Marine Fine Aggregate Resources

Exploration, Evaluation, Exploitation, Environmental Impact & Regulation

Masafumi ARITA

Former Geological Survey of Japan, AIST

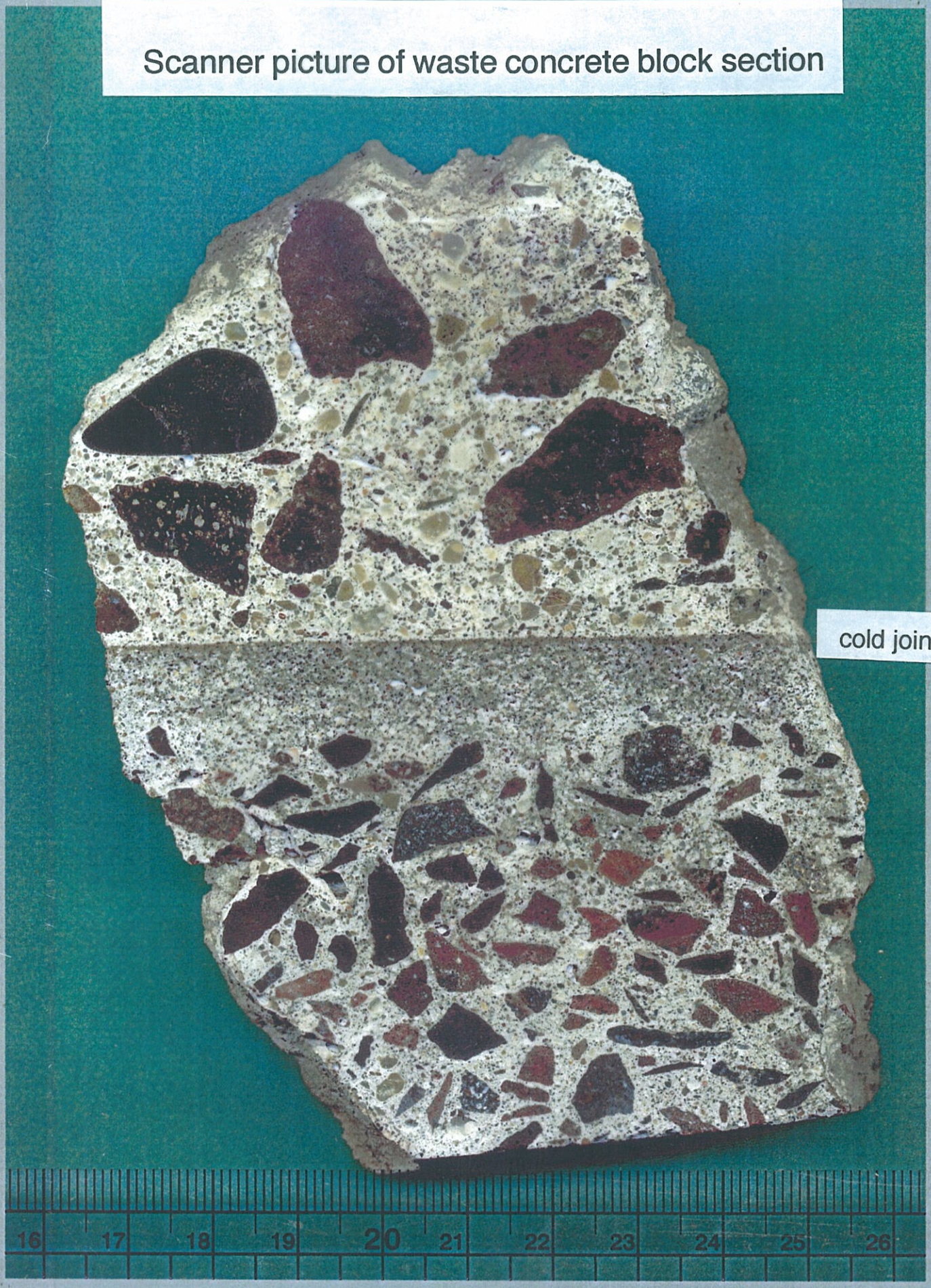
Abstract

Construction aggregate is a important resource for development of the infrastructure. Problems of land access, poor knowledge of environmental impacts, quality evaluation for the resource, and the need for material at the lowest cost contribute to significant extraction of sand and gravel from the fore- and near-shore and river plains resulting the significant coastal erosion and destruction of the coastal ecosystems. For sustainable development of the society, we must understand the suitable aggregate sources, resource potential and appropriate extraction methods under the enough knowledge on the technologies and methodologies for evaluation and extraction of marine aggregate.

Developments of fine aggregate resources and some problems in thier stable supply

by Dr. Masafumi ARITA
retired member of GSJ

Scanner picture of waste concrete block section



What is a concrete ?

A concrete is a solid body of cement, fine aggregate and coarse aggregate.

Row materials ratios of concrete are 1 of cement, 2 of fine aggregates and 3 of coarse aggregates , except waters.

Total aggregates occupy 83% in volume into concrete.

Change of Japanese society styles could not be completed without huge supply volumes of aggregates.

A concrete civilization is equal to aggregate civilization.

A safety using life of concrete constructions after built is generally considered 50 to 60 years.

Present concrete constructions such as building and traffic systems have a necessity of reconstruction in future.

Preservation of stable supply of aggregates is the most important problem in societies forming by concrete, not only past and present but also future.

If we could not solve this problem, many ruins of concrete constructions shall appear in future of the world. In the result, we should return to social style without concrete.

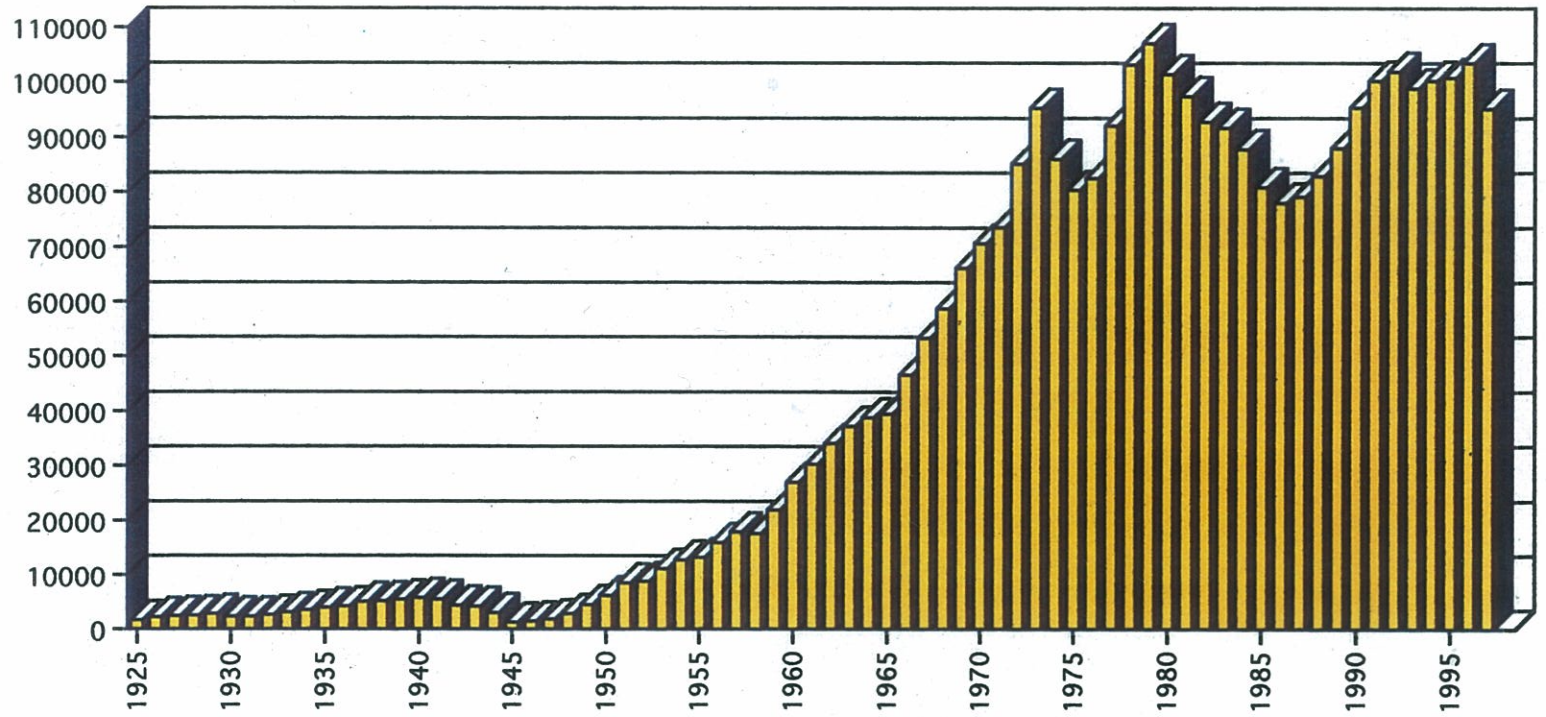
This is the true nature of the aggregate problem.

セメント用石灰石の出荷量

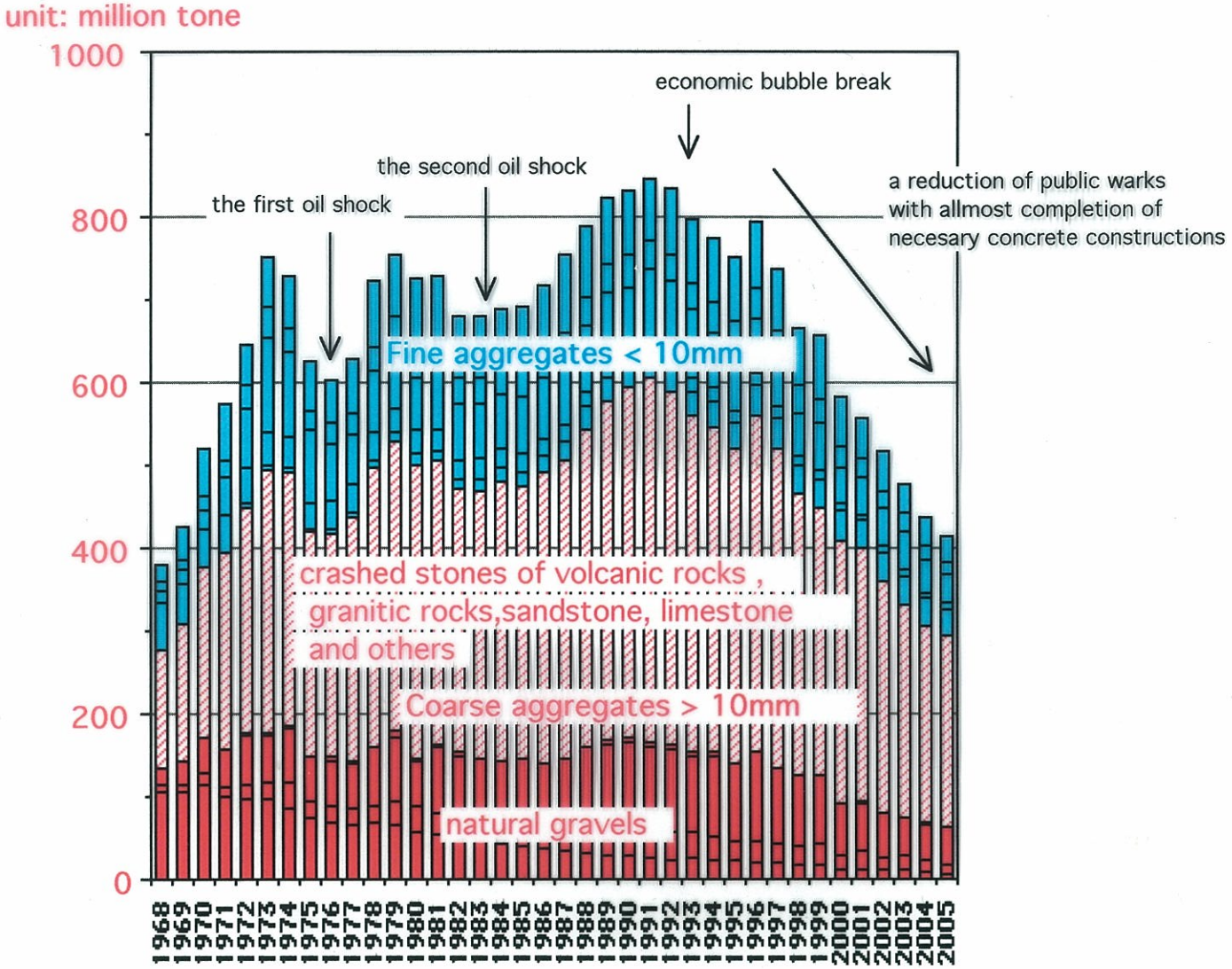
Limestone supplies for Cement production

unit:1000tons

千トン

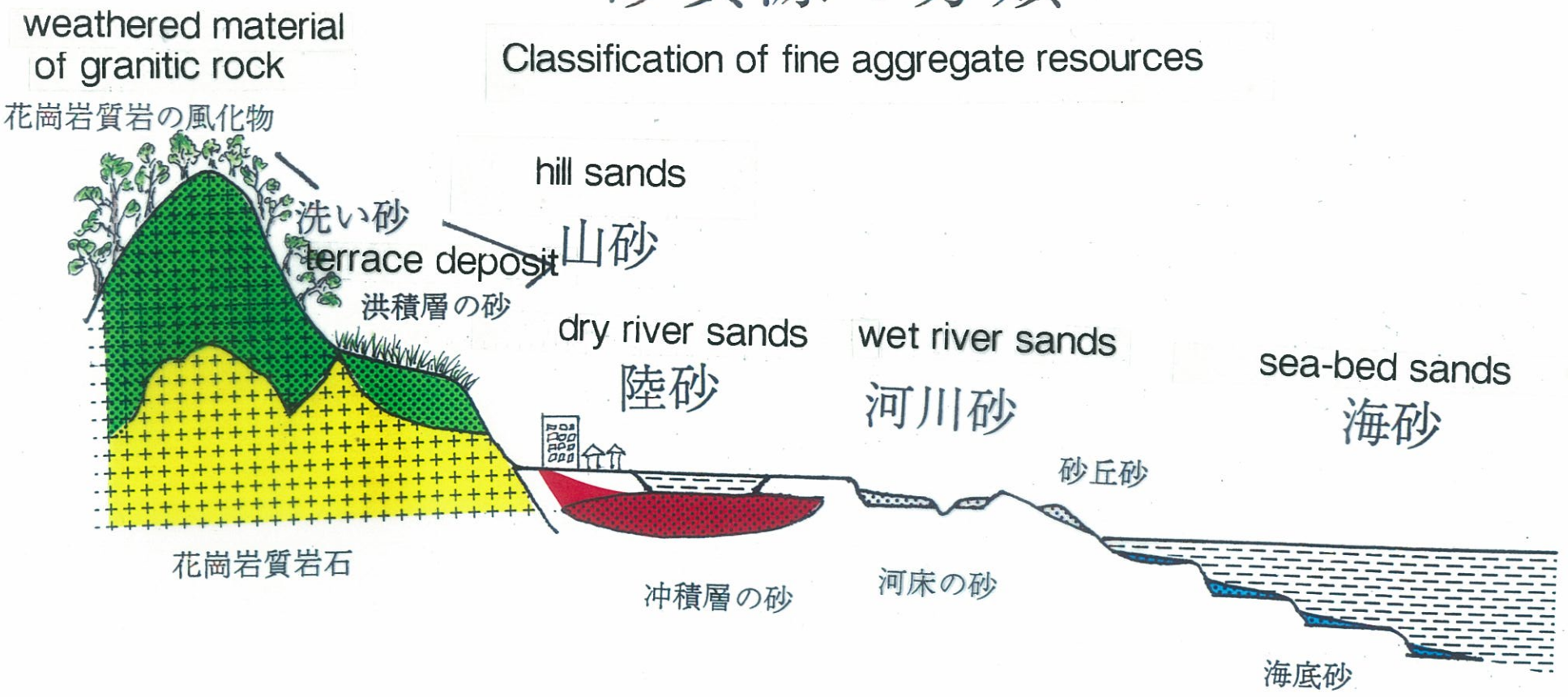


Aggregate Supplies in Japan ,1968 to 2005



砂資源の分類

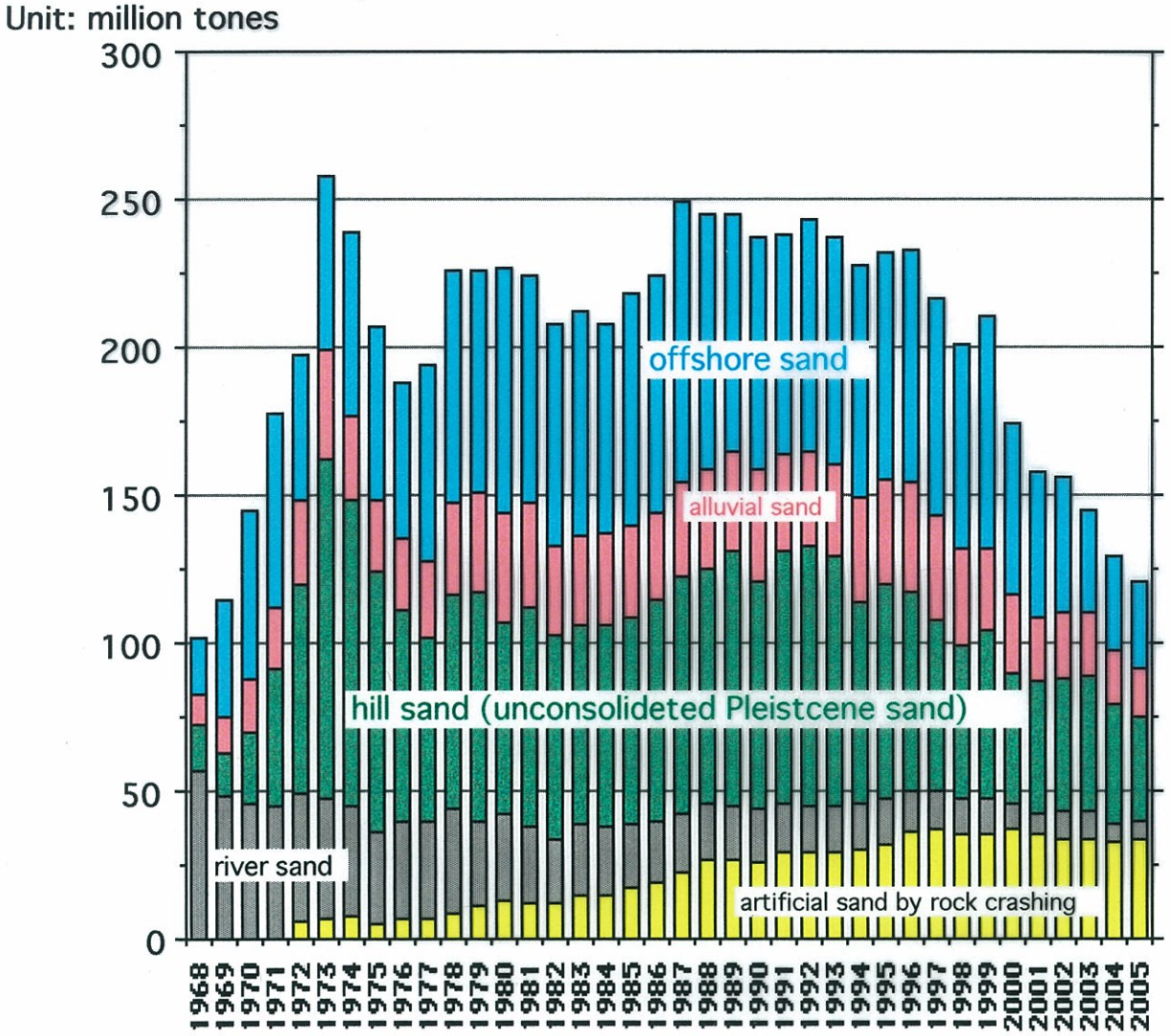
Classification of fine aggregate resources



