Preface

This Database of Earthquake Precursors is one of the products of the five-year project, carried out from 1984 to 1988, titled "A Study on Prediction of Destructive Intraplate Earthquakes". The Database consists of a precursor file, an earthquake file and a reference file, with brief comments at the beginning.

Some such databases as this have already been published by other scientists (Rikitake, 1976, 1986 ; Niazi, 1983 ; Hamada, 1987). They included in their respective bases the statistical results such as relationship between earthquake magnitudes and time durations of precursors, or between earthquake magnitudes and the maximum distances within which earthquake precursors are observable.

Besides these databases there is a precursor compilation by the Shizuoka Prefectural Office (1985). A successful earthquake prediction is most needed for this prefecture and its neighbors, where a big interplate earthquake is predicted to be imminent. In fact, most countermeasures in Japan are taken with this expected earthquake in view.

In spite of these predecessors, we worked on a similar database again. Our standpoint is, however, rather different from the others'. First, we could not be indifferent to moderate earthquakes which might occur right below populated areas. They might cause no less damage than big earthquakes. Second, we intended our database to be a tool for the JMA's (Japan Meteorological Agency) duty service for earthquake prediction in future, although the service is now limited to the predicted earthquake stated above.

As one step toward a practical prediction, we should reexamine which of the large number of reported precursors are real, and which can meet the requirements of practical use. With our present knowledge, however, it is not an easy task to ascertain which precursory phenomenon is a real one. What we can say is, at most, whether a certain phenomenon reported as a precursor is reliable or not, judging from the description and/or figures in the reports.

There is no doubt that precursory phenomena have very much to do with the occurrence of an earthquake itself. It is indispensable not only for predicting earthquakes but elucidating the whole earthquake phenomena to get a sufficient knowledge of earthquake precursors. Properly speaking, an earthquake, its precursors and its after-effects should be brought together on a common ground.

Wyss (1989) proposes quite a number of criteria, any of which has to be satisfied by any given precursor. His criteria are severely strict. All of his criteria, of course, have been taken into accounts, though not together, in our evaluting the reliability of the collected precursors. From a practical point of view, however, they are so strict that almost all that have been reported as precursors would fail to come up to them.

In the present study, all precursors were classified into three ranks, 1, 2 and 3. The smaller the rank number, the higher the reliability. The criteria by which the ranks were determined were left to each evaluator who was responsible for each observation such as geodetic observation, seismic observaion, observation of crustal deformation. The criteria for the respective observations are described in the first part of this Database. We should have set common criteria for all observations, but we could not do so because of so many different methods of observation and analysis.

As a result, the supreme rank (rank 1) was given to 8 percent of the total precursors, about half of which were foreshocks. The result was not an unexpected one, being only a little short of what had been expected. There are, however, some difficulties for practical prediciton. Almost all precursors reported, including foreshocks, were not recognized as such prior to the main shocks.

If not recognized prior to an earthquake, a precursor would be of no use to practical prediction. Precursors should be such that they can be used to calculate, for example, the probabilities of future earthquakes. We have been making efforts to gain the know-how of prediction on the basis of the data which we counted reliable. It should be said that we have taken the initial steps rather than that we have gone a long way to the destination.

Our Database is not nearly perfect. The criteria of reliability that each of us had are very subjective. Moreover, we have in most cases consulted only original papers and reports, not communicating directly with their authors to confirm their statements. So we have decided not to publish the reliability ranks thus determined. However, several figures in this Database will help to understand our criteria for determining the reliability. Various figures which show the statistical relationships among various quantities concerning the given precursors are given in the last part of this report. We wish the readers to glance over them as well as the numerical tables.

An important thing remains to be stated. All earthquakes in the present Database are those that had, at least, one reported precursor. Earthquakes without any reported precursors are not included. We are well aware of their importance and defect of our Database due

to their absence.   We are now examining such earthquakes which, if included, might occupy a large part of an earthquake file.   The result will appear in the near future.

Finally, we intend to improve this Database, for which we earnestly request the readers' criticisms and suggestions.