

Learn lessons from the Nagaoka Project

Shoichi Tanaka
The University of Tokyo

Achievements of the Nagaoka Project -1

1. Injection of 10,000 tons CO₂ within an estimated range of pressure.
2. Safe and sound injection operation of 500 days.
3. Detection of injected CO₂ movement and changes of CO₂ saturation with time-lapse geophysical well loggings.

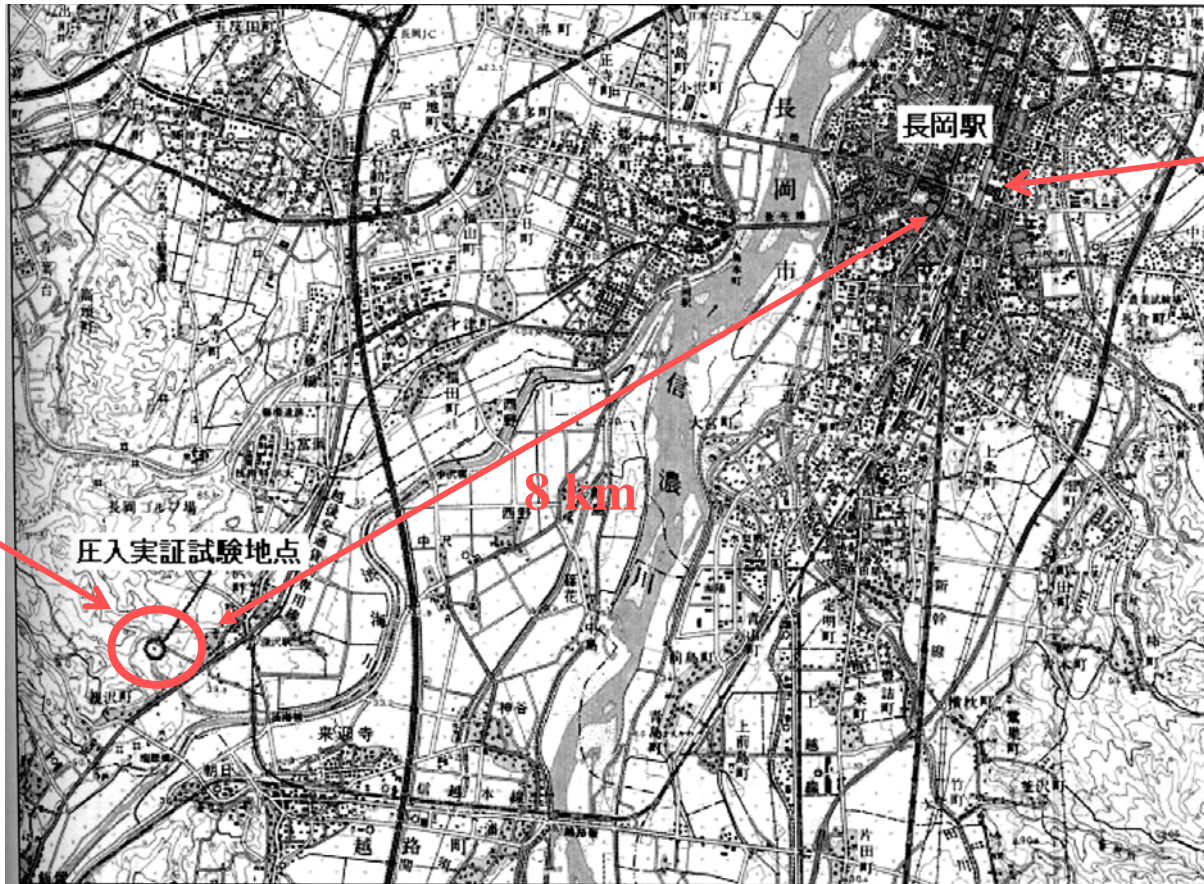
Achievements of the Nagaoka Project – 2

4. Monitoring images of CO₂ accumulation in the injection zone with time-lapse cross-well seismic tomography.
5. Finding problems to improve computer codes.
6. Keeping integrity of the wells hit by the earthquake of M 6.8 encountered at the injection operation.

Features of the Nagaoka Project

1. Well site: Suburbs of Nagaoka City with a population of 290,000.
2. One injector and three observation wells system.
3. Low permeability of the injection zone:
From 1.6 md to 11.2 md.
6.7 md on average.