開発の順序

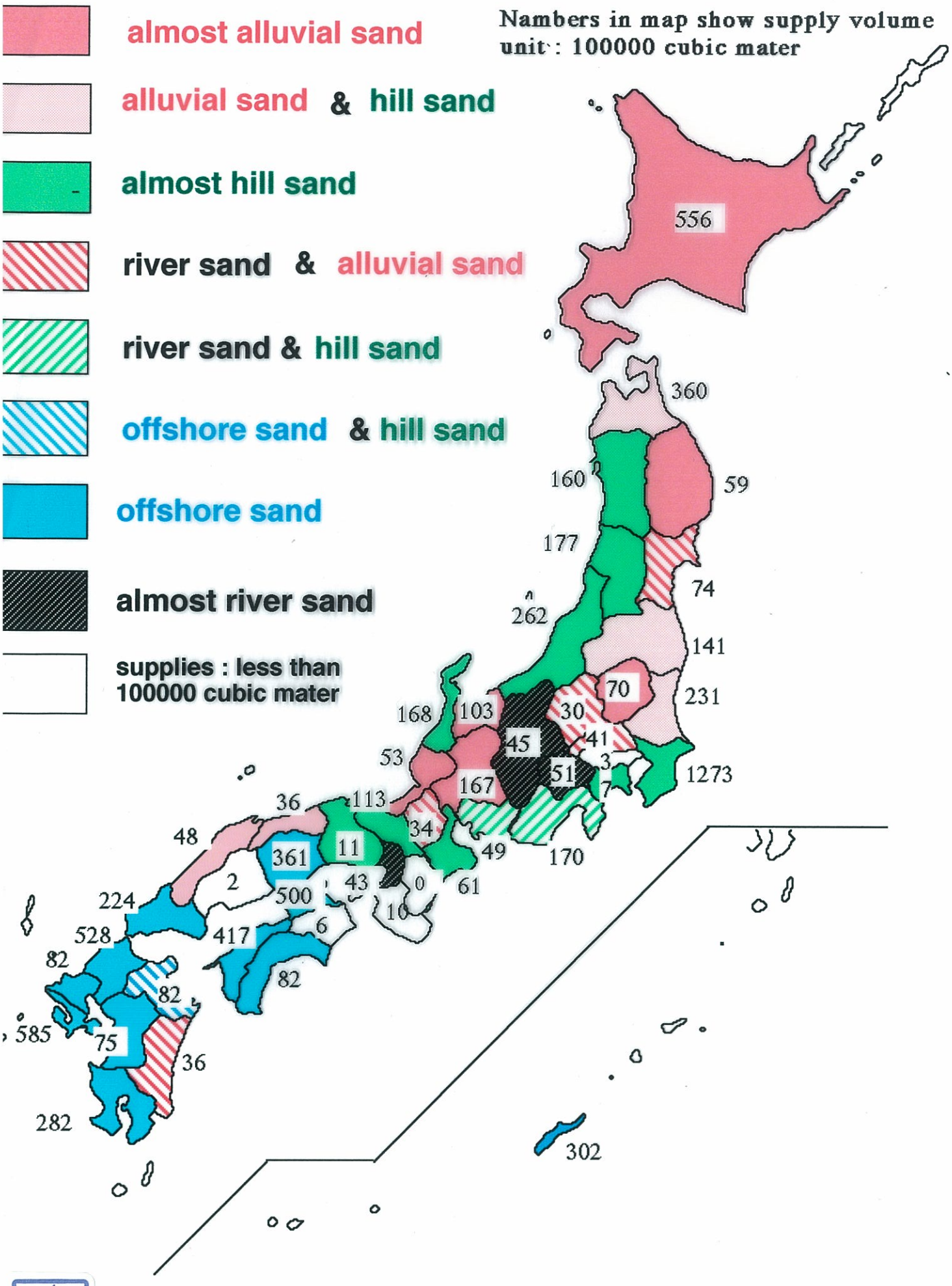
河川砂 ⇄ 山砂 / 陸砂 → 海砂 → 砕砂 → 輸入

Fine aggregates supplies for constrctions in Japan from 1968 to 2005

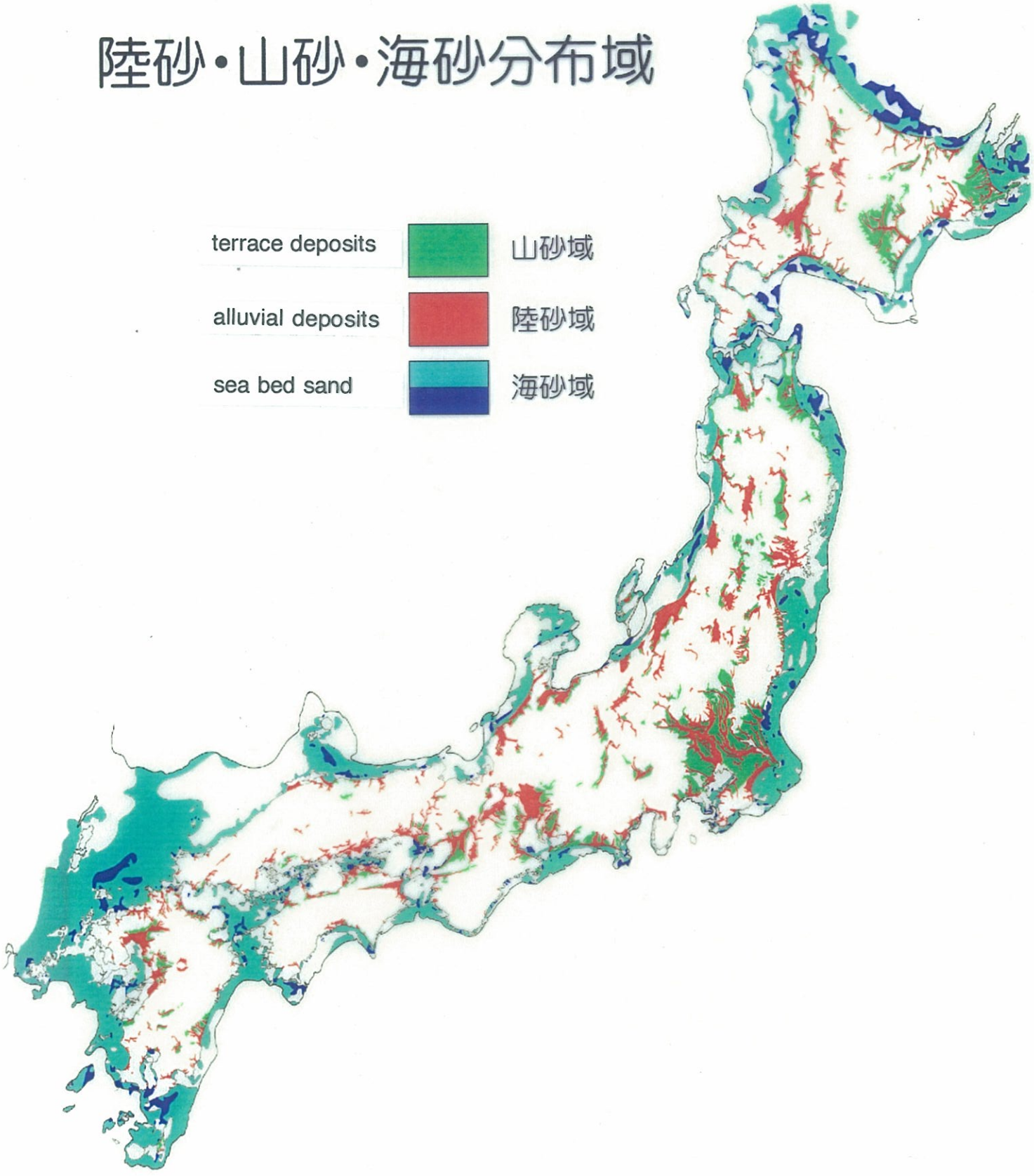


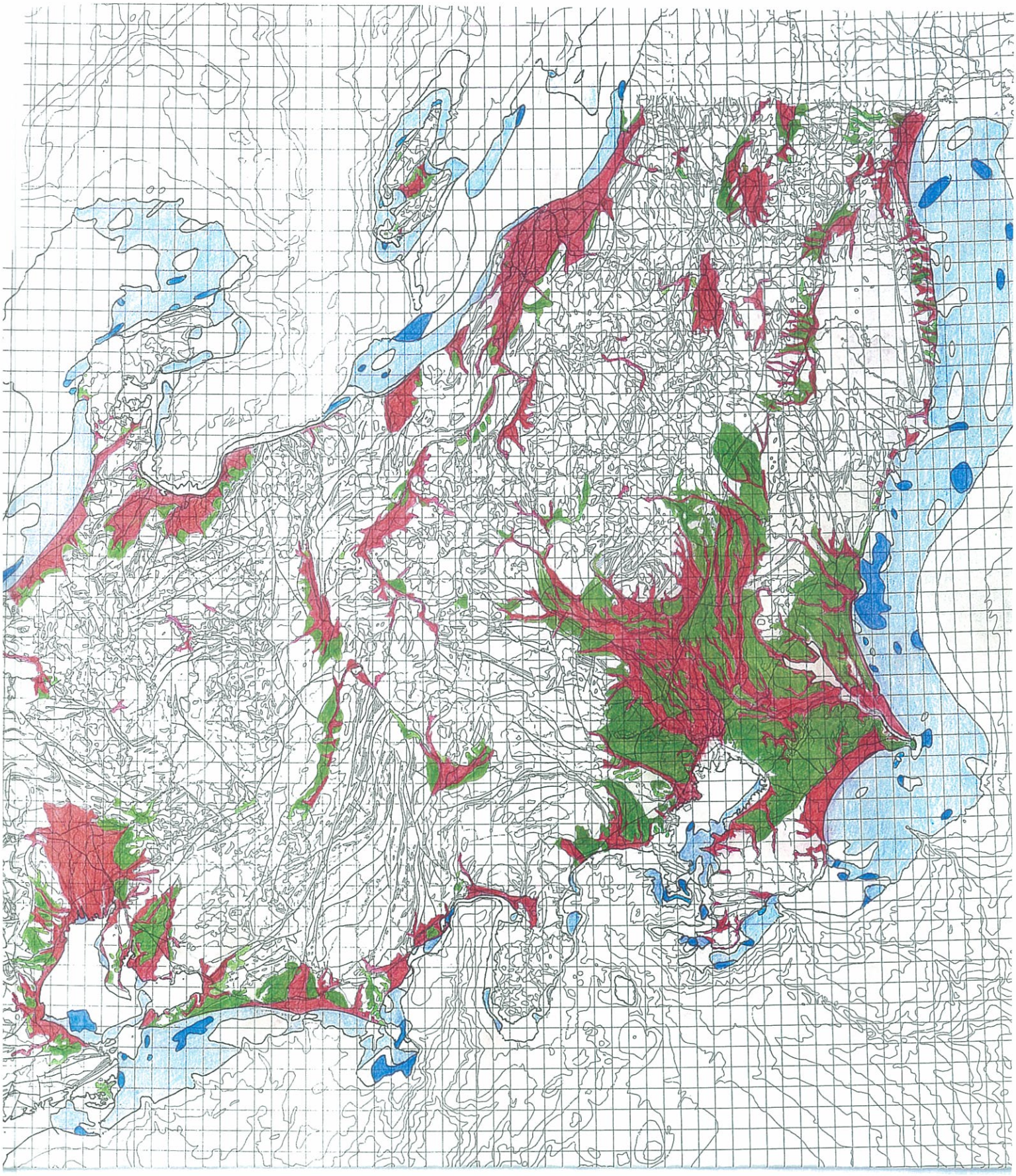
100 million cubic meters

Original resources of fine aggregate in each prefecture of Japan , 1997



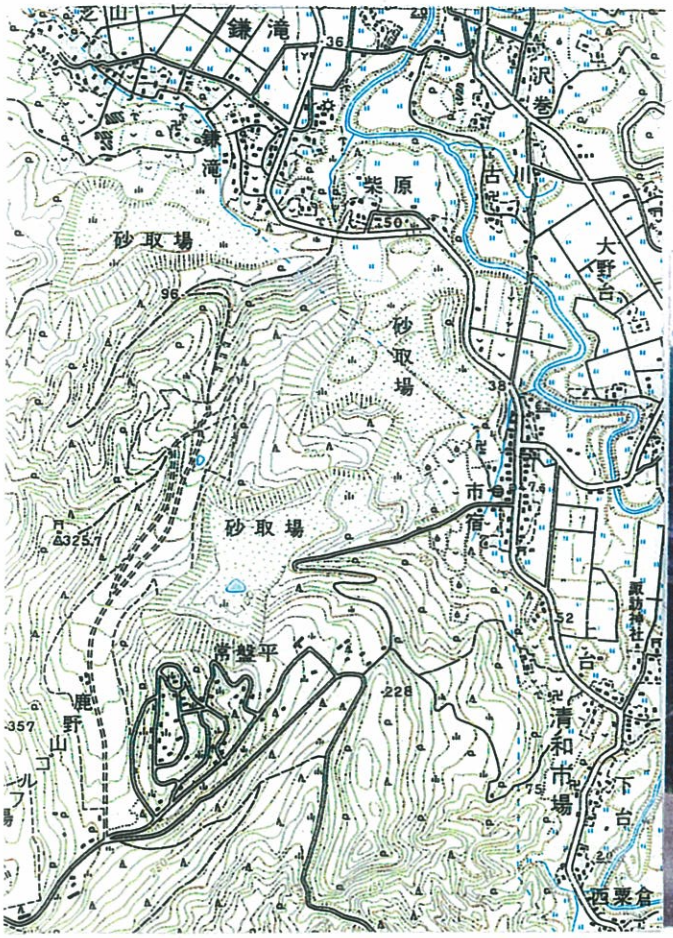
Potential areas of sand and gravel resources in Japan





