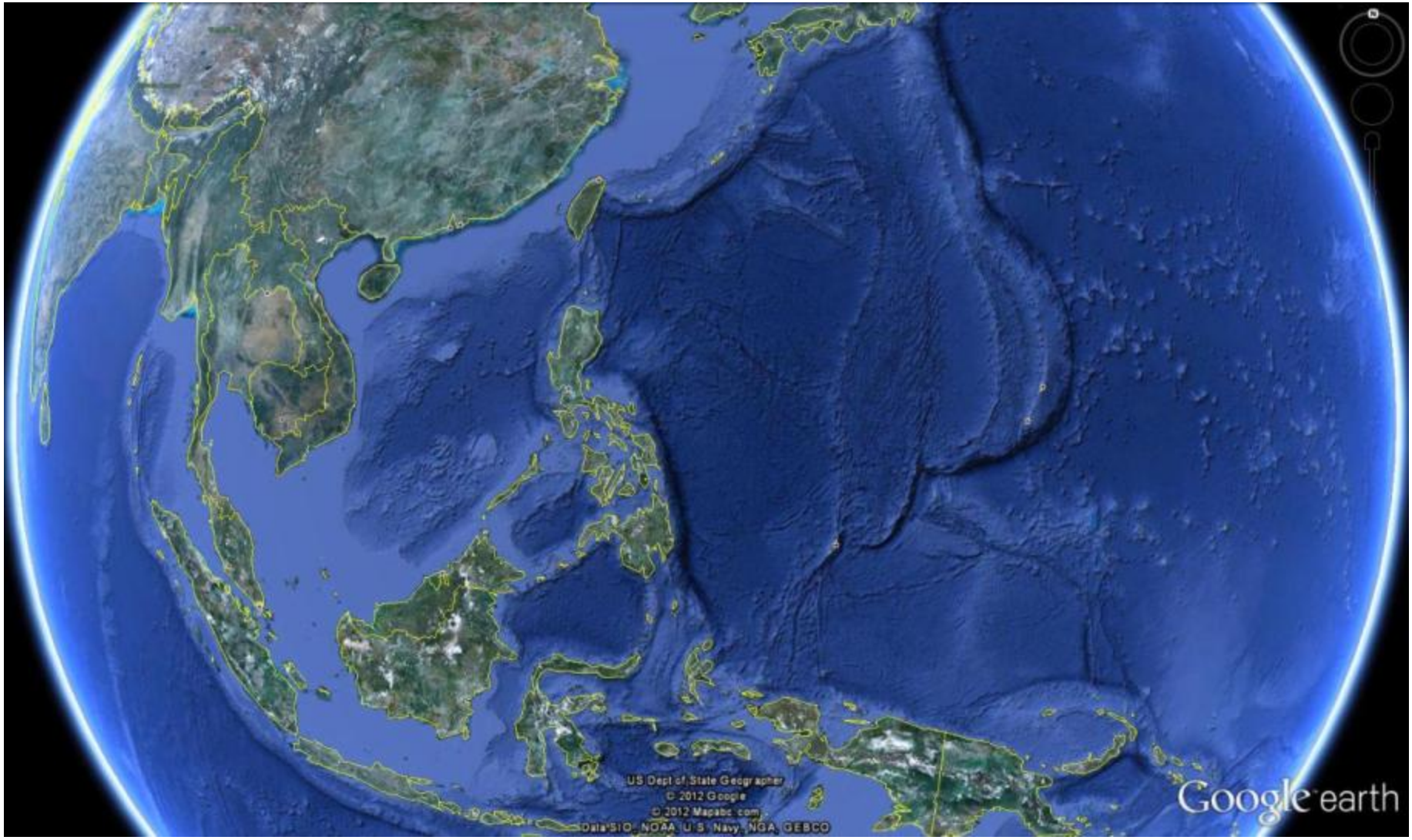
The Philippines

- Introduction
  - Location, Islands, Language
  - Geology
  - The Visayan Islands:
    - Volcanism, Active faults,
    - Karst formations,
    - Beaches