Map of Nagaoka City



Nagaoka
Station

Well site

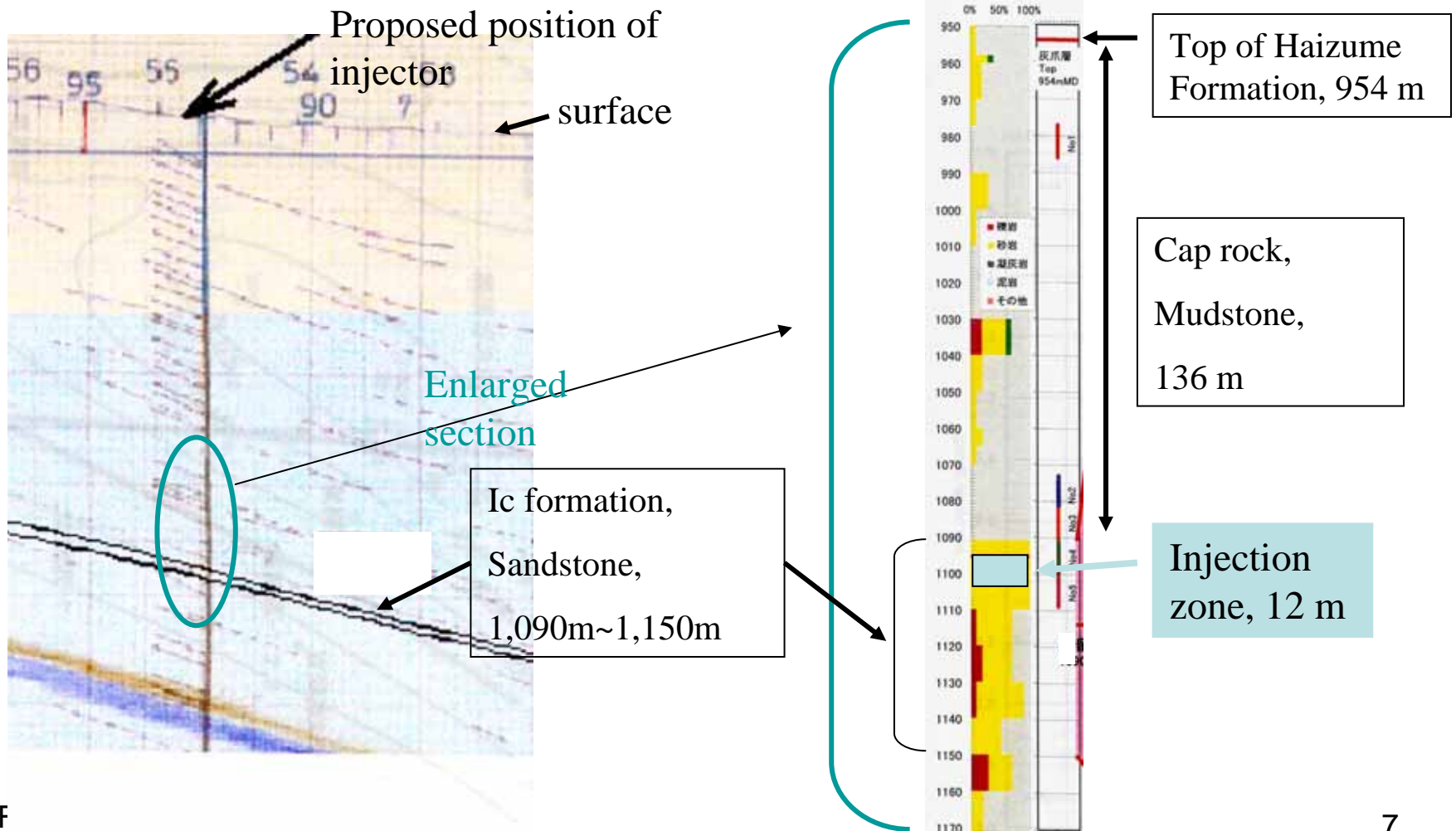
8 km

圧入実証試験地点

Study of suitability of selected zone -1

1. Properties of cap rock: Mudstone.
Thickness: 136 m at injector.
Formation pressure gradient: 1.1 g/cm³
equiv.
2. Properties of injection zone: Sandstone.
Thickness: 12 m.
Formation pressure gradient: 1.09 g/cm³
equiv.
Chloride ion concentration: 4,200 ppm