地域F

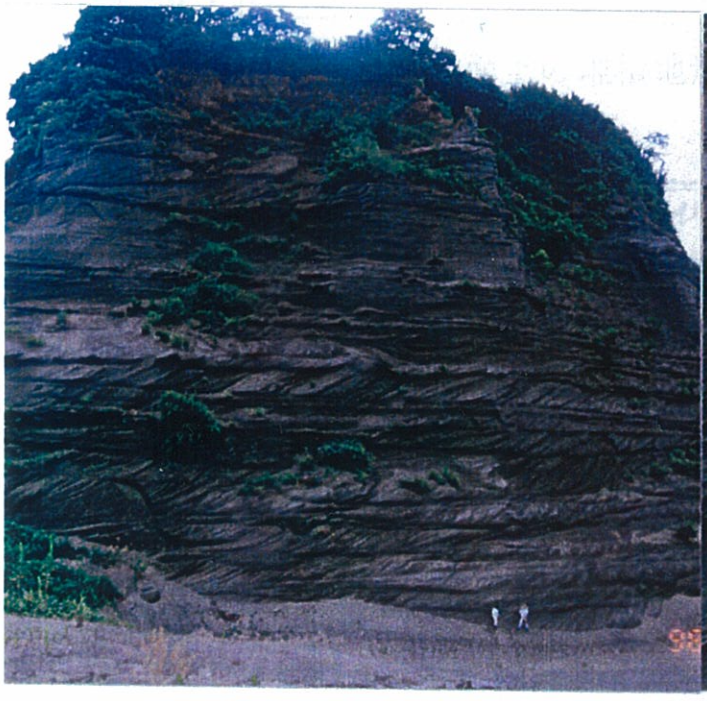
海底の砂丘（？）の化石，大規模斜交層理！？
—上総層群市宿層—



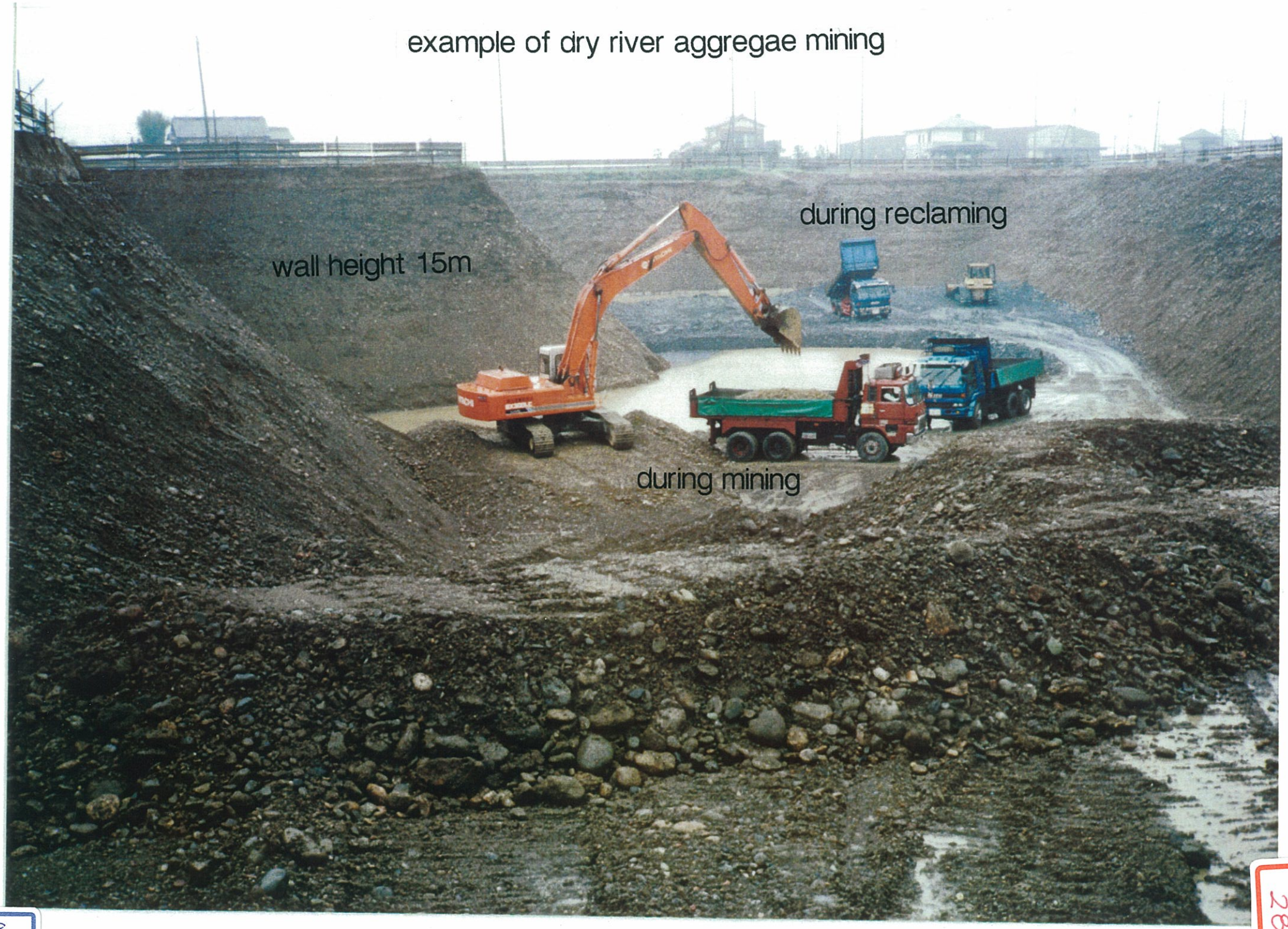
example of hill sand mining

流れ（古流向）にほぼ直交する
断面の模様（堆積構造）

流れ（古流向）にほぼ平行する断面の模様（堆積構造）
（流れの方向は，向かって右から左の方向）



example of dry river aggregae mining




reclaimed ground in original level
after aggregate mining

13

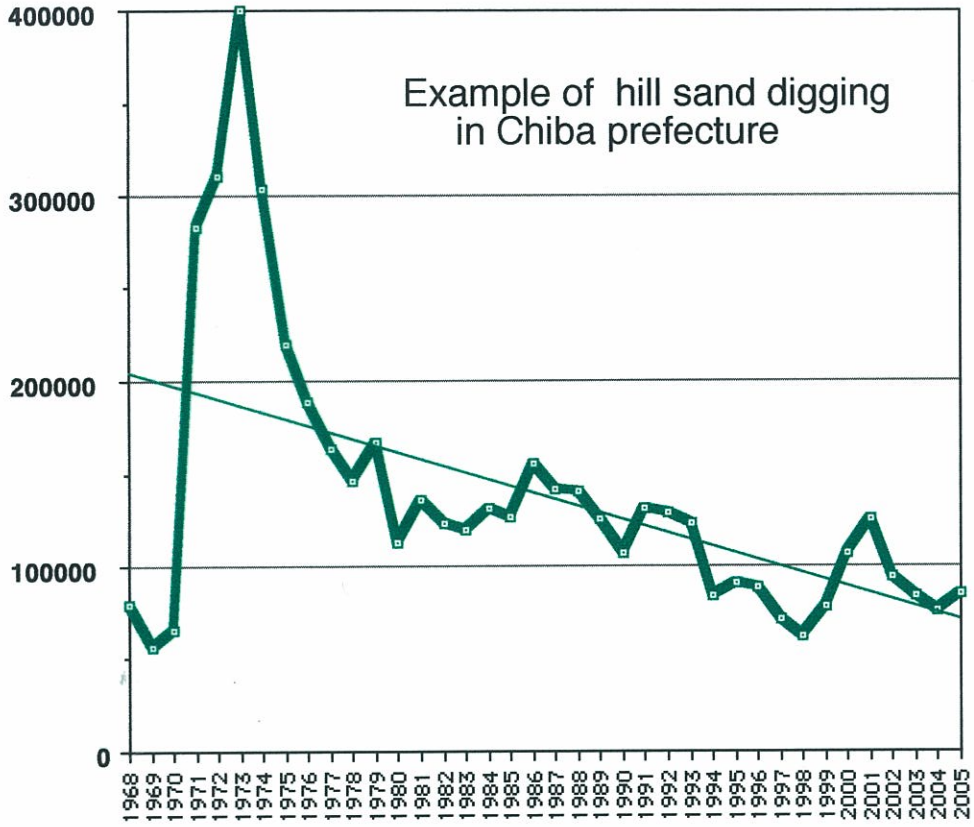
29

14

30

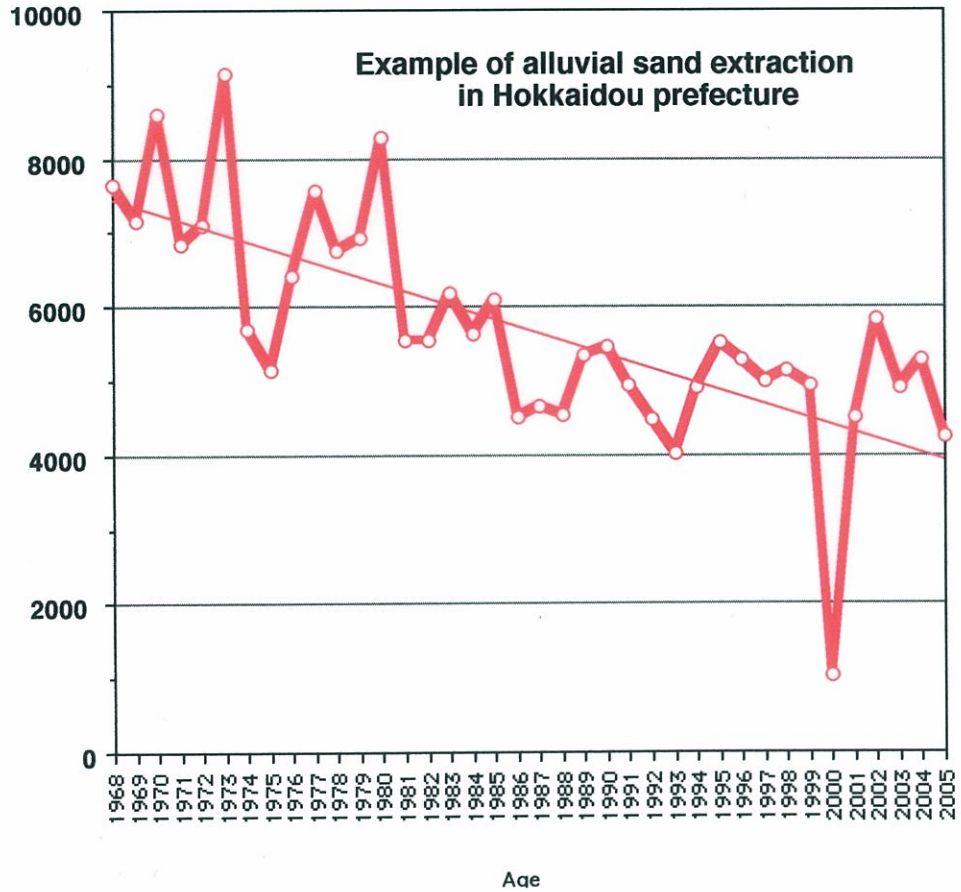
Potential change of fine aggragate supply in one digging site