The Philippines

Geology, Environmental Issues and Impacts, Ecotourism Development

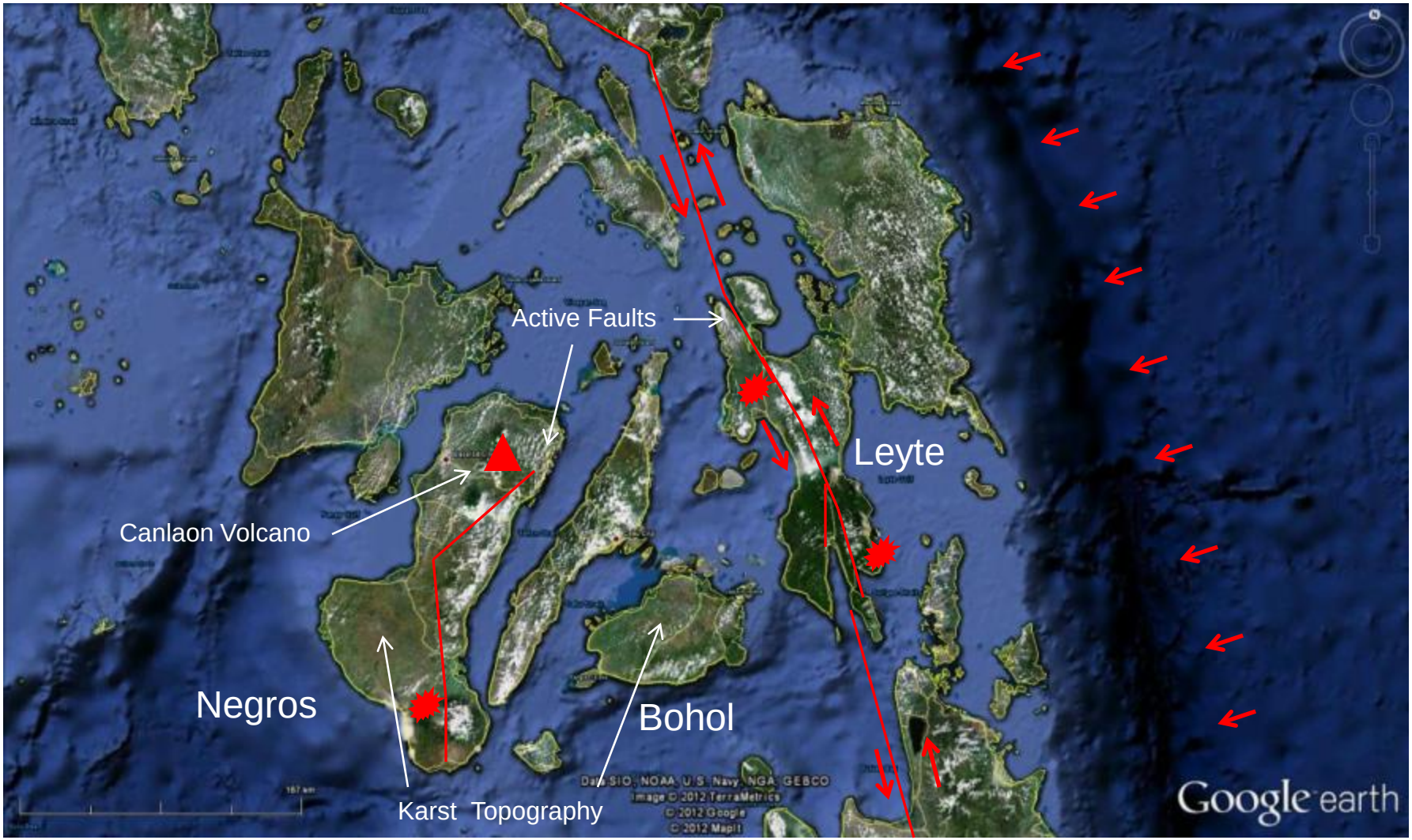


Three Main Regions and Palawan.

Dialects areas are delineated by mountain ranges and ocean basins.

The Visayan Islands

Area of Investigation
Southern Leyte
Southern Negros
Bohol



Geothermal Area Active Volcano Plate Movement

Mt. Canlaon

Photo From: http://www.skyscrapercity.com/member.php?s=a3e93f964d793ea7c6e13ac3edcea8bc&u=16971.

