

**The International Working Group on Man-Made Strata and Geo-pollution (MMS
& GP)**

**International Union of Geological Science (IUGS)
Commission on Geoscience for Environmental Management (GEM)**

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**Geological Hazard Prevention Measures Learned from the 2011 Earthquake off
the Pacific Coast of Tohoku and the International Declaration on Man-Made
Strata and Geo-pollution**

Four years have passed since the Great East Japan Earthquake of March 11, 2011. We, international researchers on man-made strata and geo-pollution, pray for the victims of the earthquake to rest in peace and for a much faster, science-led, recovery of the affected areas. We also hope and pray for the health of the victims of the radiation pollution following the associated nuclear power plant accident and for science-led revitalization of the affected areas in future that we can be proud of for years to come.

The MMS & GP Working Group of IUGS-GEM released the “International Declaration for Deterring the Geological Hazards occurring in the 2011 Earthquake off the Pacific Coast of Tohoku” on June 18th, 2011. That declaration made the following three points. (1) The need for investigation of, and measures against, damage from liquefaction-fluidization and ground wave (known in Japan as “Jinami”) phenomena. (2) The need for evacuation plans and measures against tsunami damage. (3) The need for investigation and measures against the radiation pollution resulting from the Fukushima Daiichi Nuclear Power Plant accident.

We acknowledged it to be an obligation of this international working group to summarize and report that earlier declaration for deterring geological hazards at the Third United Nations World Conference on Disaster Risk Reduction (March 14th to 28th, 2015 in Sendai, Japan). Even though four years have passed since the disaster, all three points listed above remain very true today. Thus, that international declaration continues to be a valid and important declaration for the prevention and mitigation of earthquake damage world-wide, and for the investigation and planning of measures against radiation pollution resulting from the nuclear power plant accident.

Since the birth of human civilization, the magnitude of disasters has been increasing with the expansion of settlements exposed to potential damage. With extensive developments on, and

utilization of, land and coastal areas, the distribution of man-made strata in those areas has been expanding and accelerating. Those man-made strata are not only more physically and chemically varied than natural strata, but the range of associated effects is also rapidly increasing. Furthermore, the Jinji Unconformity (as the base of man-made strata is termed in Japan) and variability of man-made strata also gives rise to complex groundwater flows.

Investigations undertaken in the four years since the Great East Japan Earthquake have taught us that areas containing man-made strata distributed were affected by many complex disasters and complex pollution events. For example, (1) the destruction of breakwaters and tsunami evacuation roads along the coast by liquefaction, fluidization, or ground waves before the arrival of the tsunami and the subsequent arrival of huge tsunamis resulted in a complex disaster; (2) the transport and spouting out at the ground surface of pollutants contained in man-made strata due to liquefaction, fluidization, or ground waves caused local as well as dispersed pollution adding to the complex disaster; and (3) the man-made strata distributed areas along the coast polluted by high concentrations of radioactivity from the Fukushima Daiichi Nuclear Power Plant accident were also found to have sustained damage from liquefaction and fluidization, and tsunami, as well as the pollution from radioactive substances. Therefore the complex disaster was caused by three factors.

The MMS & GP Working Group of IUGS-GEM, in research focusing on man-made strata and geo-pollution, has been able to confirm the close association of characteristics of the Jinji unconformity and the composition of man-made strata with the geological hazards and damage at the time of the earthquake. In addition, the Working Group was also able to confirm that secondary sedimentation of layers containing radioactive substances from the Fukushima Daiichi Nuclear Power Plant took place during the formation processes of man-made strata.

Since the Holocene, the expansion of man-made strata throughout the globe has been unavoidable. On the occasion of the Third United Nations World Conference on Disaster Risk Reduction in Sendai, Japan, we stressed the increasing importance of the research on both the formation process of man-made strata and Jinji unconformity in connection with disasters so that people around the globe will, some day, be able to avoid or reduce the impacts resulting from these causes.