unit : cubic mater

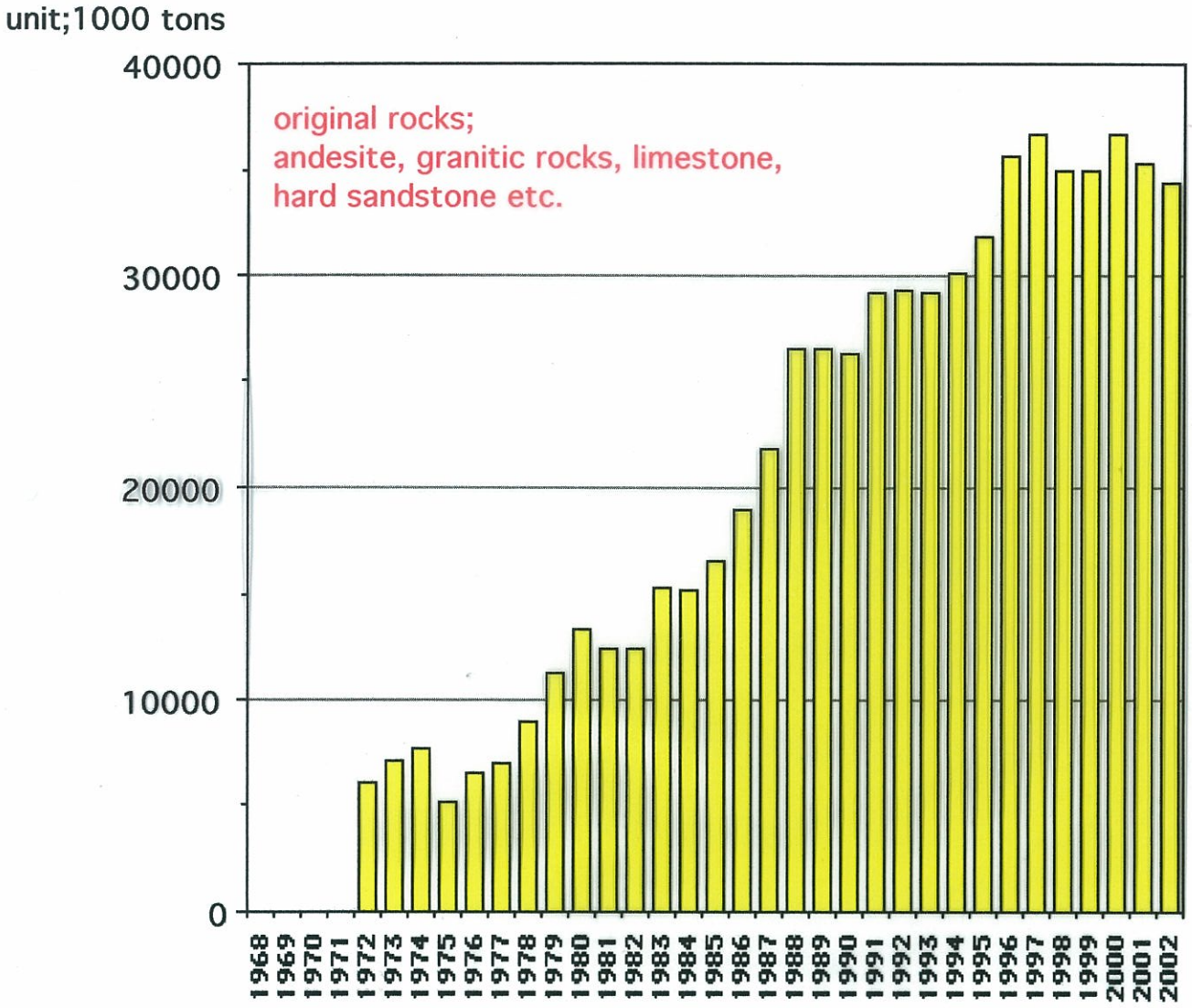


Potential change of fine aggregate supply in one extraction site

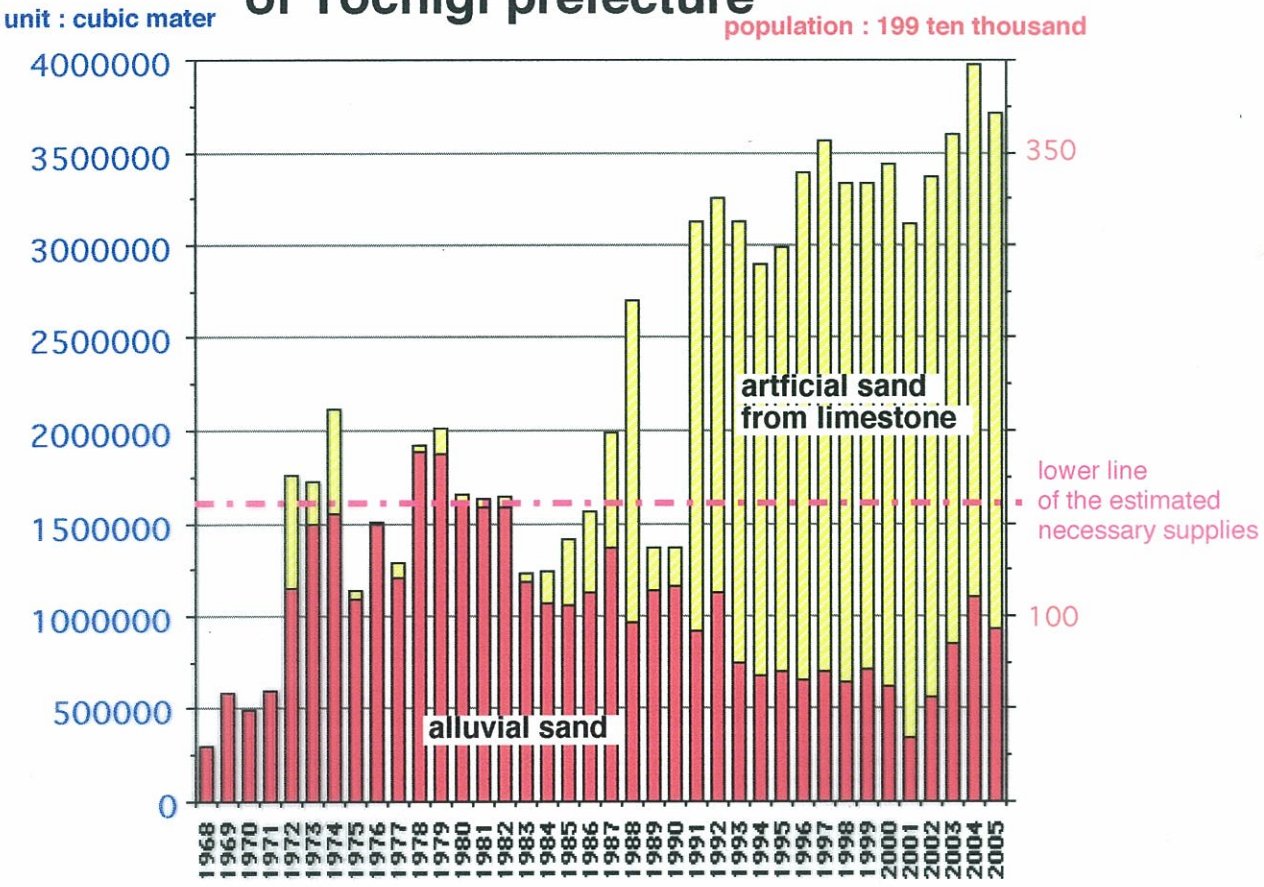
unit : cubic mater



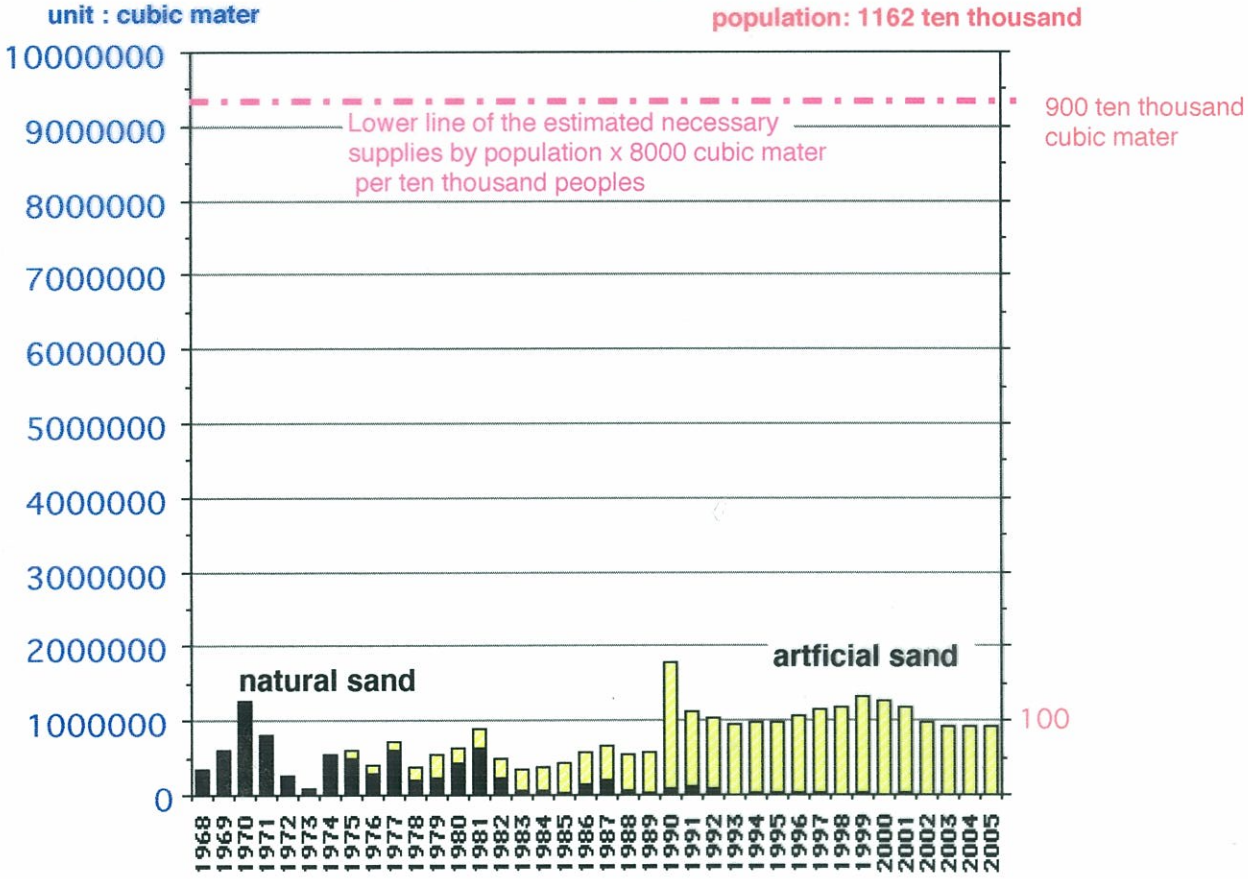
Artificial Sand Supplies by Rock crashing in Japan



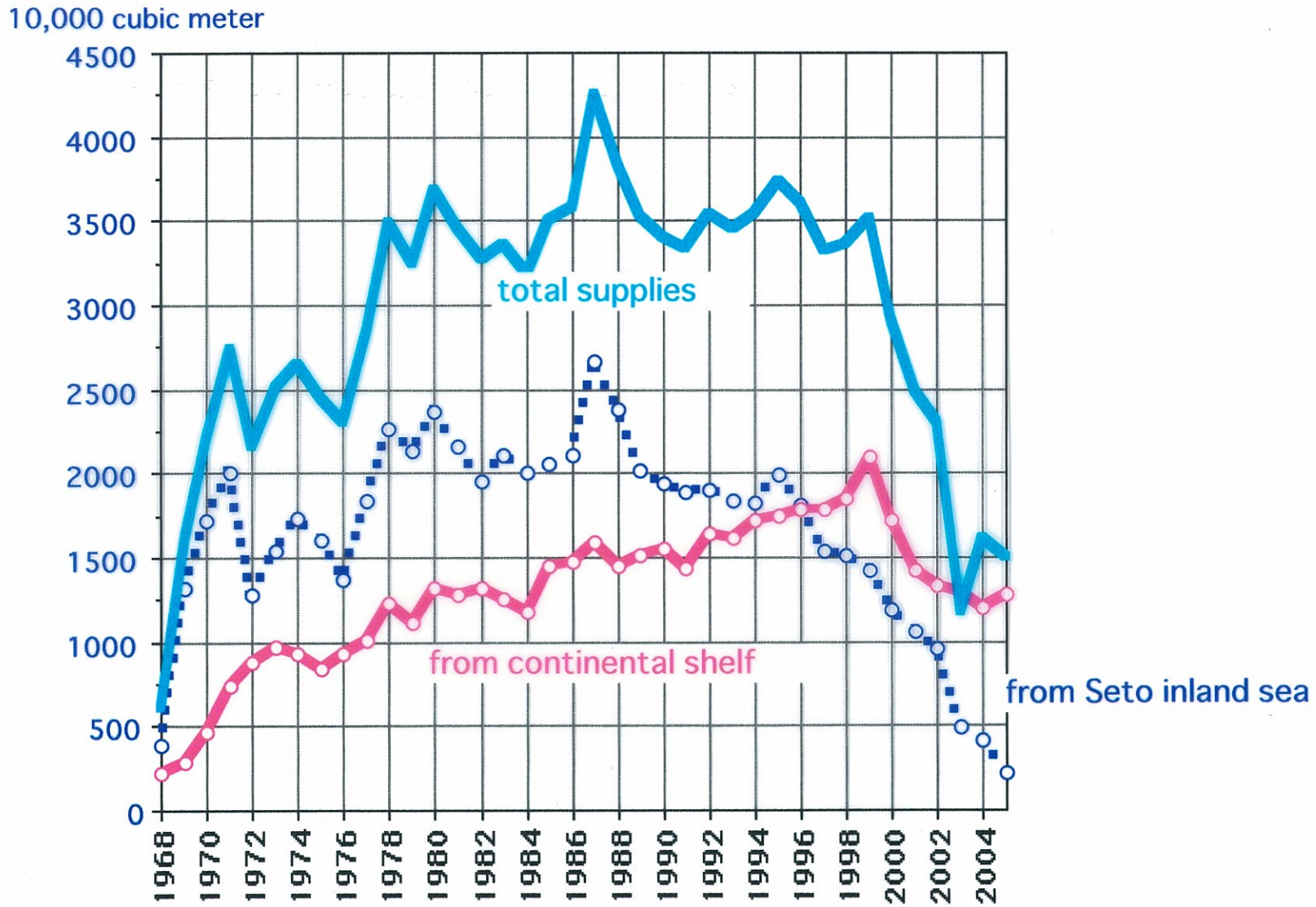
Self-sufficiency in fine aggregates of Tochigi prefecture

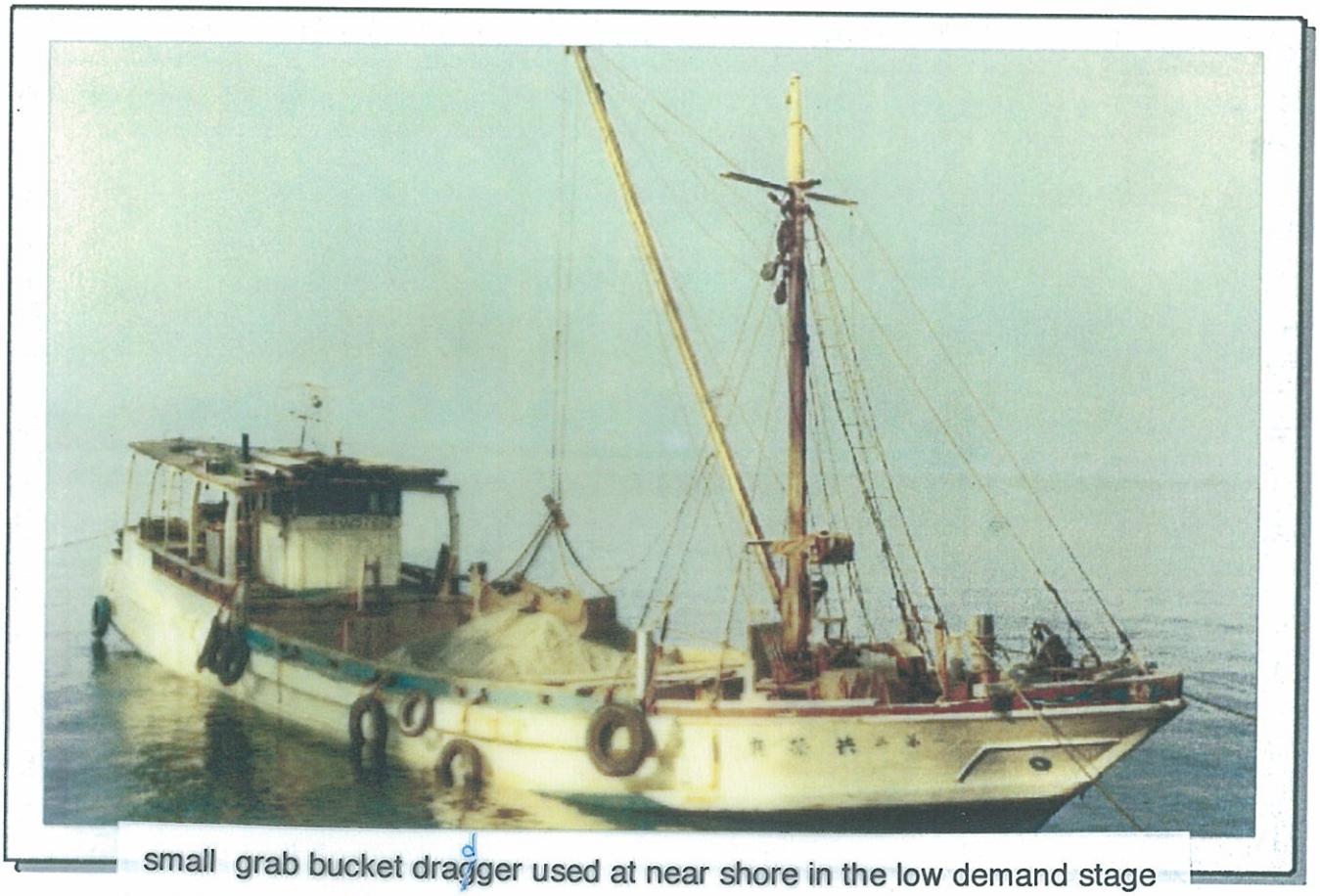


Self-sufficiency in fine aggregate of Tokyo



Offshore fine aggregate supplies in Japan

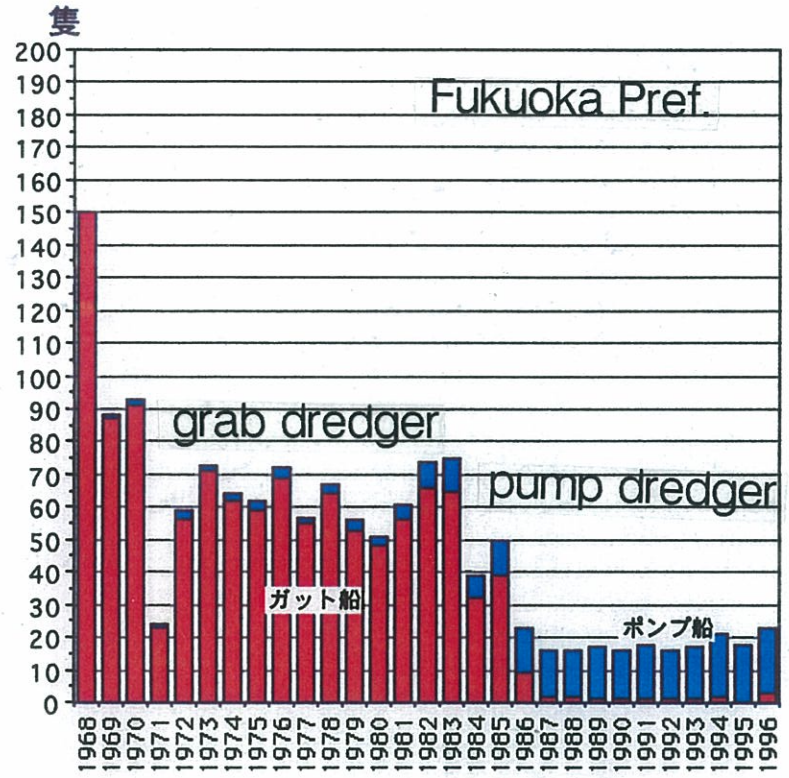




small grab bucket dragger used at near shore in the low demand stage

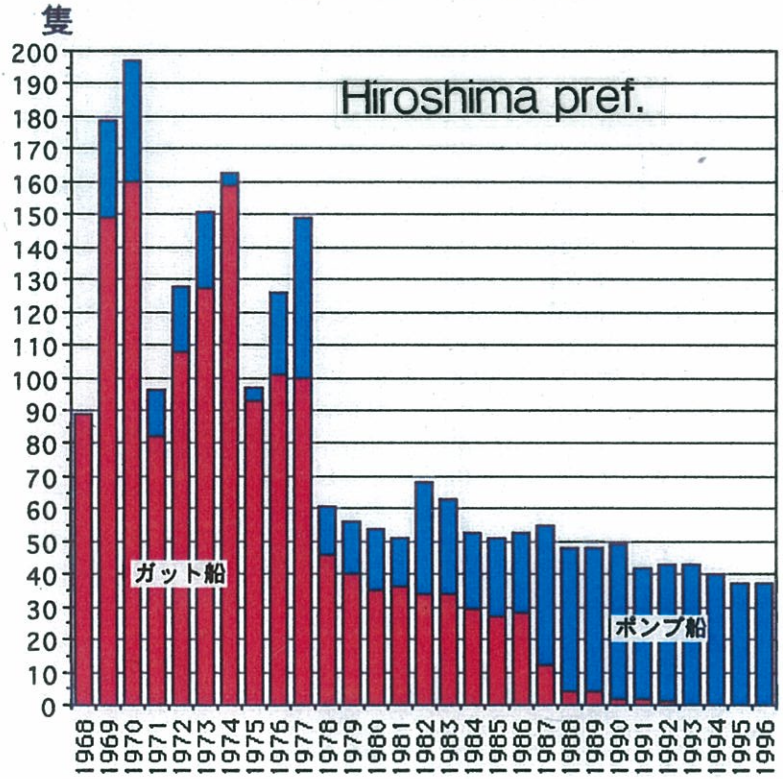
599GT class grab bucket dragger at Seto in-land sea