Mt. Canloan has erupted 26 times since 1908.
Eruption killed three mountain climbers in 1990.
At 2,435 m (7,989 ft) it is the highest peak in the Visayas

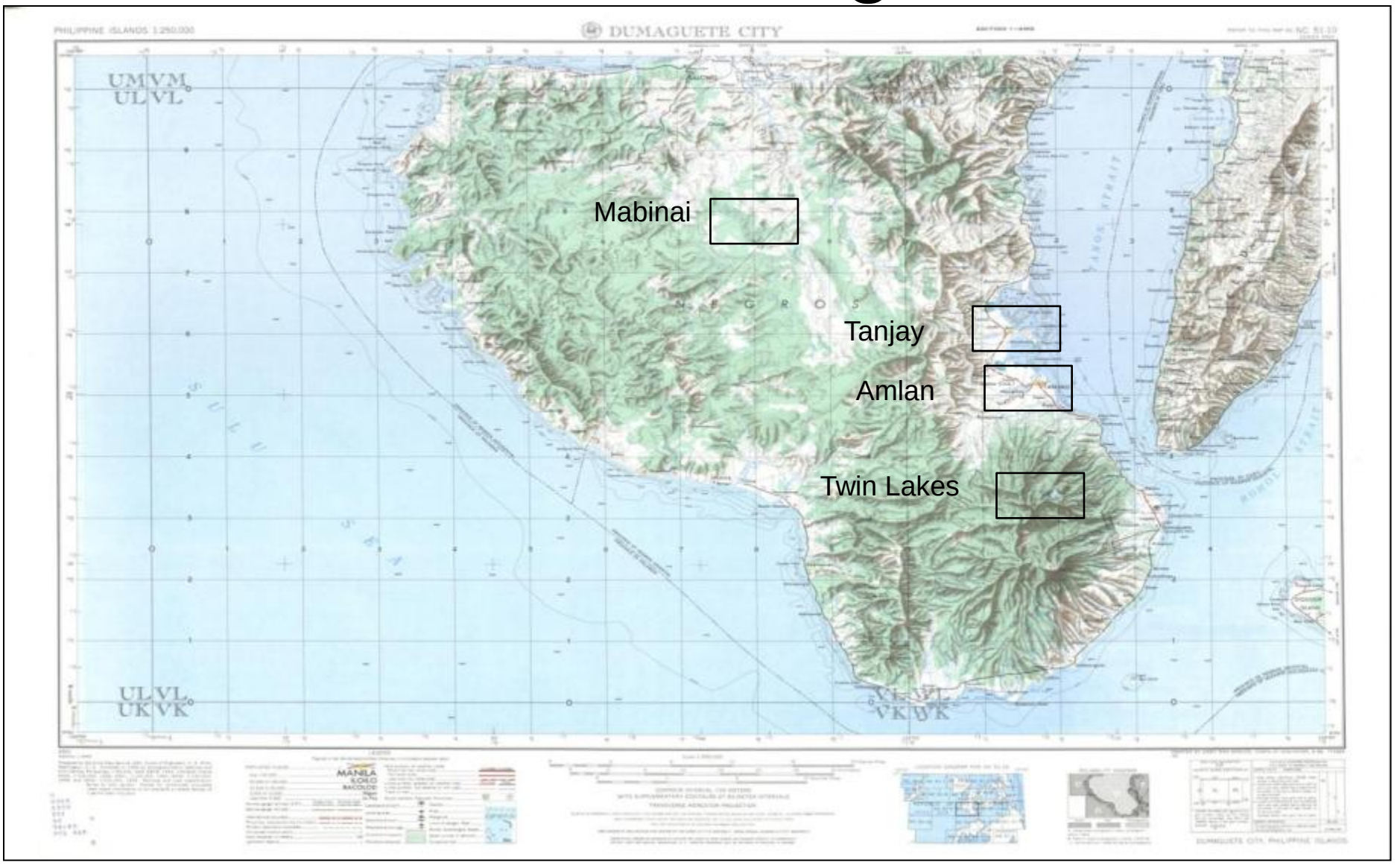
A 6.7 magnitude earthquake struck Negros Feb. 6, 2012, triggering landslides and killing 22.

Photos from: http://www.csmonitor.com/World/Latest-News-Wires/2012/0207/Negros-earthquake-Urgent-rescue-efforts-as-death-toll-rises-video

Fields of boulders ringed volcanoes regions. Volcanic Intrusive or Metamorphic, perhaps evidence of pyroclastic flows

More Boulder Fields, with field assistants.

Southern Negros



Central Negros

Karst area of Mabinai Municipality: Caves and Springs

Caves of Mabinai, Negros Island: A nice attraction, but a good example of how local tourism has degraded natural resources. Newly discovered caves are protected and preserved.

