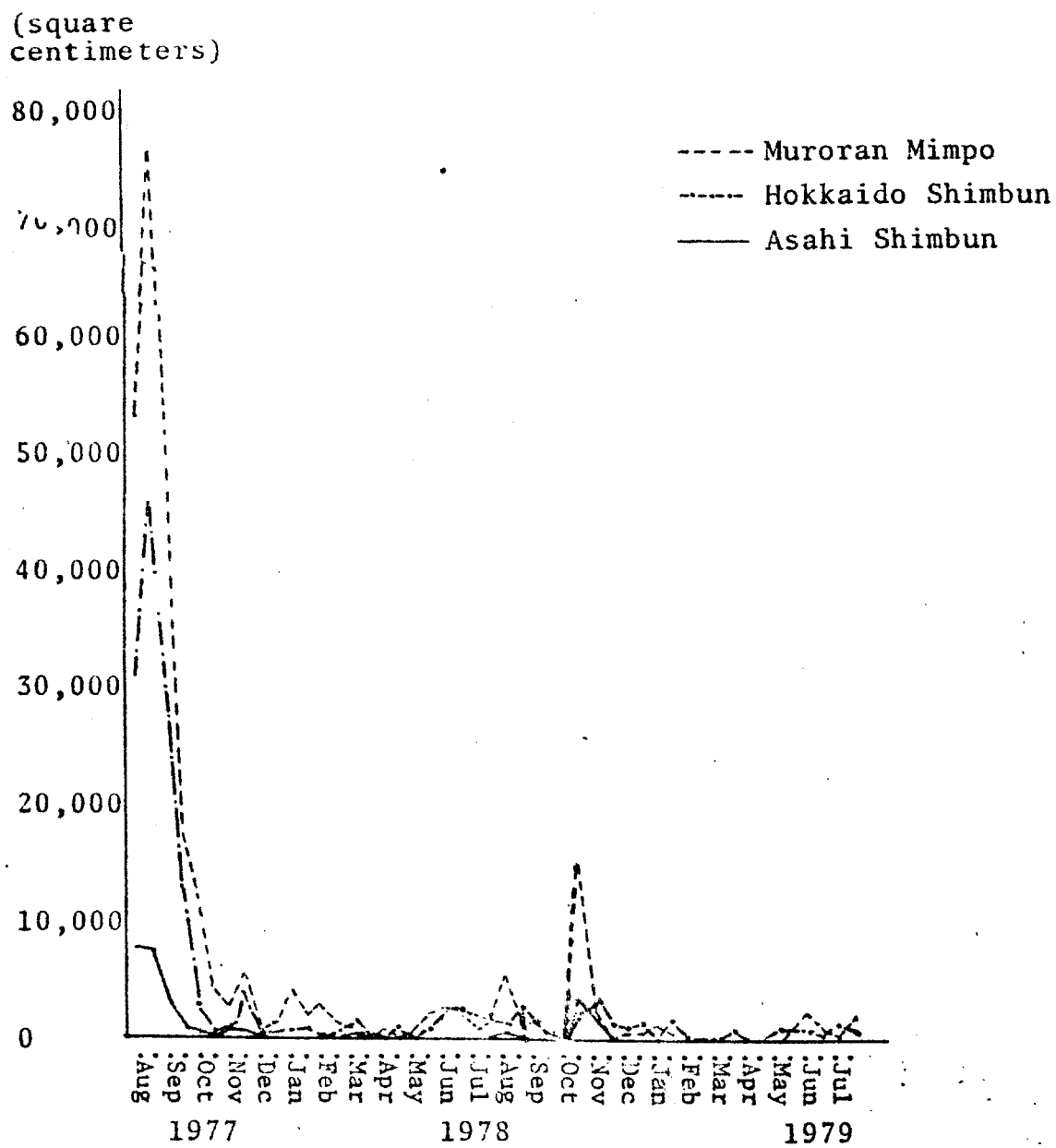


Fig. 11. Coverage of Mt. Usu in Three Newspapers

CONCLUSIONS

The author has described the long-term effects of a major fire that swept the central part of Sakata, a medium-size city in the northeast of Japan, in another paper as follows: "After recovery, the damaged area is forced to make a new adaption to its external environment. During the time while the community's functioning is halted by the disaster, the role it had played in society at large is taken over by other communities. An exchange of roles, or a functional substitution, takes place." (Hirose, 1981)

The same could be said of Toyako-Onsen. Because it was one of the outstanding tourist areas in Japan and suffered severe damage from the eruption of Mt. Usu, vast quantities of resources were donated after the eruption by the national, prefectural, and municipal authorities and the residents of Toyako-Onsen itself, and recovery from the disaster was extremely rapid; but the eruption altered the role Toyako-Onsen played in relation to its external society. The disaster marred its prestige. The volcano set the community back to the same starting line as other similar communities. Hokkaido has a large number of tourist areas which compete with each other for the tourist trade. Several of these areas are at an advantage for one reason or another, and Toyako-Onsen had been one of these favored locations. The eruption of Mt. Usu robbed Toyako-Onsen of its advantage, and its tourists vanished to other areas such as Noboribetsu-Onsen. This type of change is irreversible; even after Toyako-Onsen had become safe again, the tourists did not return. However, through the process of recovering from the disaster, another change took place. Toyako-Onsen was transformed by being refurbished as a modern resort area. Although it must now enter the competition for tourists at the same level as other areas, the various new resources which it derived from the recovery process will undoubtedly give it a competitive advantage.

Disasters also have serious effects on individual people (Erickson, K. T., 1976; Stern, G. H., 1977), but the question of such effects has been omitted from the present discussion, which makes use mainly of aggregate data to analyze the effect of the eruption. The author feels confident that the disaster's impact can be adequately traced in the aggregate data alone (Friesema, H. P., et al., 1979; Wright, J. D. et al., 1979).

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