福岡県の採取船

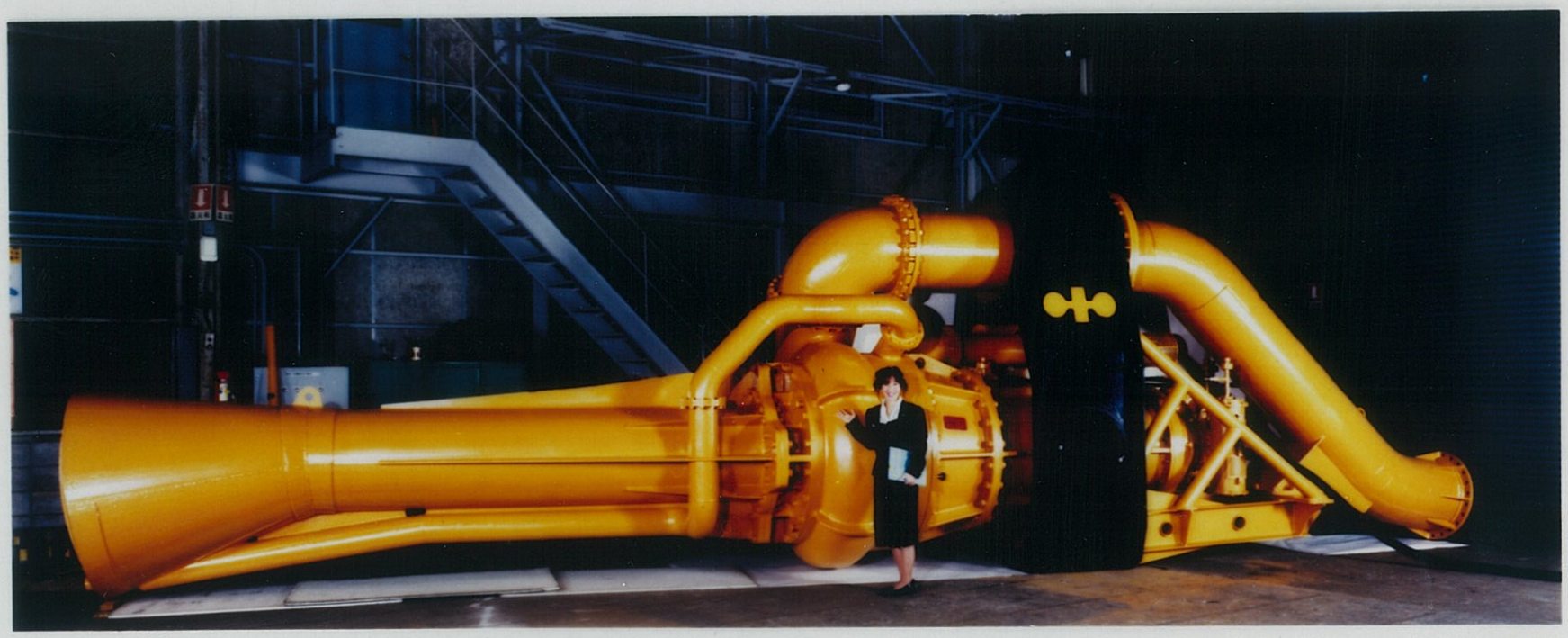


change of number of dredger

広島県の採取船



24



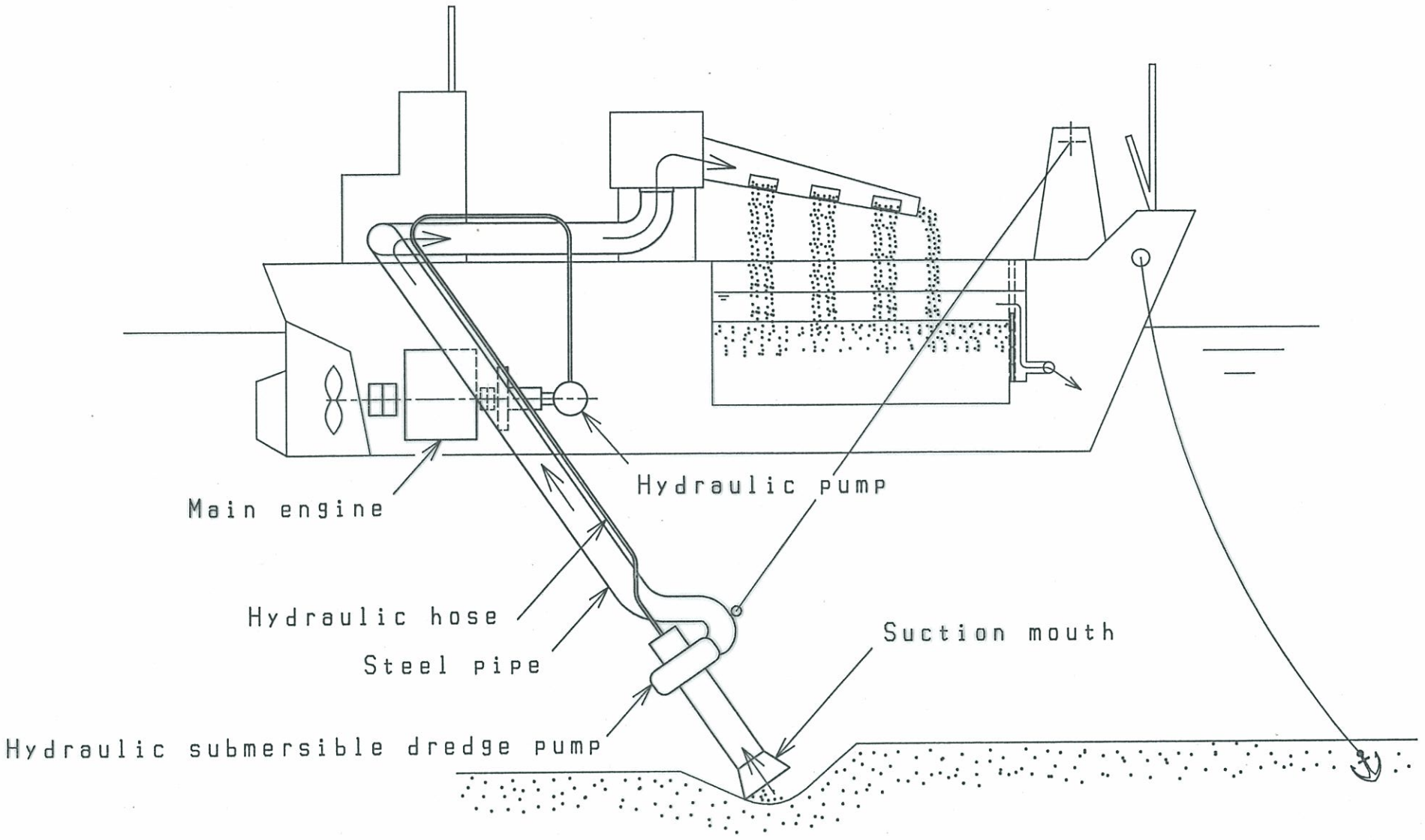


Fig. 6 Vessel with hydraulic submersible pump

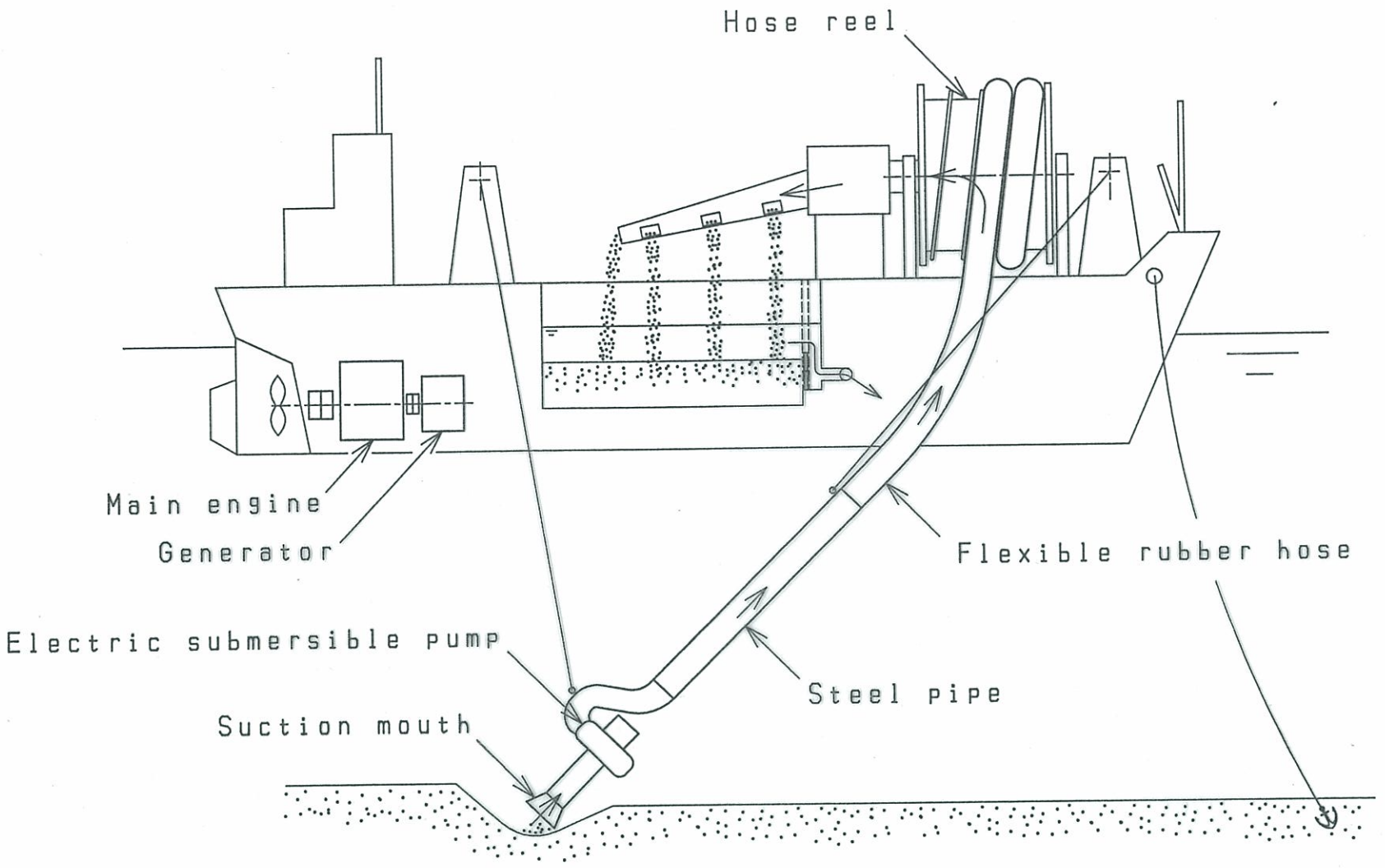
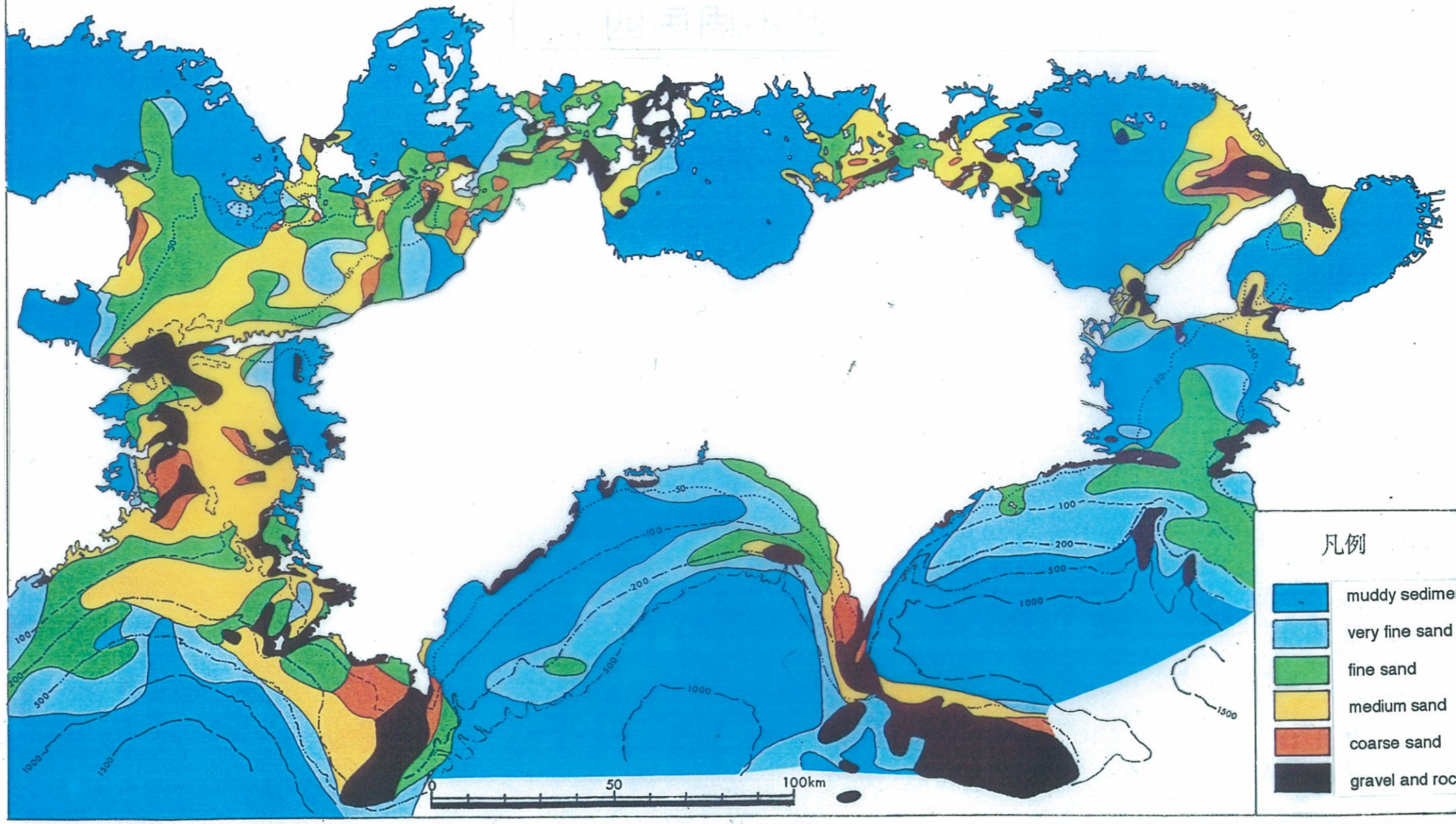


Fig. 12 Vessel with hose reel

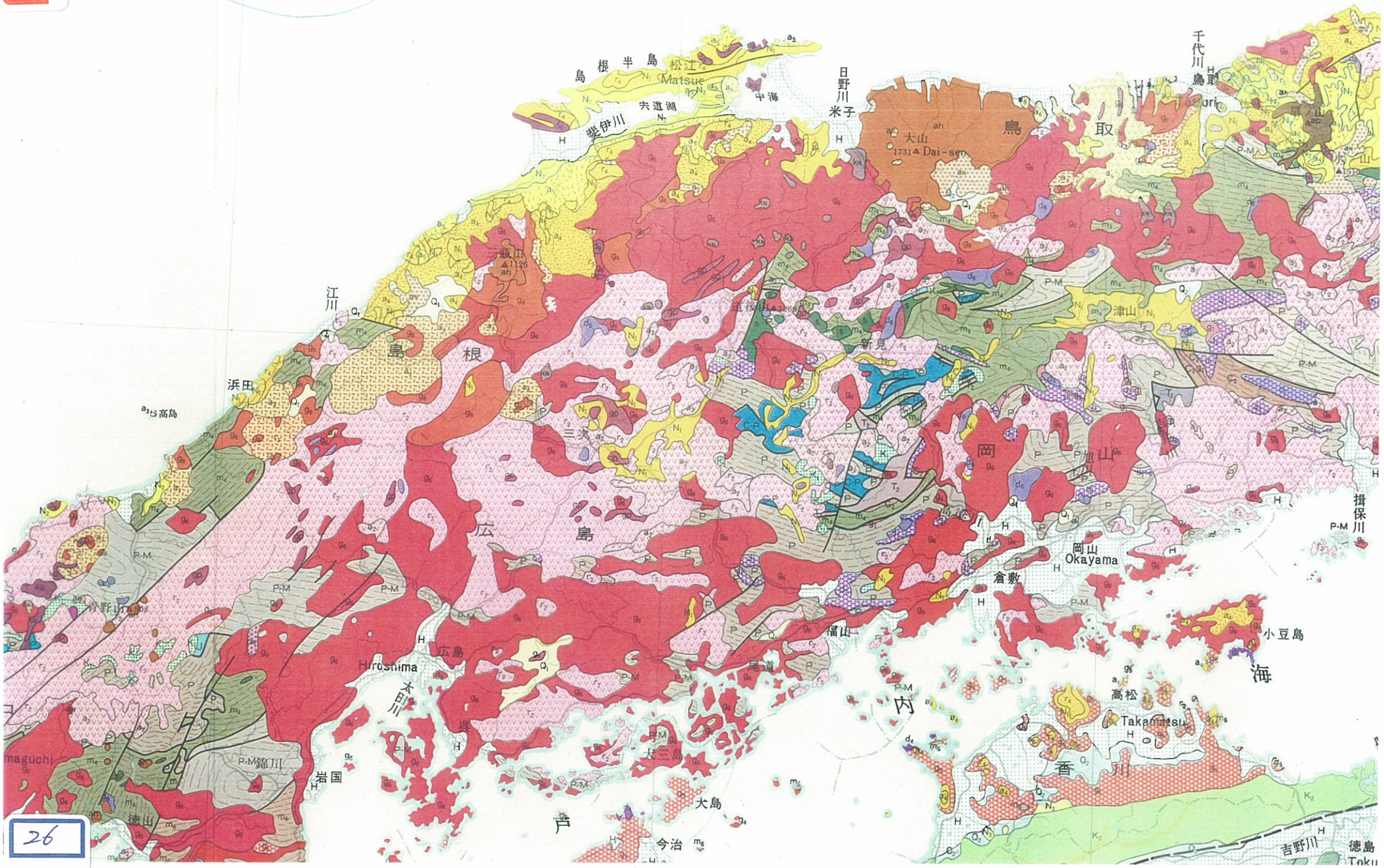
Sea bottom ~~future~~ feature map in Seto in-land sea and its vicinities in JAPAN

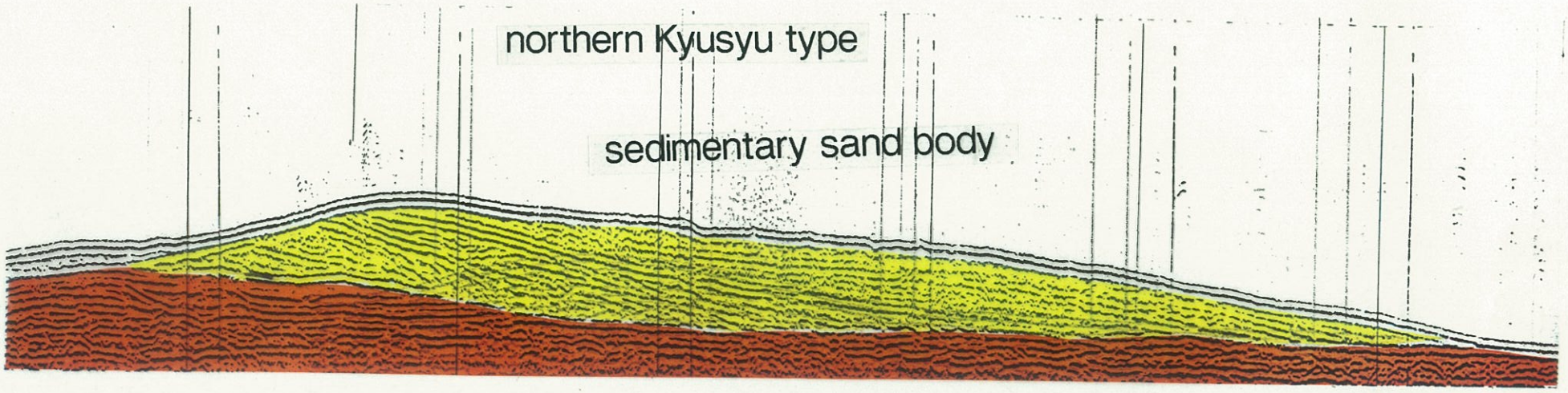
工業技術院地質調査所
有田正史作成



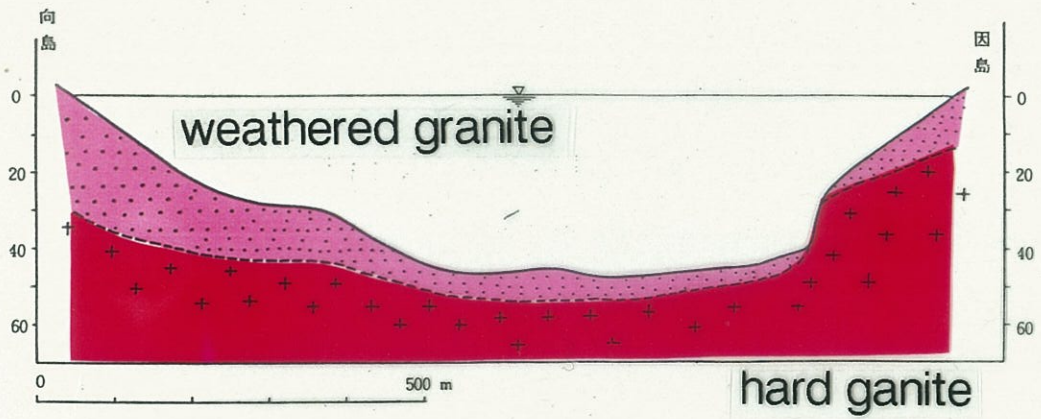
25

011


島根半島
松江
Matsue
中海
宍道湖
斐伊川
日野川
米子
大山
1731▲ Dai-sen
鳥取
千代川
鳥取
Tottori
江川
浜田
島根
広島
三次
新見
津山
岡山
旭山
揖保川
岡山
Okayama
倉敷
福山
小豆島
瀬戸内海
広島
Hiroshima
太田川
高松
Takamatsu
香川
岩国
錦川
大三島
大島
今治
吉野川
徳島
Toku