Caves of Mabinai: Reputed to be an area of a Tom Cruise

Bohol


EDITION 1—AMS
NC 51-7
BOHOL STRAIT
B O H O L
LAPINIG ISLAND
B O H O L
BOHOL

The Karst Region of Bohol

Cone Karst: Bohol--The Chocolate Hills

The Chocolate Hills

Bohol: Evidence of alternating fluvial and marine environments.
Evidence of Sea Level Change.

Clay Layer

Calcium Rich layer

Coral Beach: Padre Burgos, Southern Leyte

Coral Beach: Padre Burgos, Southern Leyte

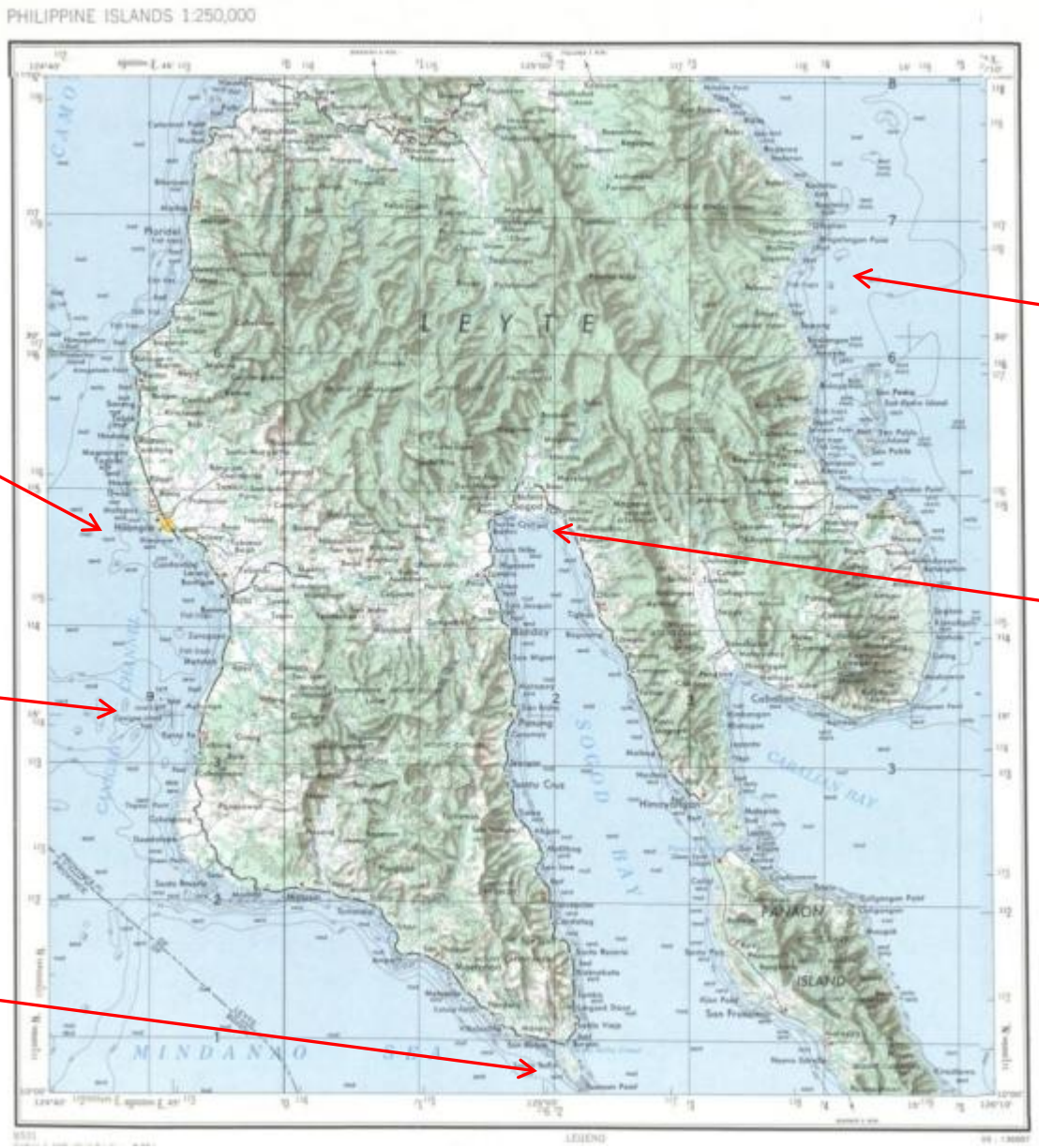
Canigao Island: Coral Sand

Shingle Beach: Sogod, Southern Leyte

Volcanic Sand Beach, Pacific Coast, Silago, Southern Leyte Fine sand well sorted.