Seismic section and lithology of injection well



Study of suitability of selected zone -2

3. Step rate injection test of injection zone at injector:

Maximum test pressure: 19.2 MPa

No indication of formation breakdown or leakage from the wellbore

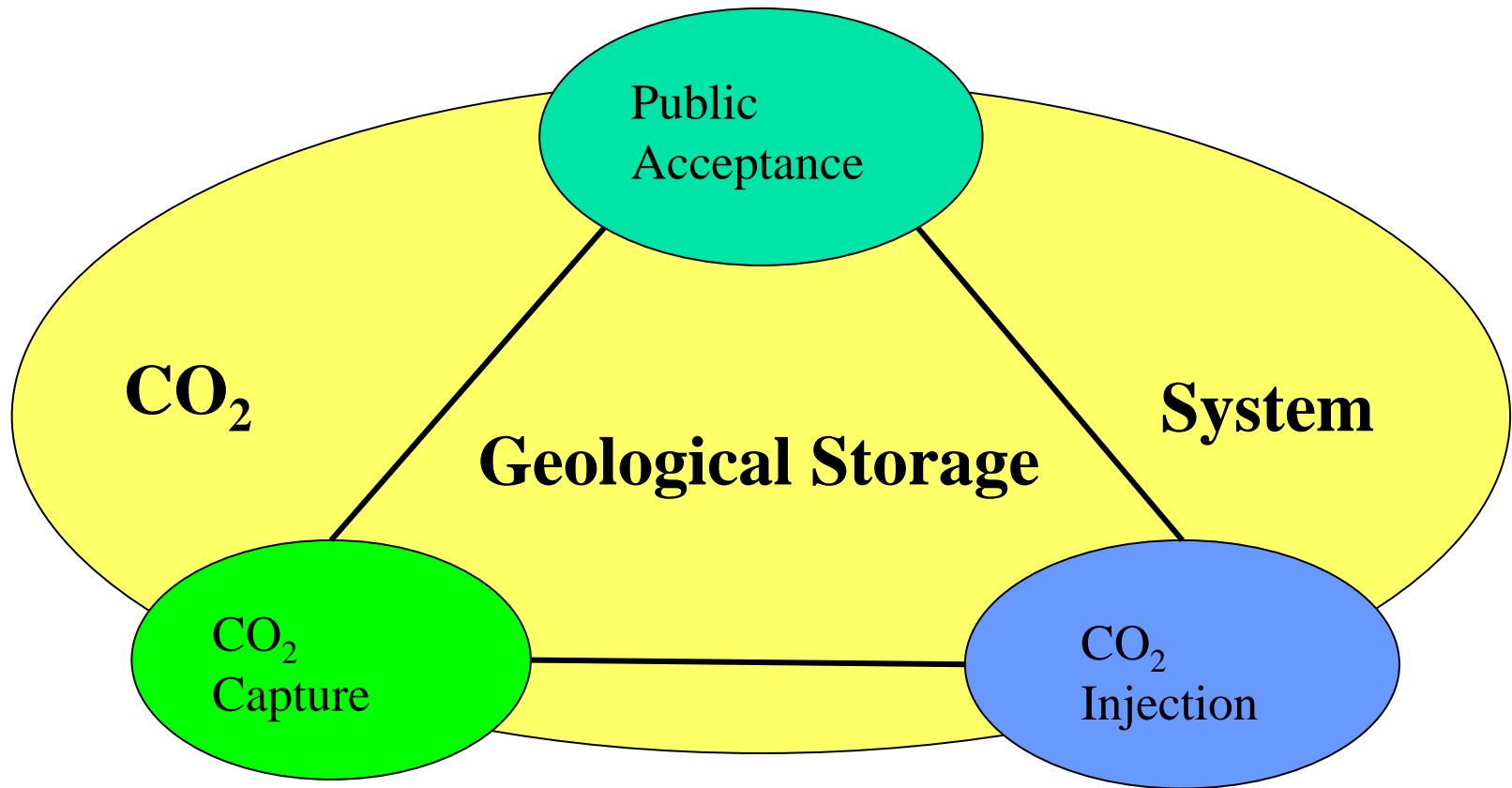
Assumed injection pressure of simulation:
18.6 MPa

(Ref. Maximum pressure at injection of
40 t/d rate: 12.6 MPa)

Assignments of the Nagaoka Project

- ✓ Study of long-term monitoring system.
- ✓ Study of formation pressure control system for injection of large volume CO₂ for a long period.
- ✓ Study of flow of subsurface water in a depth of 1,000 m and deeper.
- ✓ Measurement of curves of relative permeability to CO₂ for various rocks.
- ✓ Study of estimation and classification system of capacity and suitability of formations for CO₂ geological storage similar to oil and gas reserves.

Contribution of the Nagaoka Project to CO₂ geological storage system



Expectations

- Implementation of full-scale geological storage of industrial CO₂ in the near future to abate environmental deterioration.

Thank you for your attention.