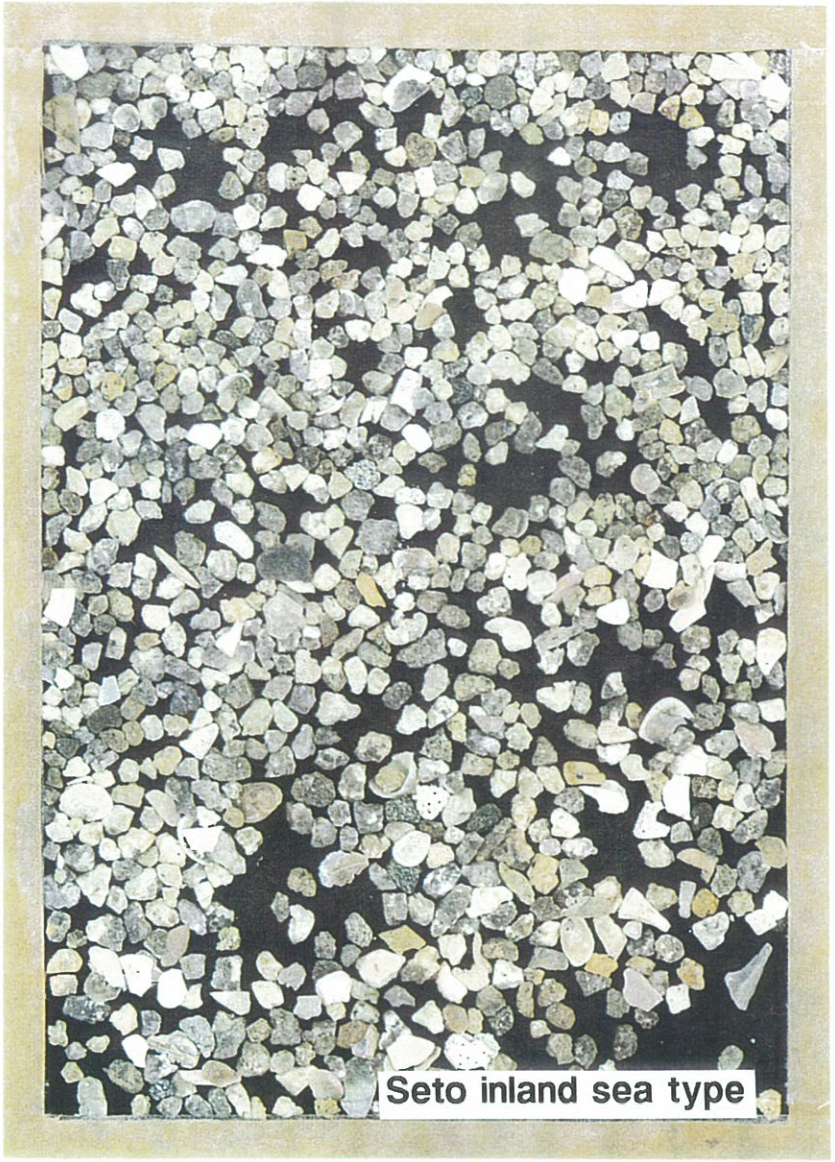


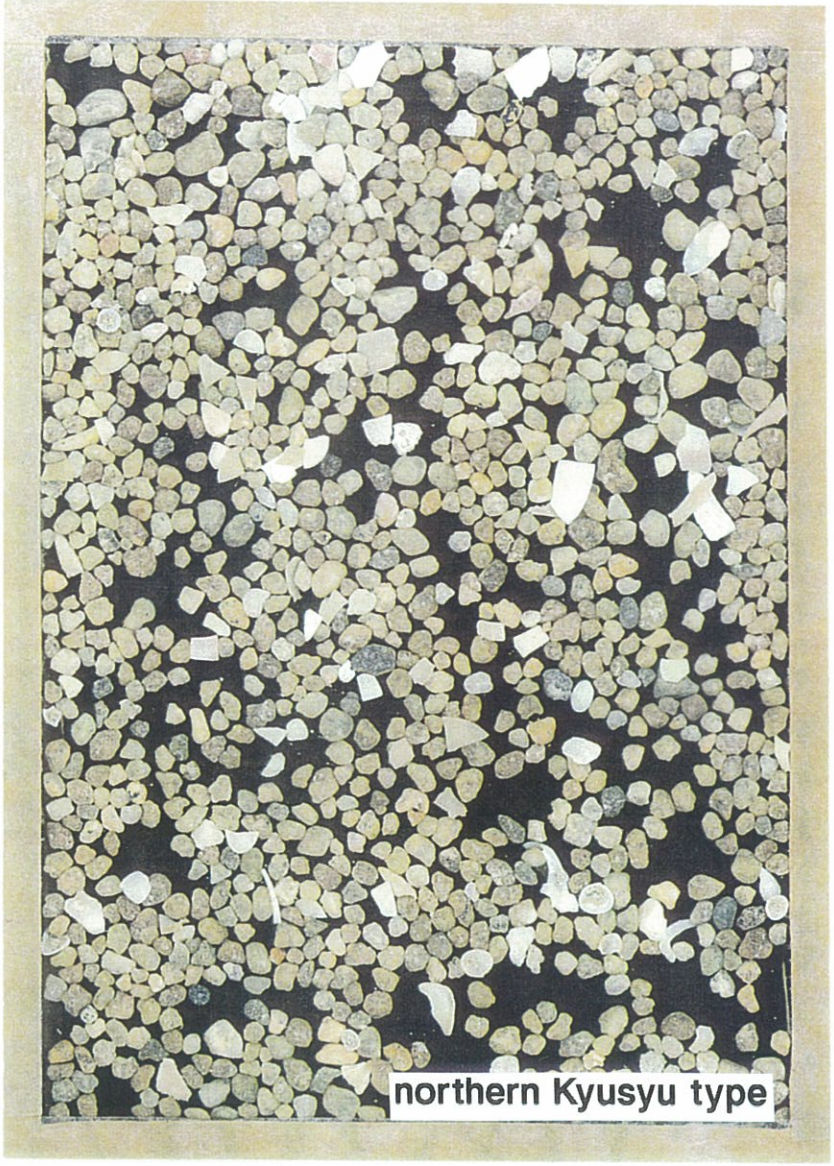
Seto inland sea type



瀬戸内海

北九州





seabed sand

海　　砂

（砂の中から２mmより大きな粒子を抽出）

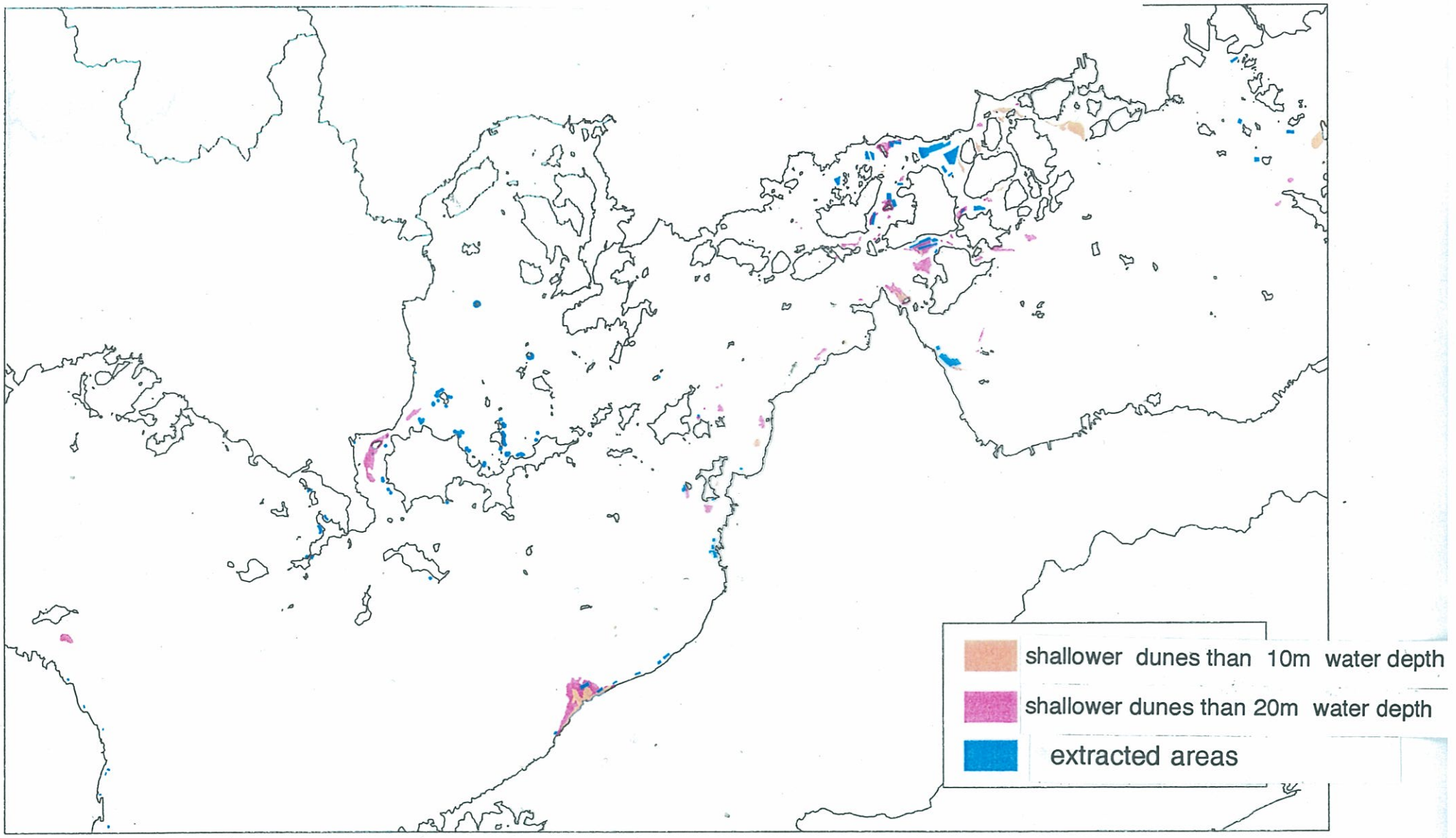
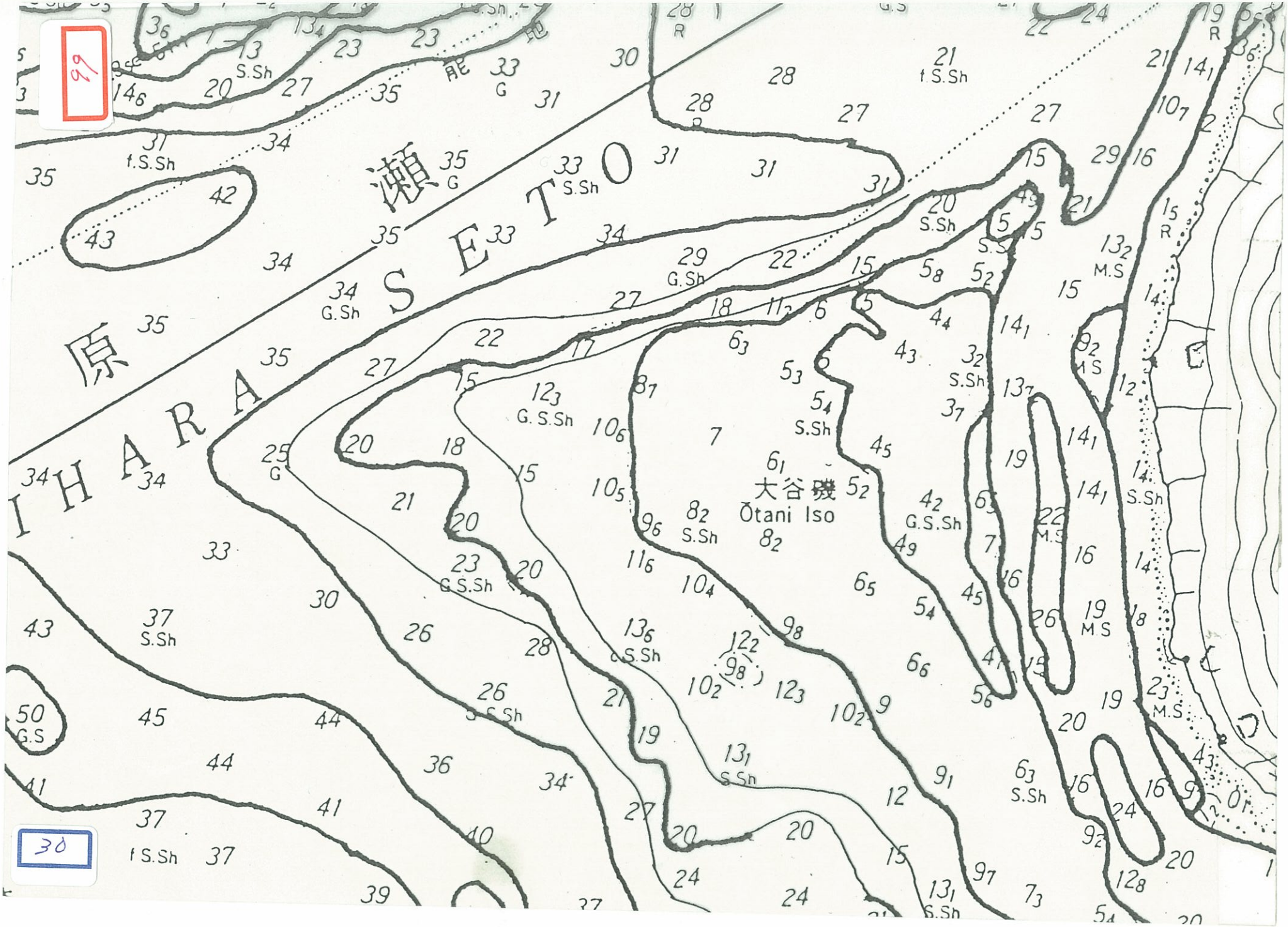