Inter-Island Sea Coast: Hilongos, Southern Leyte, Volcanic Gravel persists due to less wave energy.

Beach Locations surveyed in Southern Leyte.



Inter-Island Coast Hilongos, Beach Volcanic sand

Pacific Coast Beach, Fine volcanic sand

Sogod Bay Beach: Shingle

Canigao Island. Coral Sand

Padre Burgos. Coral sand

Environmental Issues

- Local Food Production
  - The local market
- Geothermal Energy
- Public Transportation
- Municipal Services
  - Solid Waste
  - Water
  - Municipal Leadership

The Local Market: Only 5 minutes walking distance away from the house. Within the market are “convenience stores”

The Local Market: Local Vegetables

A day trip up in the mountains can give save a few pesos. Villages have one day a week set aside as market day.

The Local Market: Dried Fish

The Local Market: Meat section

The Local Market: Blue and White Marlin $2 per pound.

The Local Market: Some Western notions concerning food handling rules are violated.

Negros Oriental: Geothermal Energy provides most of the Electrical Energy. Economic Growth is tied to Geothermal Energy throughout the Visayas.

Transportation Systems: The busses run every 20 minutes between population centers. Two cents a mile. Driver will stop and pick up anywhere along the road.

Transportation Systems: Put-puts and Pedi-cabs

To get to areas not served by regular public transportation, you ride a “habul-habul”

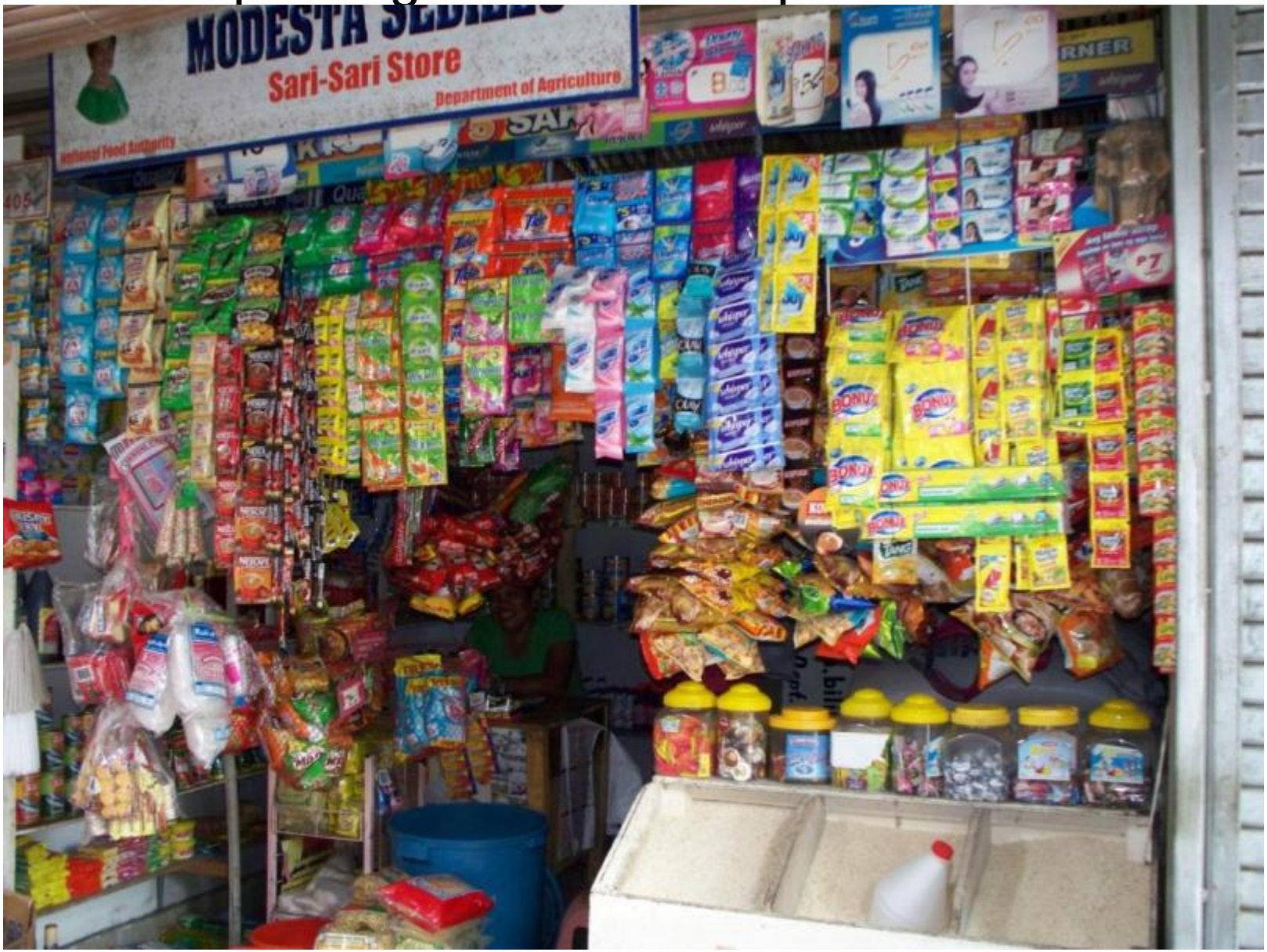
Always room for one more. Fares are about 20 cents to go anywhere in town or to the next village. 125cc motorcycle powered. Students (wearing uniforms) pay less.

