

Ashes and allophane: linking soil science at Meiji and Waikato universities

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Introduction

In September, the Department of Earth Sciences of the University of Waikato was pleased to host a soil science group from Meiji University (Ikuta Campus), Kawasaki City, Tokyo. Led by Professor Hiroshi Takesako, the group comprised three staff and six students (three graduates, three undergraduates). Associate Professor David Lowe, who had visited Professor Takesako's Soil Science Laboratory in the Faculty of Agriculture at Meiji University during his JSPS Fellowship trip last year, was able to repay some of the hospitality and field experience bestowed upon him by various Japanese soil science colleagues by co-leading the group on a six-day central North Island field trip from 8–13 September, 2001, as described below.

Meiji University is privately funded and was founded in 1881 (as the Meiji Law School; it became Meiji University in 1904). It comprises three campuses in the Tokyo region: Surugadai, Izumi, and Ikuta. There are about 8000 students at the Ikuta Campus enrolled in the School of Science and Technology or in the School of Agriculture.

Before arriving in New Zealand, the Meiji group spent several days in Adelaide where they visited Drs Jock Churchman (CSIRO) and David Chittleborough (University of Adelaide) and looked at a range of soils in the area. In New Zealand, we planned to examine sequences of tephra deposits ranging in composition from basaltic to andesitic to rhyolitic, and various multisequal soils, allophanic to halloysitic, derived from these. In some ways the trip was a belated run of parts of the (cancelled) pre-conference North Island tour prepared for last year's NZSSS/ASSS conference at Lincoln University.

North Island tour

The tour began (Day 1) in Auckland on One Tree Hill with extensive views of the Auckland Volcanic Field, inspection of Papakauri silt loam developed on basaltic tephra, and a Maori midden, and then moved to the Waikato where an halloysitic Kainui silt loam (on post-Rotoehu Ash tephra deposits overlying Hamilton Ash) was examined and sampled (Fig. 1). The classic and internationally recognised Horotiu-Bruntwood-Te Kowhai soil drainage sequence (developed on mainly rhyolitic tephra deposits overlying volcanogenic alluvium of the Hinuera Formation) was then studied and sampled—a highlight for Professor Takesako especially.

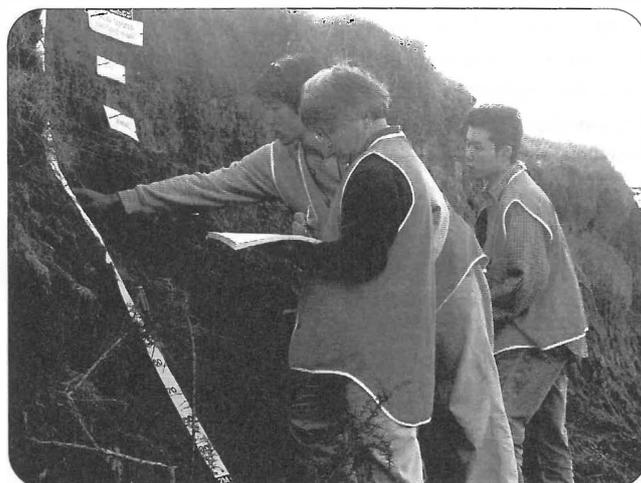


Figure 1. Professor Hiroshi Takesako (writing), Kenji Goto and Kenta Yuasa examine the Kainui silt loam and Hamilton Ash sequence in Silvester Road, Hamilton.

Day 2 began with inspection and sampling of an Ohaupo silt loam (derived from mixed rhyolitic and andesitic tephras), and containing both allophane (upper solum) and halloysite (lower solum). At this site the group met up with Dr Chris McLay (Environment Waikato), who happens to live nearby on these soils, and who arrived just in time for morning tea comprising Maria Lowe's chocolate cake and 'magic slice'. Then it was on to the Moanatuatua bog to see the Rukuhia peat (Organic Soil), the thin layer of fine lapilli of the Taupo Tephra (*c.* 200 AD) preserved in the peat deposits, and a blueberry orchard. We visited and sampled the allophanic Tirau sandy loam (developed chiefly on composite rhyolitic material younger than Aokautere Ash) and, on the lower margins of the Mamaku Plateau, inspected the tephra-loess-paleosol sequence at Tapapa dating back to 225,000 years BP. All the students had a go at using our magnetic susceptibility meter at this site to help identify the buried soils. Finally, the group visited the small explosion crater and fallout deposits that were formed in a phreatic eruption on 26 January, 2001, in Kuirau Park, Rotorua. At this site we were joined informally by a group of Queenslanders, both polite and appreciative of the free lecture, but genuinely quite disbelieving that anyone should be mad enough to live in 'dangerous' Rotorua.

After examining a sequence of Okataina-derived rhyolitic tephras and paleosols dating back to around 20,000 years BP on the Whakatane Road near Te Ngae, the group enjoyed a visit to the Whakarewarewa geothermal field where Pohutu geyser and live kiwis were highlights. In the afternoon, we were guided through the Rotorua Land Treatment System (LTS) in Whakarewarewa Forest by Dr Gerty Gielen, who gave an excellent account of the system and the latest research being undertaken in the catchment by *Forest Research* (fig. 2). We also briefly inspected the free-draining Whakarewarewa soils developed in a composite of young rhyolitic tephra deposits that overlie coarse, thick Rotorua Tephra. Our visit to the LTS was kindly facilitated by Drs Gujja Magesan and Tim Payn. To finish the day (Day 3), the group visited the Te Wairoa Visitors'

Centre, site of the buried village destroyed by fallout from the 10 June, 1886 Tarawera eruption, and then finished off Maria's chocolate cake on the shores of Lake Tarawera while the sun set on the Tarawera massif. That evening we all enjoyed an outstanding Maori concert and hangi at Rydges Hotel, Rotorua.