図3-5（B）　海砂利採取区域と主な砂州･砂堆の分布


原瀬 HARA SETO
大谷磯
Ōtani Iso
39
30

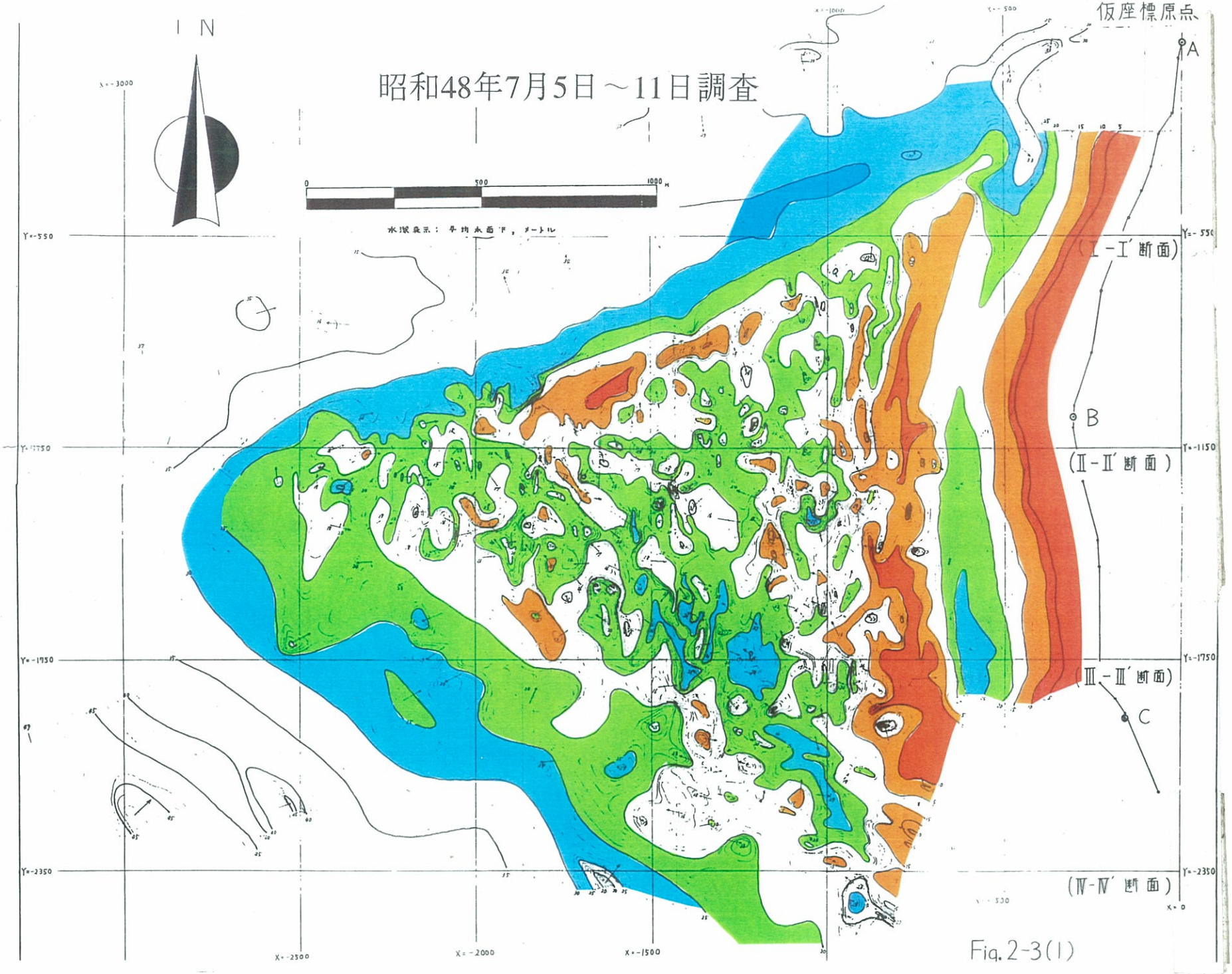

昭和48年7月5日～11日調査
仮座標原点
A
B
C
(Ⅰ-Ⅰ′断面)
(Ⅱ-Ⅱ′断面)
(Ⅲ-Ⅲ′断面)
(Ⅳ-Ⅳ′断面)
N
0
500
1000 M
水深表示：平均水面下，メートル
X=-3000
X=-2500
X=-2000
X=-1500
Y=-550
Y=-1150
Y=-1750
Y=-2350

Fig. 2-3(1)

FH020011. JPG

FH020012. JPG

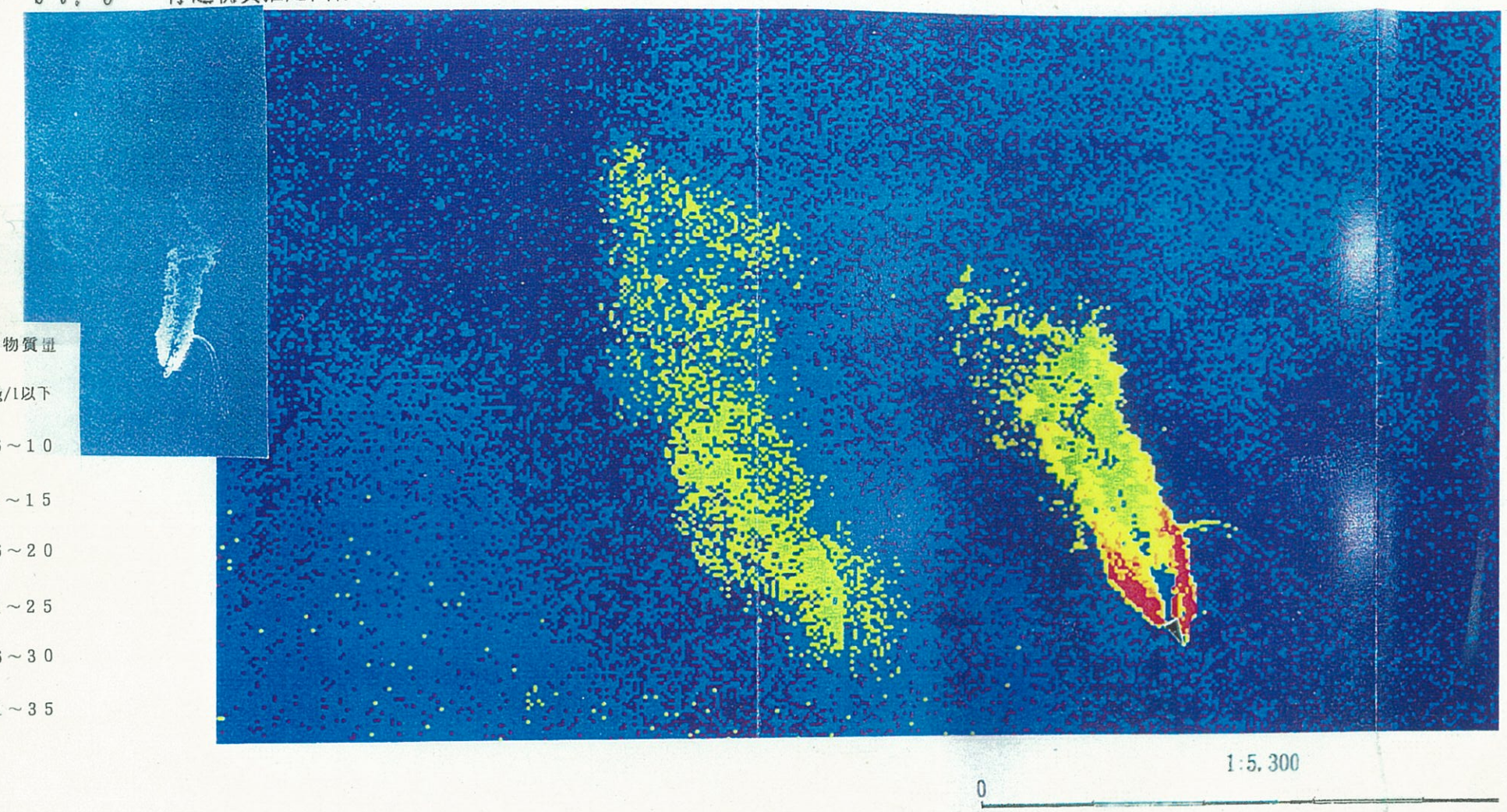
FH020019. JPG

FH020021. JPG

3X

diffusion of muddy water from pump dredger at Seto in land sea

st. 9　浮遊物質推定画像



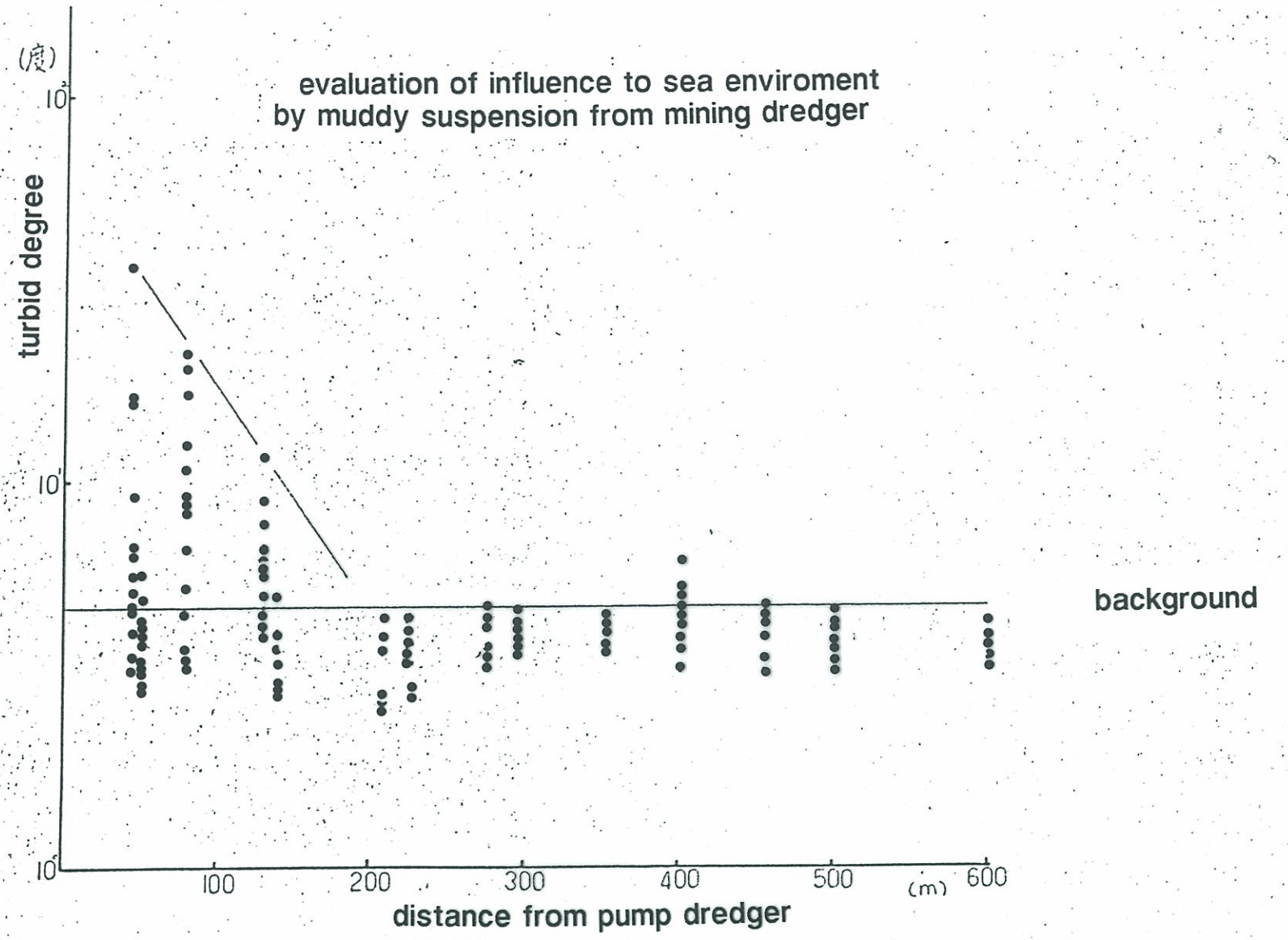


図-52 距離と濁りの関係（30m 採取）---ポンプ浚

A magnificent expanse of water sparkling in vivid blue....
below the surface lies a wealth of untapped resources.
Our desire is to utilize these effectively to create a more comfortable
social environment and to maintain the beauty of our natural
surroundings for future generations.
These themes are at the heart of Komatsu's total technologies,
guiding the company in laying a path into unknown fields.

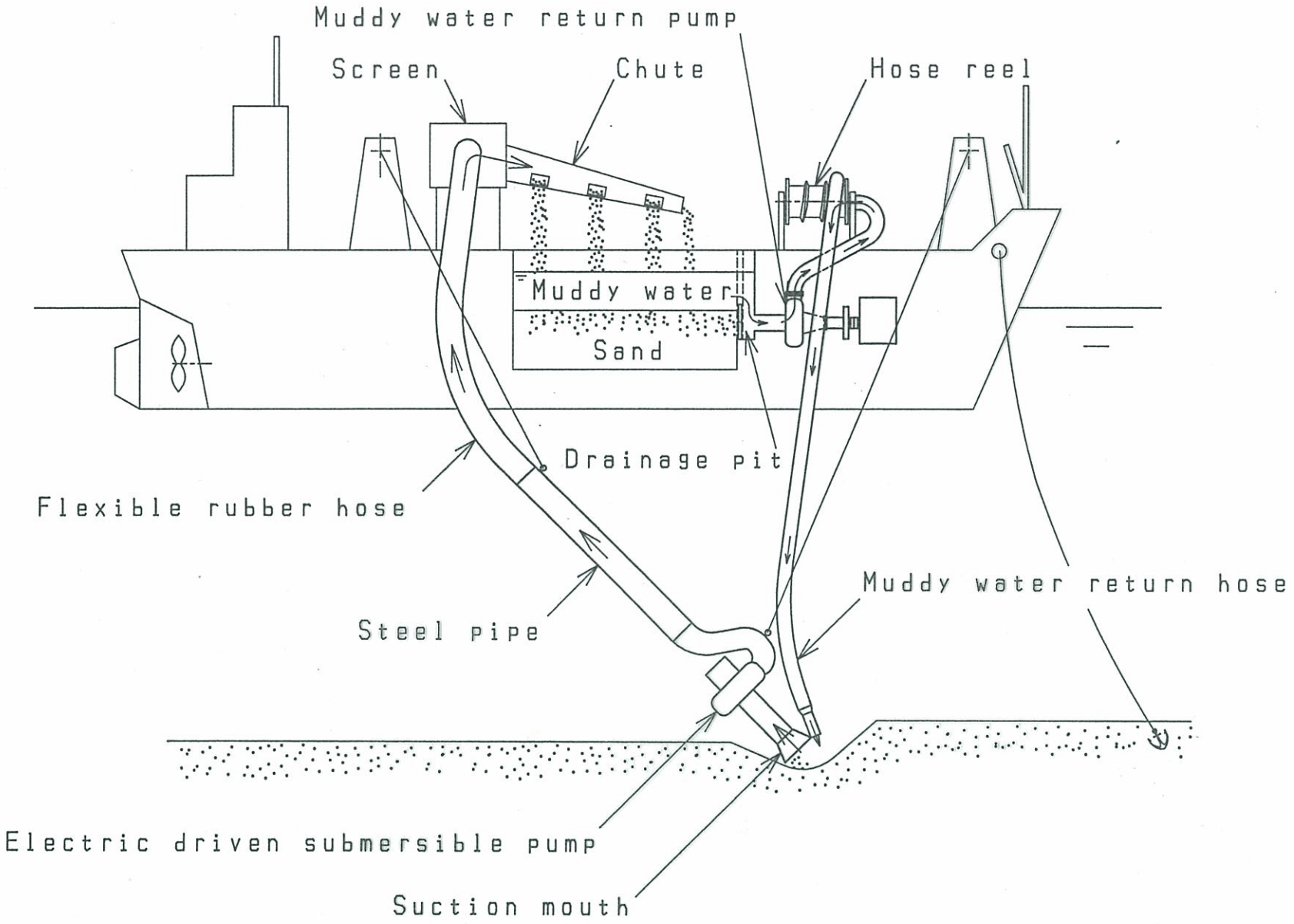
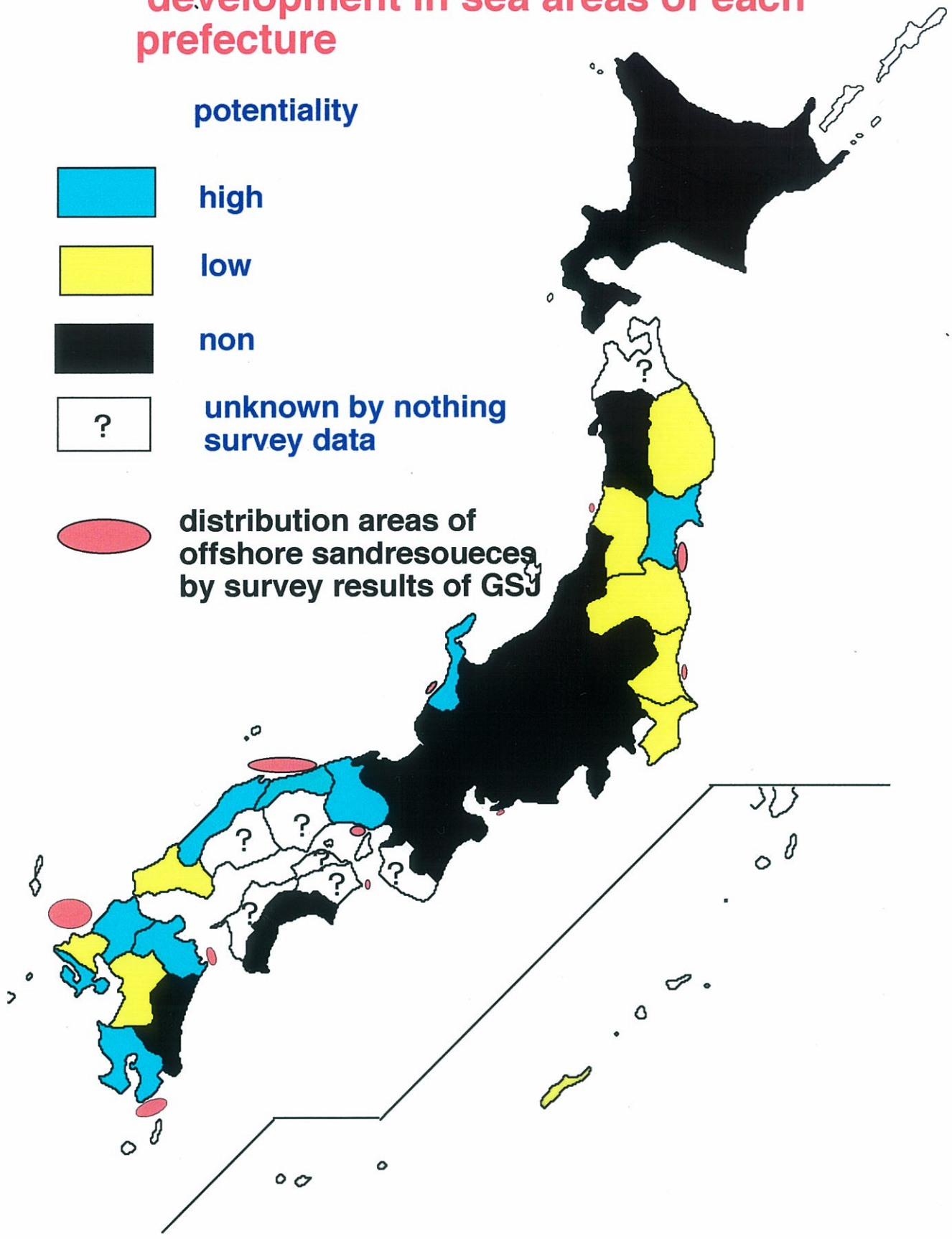
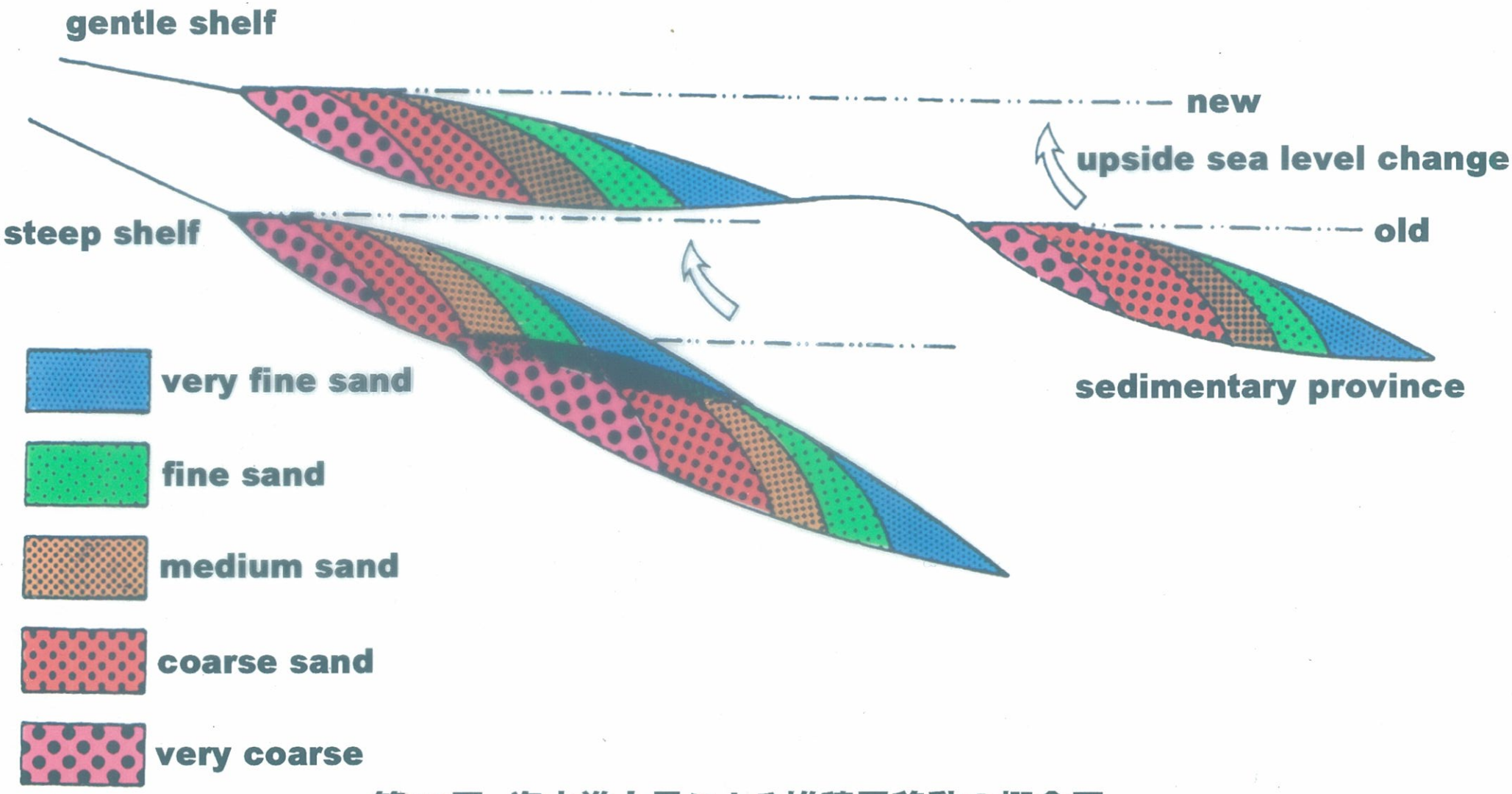