The Philippines is well known for Jeepney's. but they are not utilized like they once were.

The Local Market: Recycling Segregation.

The national government mandates that all village governments set up recycling centers.

Most of solid waste consist of plastic from individually packaged consumer products



Solid Waste: The Tanjay “dump site”.

Organic Matter and Plastic.

Most of the stormwater material is biomass waste from coconut (copra) production

Streets are kept clean by the elderly who depend on public support.

Water: Neighborhood pump. Depth 30 meters (one pipe length) into the ground. Used for washing clothes and bathing.

Waste Disposal: “Water sealed” toilets are traditional with catchment directly below. Modern facilities are common but use the same disposal method. No field lines or sewerage system. Five or more household units are within 10 to 20 yards of community water pump.

Water: City Water is used for cooking and bathing, but you have to pay for it.

Bottled water is used for drinking. Small filtration operations are a local cottage industry.

Leaders in Environmental Stewardship are often found at the Municipal level.

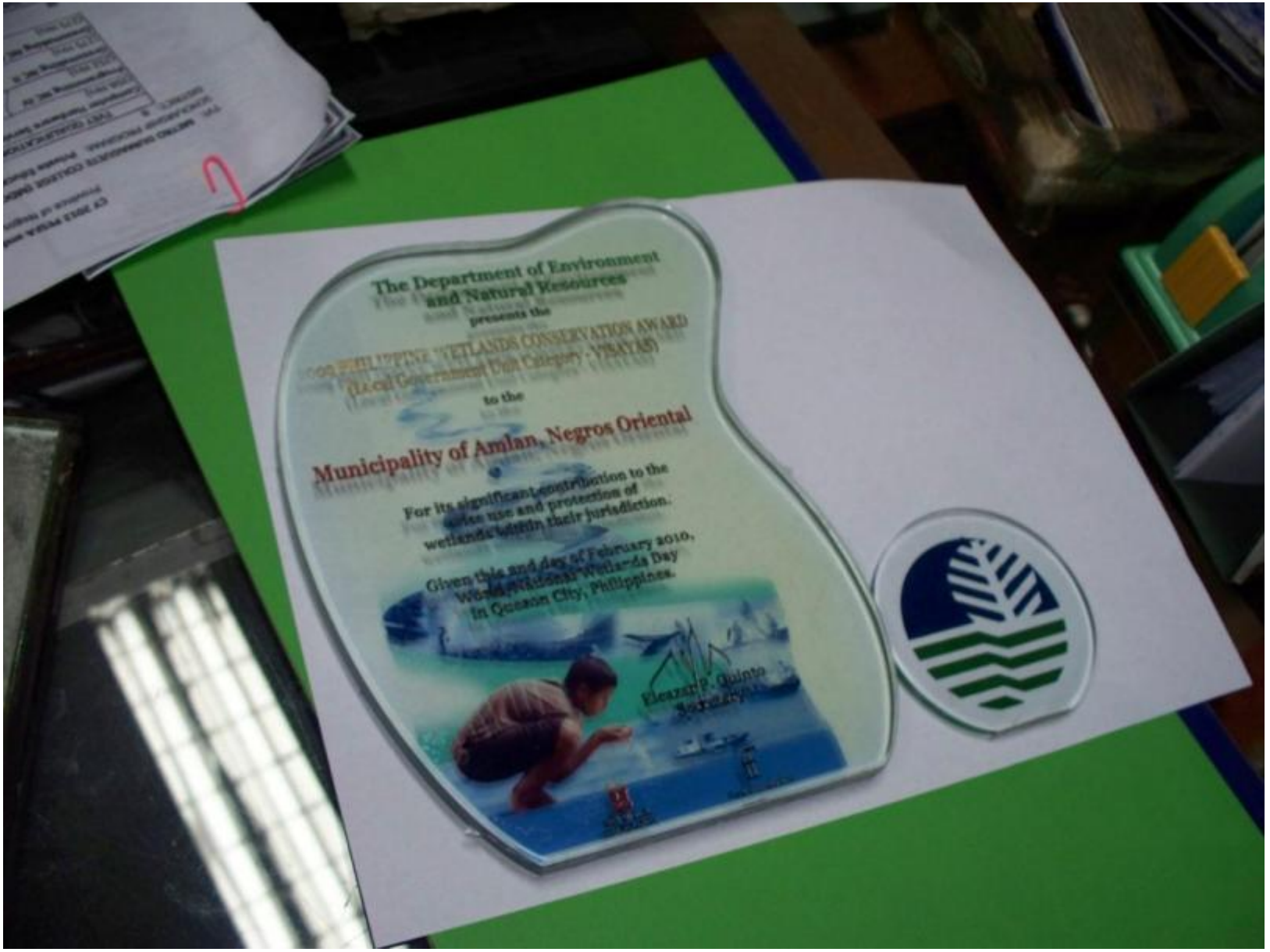
A local Sperm Whale exhibit

Amlan's Environmental Education/Operation Center

Amlan prohibits fishing within 100 m of the seashore

Amlan Mangroves

Amlan: An Award for Wetland Conservation



Eco-tourism Hits and Misses

Every local has some natural resource that can be developed for tourism, often developed for local tourist, sites are overbuilt or degraded. Development of Eco-tourism is a high priority for the Philippine government and they are implementing a plan that includes basic consensus international standards.

Mangrove Forest: Tanjay, Negros

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A local government initiative to promote Ecotourism

On the way to the Mangrove Forest Preserve: A Hot Spring