Figure 2. Meiji University tour group at *Forest Research's* effluent irrigation research facility in Whakarewarewa Forest with Dr Gerty Gielen (back right). From left, Kenji Goto, Professor Haruo Watanabe, Professor Hiroshi Takesako, Kenta Yuasa, Yuka Kobayashi (holding main part of sampling system), Professor Yasuhiko Matsumoto, Aki Sato (holding thin tube), Yukiko Osawa, and Yasuyo Odaka.

Day 4 began with inspection of a tephra-paleosol sequence dating back to 15,000 years BP near Waimangu, south of Rotorua. The upper part of the modern soil here, Rotomahana sandy loam, is formed in Rotomahana Mud (deposited 10 June, 1886), with lower horizons developed in Taupo tephra and earlier eruptives. The Rotomahana soil is unusual for a Recent Soil in containing pre-weathered material including smectitic and other clays erupted from the Rotomahana Crater, a (pre-1886) centre for hydrothermal activity, during the second phase of the Tarawera eruption. The Waiotapu geothermal field was the next site on the schedule, and we arrived just in time to see the artificial Lady Knox geyser being soaped into action at 10.15 am. Surprising to me, this minor event was the highlight for most of the group for that day. The afternoon was devoted to inspection of the Taupo deep sand, developed on Taupo Ignimbrite and associated fall deposits of *c.* 200 AD (fig. 3), and older Taupo-derived tephra, associated paleosols, and loess deposits dating back to around 20,000 years BP at a site near Wairakei. By good fortune, the impressive opening of the Aratiatia Rapids spillway was witnessed at 2.15 pm, followed by a visit to the Wairakei Research Centre of IGNS where Dr Steve Sherburn and Julia Becker showed us the seismic and other volcano monitoring equipment of the volcano observatory. Steve gave an impressive and appreciated display of fluent Japanese during his introductory talk. Finally, Huka Falls and the Lake Taupo waterfront and harbour were viewed and then the group headed south to Turangi as the sun set over Lake Taupo.



Figure 3. Taupo deep sand profile developed on *c.* 200 AD Taupo Ignimbrite and fall deposits (above spade) overlying earlier Taupo-derived tephra and paleosols, at View Road near Wairakei.

Day 5 began with the dreadful news of the calamities in New York and Washington. Somewhat subdued, the group climbed Te Ponanga Saddle and near Lake Rotoaira described and sampled pre-Taupo andesitic tephra and (allophanic) paleosols dating back to around 10,000 years BP, the final set of samples collected on the trip. We walked part-way up the wonderful Mangateupo Valley in Tongariro National Park through Ngauruhoe-derived lava fields, and inspected the Ngauruhoe sand developed on accumulating, thin andesitic tephra overlying Taupo Tephra. Another surprise: seeing the thin, developing iron pan (placic horizon) marking the junction of these two materials (fig. 4) was a highlight for several of the Japanese soil scientists that morning. By midday, it was time to head north to Auckland, via a late lunch at Taumaranui, ice creams at Te Kuiti, a drive past the University of Waikato campus in Hamilton, and the setting sun on the Waikato River.

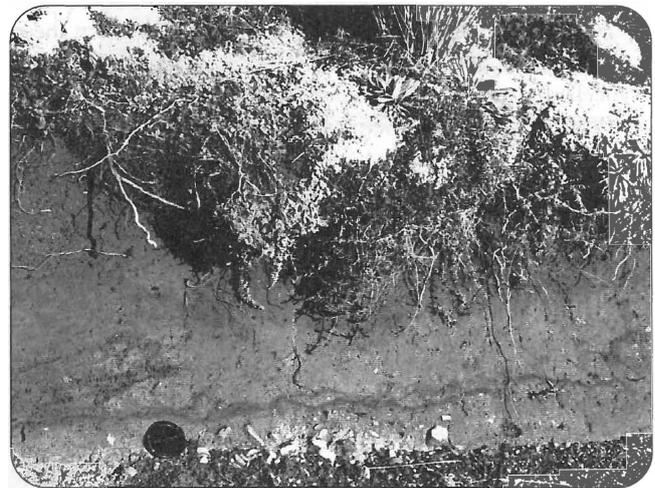


Figure 4. Ngauruhoe sand profile with a thin iron pan at the boundary between accumulating andesitic tephra and the weak paleosol developed in the top of Taupo Tephra (marked by lens cap).

The trip concluded on Day 6 with the students heading to Queen Street on a shopping spree whilst the rest of us walked through the Auckland Domain grounds and visited the excellent Auckland War Memorial Museum before returning to Auckland Airport and flights to Japan. Professor Takesako stayed on in Hamilton and the University of Waikato for several days before his trip home.

Conclusions

In all respects, the trip was very enjoyable because all members of the group were helpful, friendly, appreciative, and receptive.

The students described and sampled soils smoothly, rapidly, and accurately, having been very well trained by Professor Takesako. The group appreciated the differences between New Zealand and Japanese Andisols, the major factor being the long involvement of human-related activities in Japan and associated grass-dominated vegetation that have resulted in the formation of very deep, dark A horizons ('Kurobokudo') in Japan. The group was also very interested to see our highly siliceous rhyolitic tephra-derived soils, these being much less common in Japan. It was rewarding for me to see the group take such an active interest in our soils, landscapes, ecosystems and history.