Fig. 13 Muddy water return system (example)

Potentiality of offshore sand resources development in sea areas of each prefecture

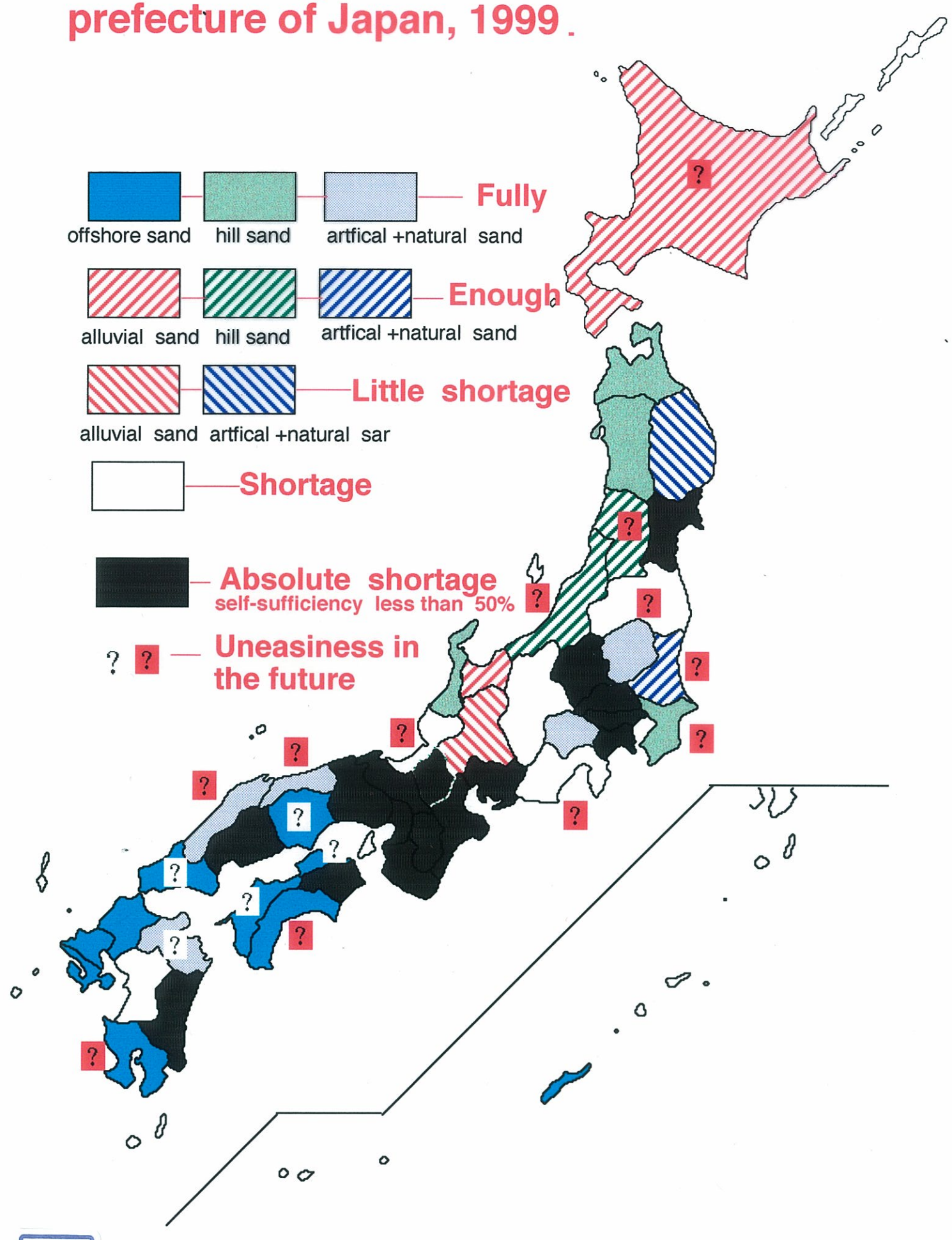


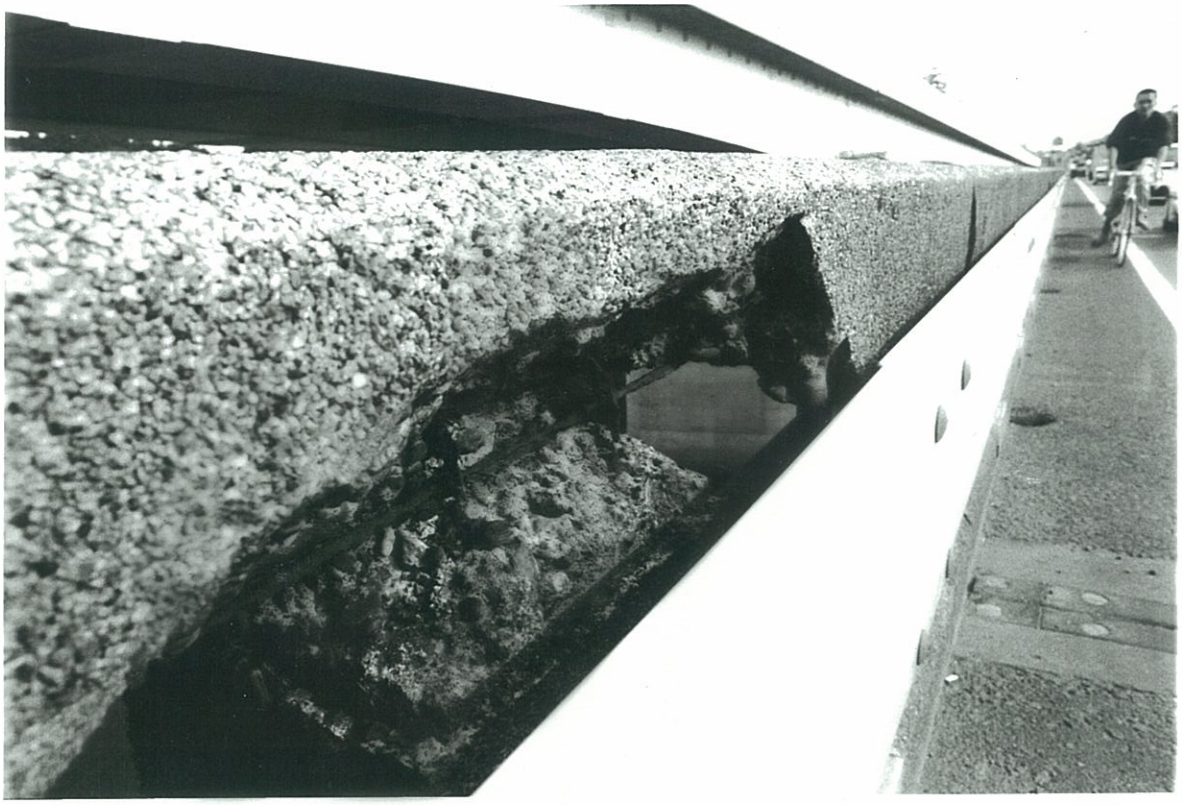


第10図　海水準上昇による堆積区移動の概念図

骨材資源　通巻No.69　1986

Self-sufficiency in fine aggregates and their original resources in each prefecture of Japan, 1999

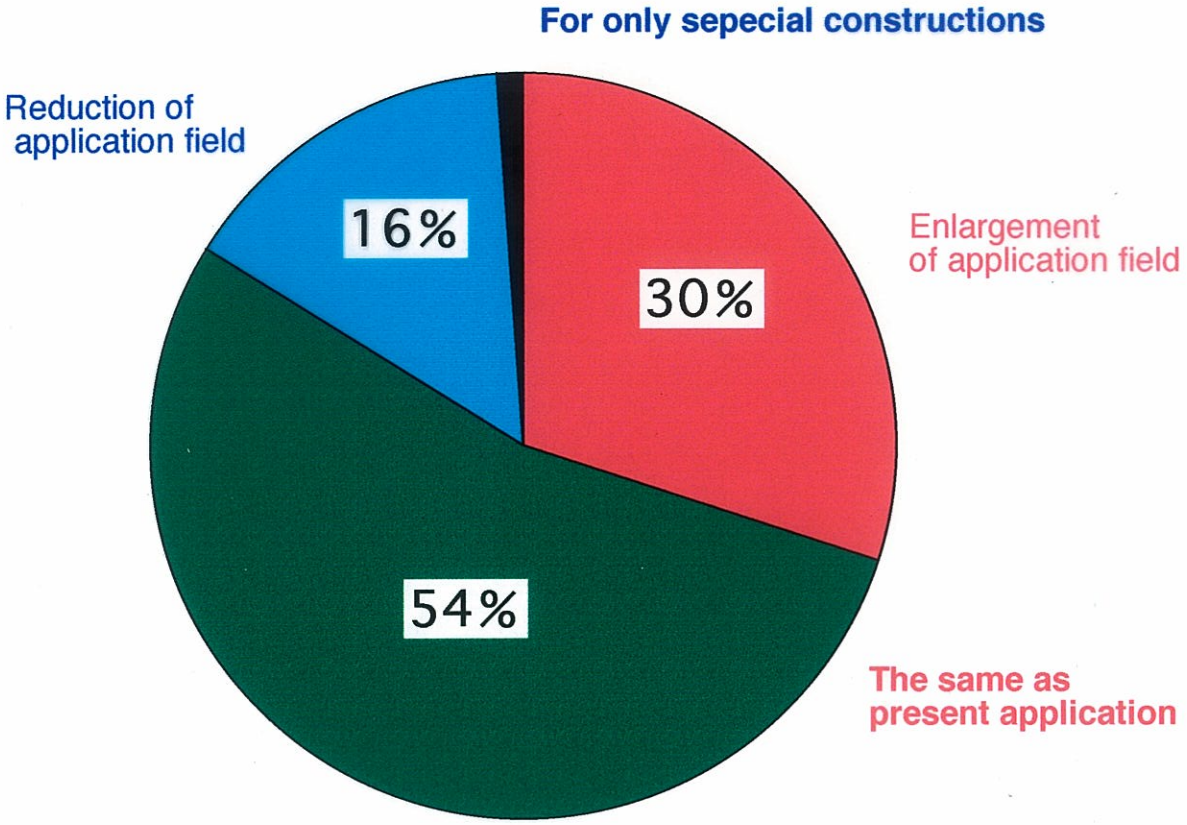




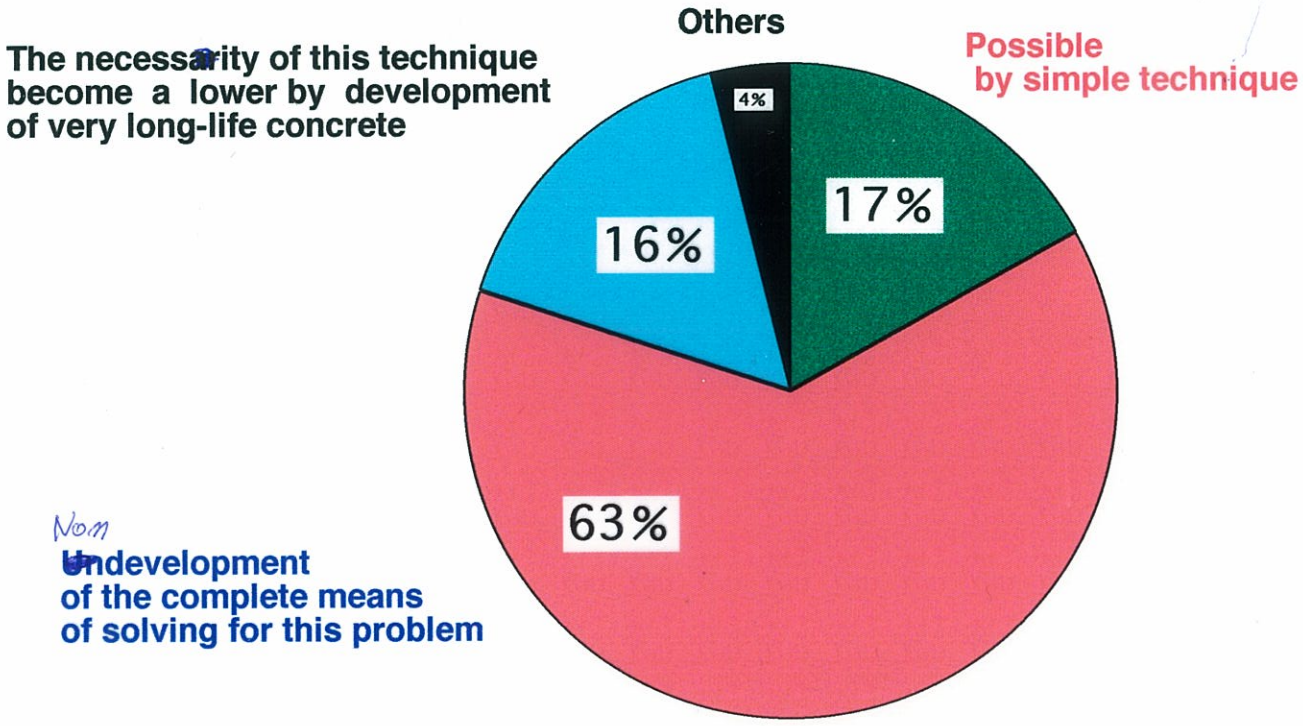

注意
自転車
歩行者

Examples of answers for a quetionnaire survey to many exparts on concrete from publisher of Concrete Engineering in 1995.

Q --- Application field of concrete after 20 years?



Q---Development of a prevention technique for deterioration of concrete constructions after 20 years ?



The total supplies of aggregate supplies in every 10 years in Japan , except aggregates for road base