A natural asset degraded by misdirected development

A swimming pool was constructed at the hot spring as “development” to complement the mangrove preserve.

The swimming pool project only benefited the local official and his associates who received the construction funds. The spring was enjoyed by the local people as a natural resource, and in its natural state, approached perfection. Now, with no ongoing maintenance plan, the spring is a small corner to a cesspool. The local people have no resources to maintain it.

Bohol: “Man-made Forest”. Reforestation efforts, while commendable, are common attractions along the tourist trail.


TARSIER
CONSERVATION
AREA
LOBOC BOHOL

Ecotourism Bohol: Tarsier Reserve

Nocturnal animals, Tarsiers come back to the same tree branch each night.

Tarsiers are confined with netting at the preserve. Do Tarsiers live longer in the preserve than in the wild? The resident biologist do not know. The center has been open for only two years. It is a big improvement over the privately operated tarsier petting zoos which are now outlawed. The preserve is a positive development for the tarsiers.

Ecotourism Bohol: Beach Resort, promote sustainability, eat locally grown honey and food for $100 a night! Nice accommodations downtown cost around $10 a night.

Ecotourism Bohol: Bee Farm

Bohol: Road side attraction--Butterfly Conservation…Flying Colors

Pupae are protected inside from ant predation. Super Glue is used for re-attachment.

Butterflies Mating

Landslides in Southern Leyte

- 2012 Area survey.
- 2006 University of Waterloo, Ontario Canada Analysis

Area of Landslide survey in Southern Leyte.

Geology of Leyte

- The geology of Leyte Island consists of a number of Pliocene-Quaternary volcanic cones, generally andesitic in nature, Tertiary sediments and thick successions of Tertiary volcanic and volcaniclastic rocks The dominant structure is the Philippine Fault which bisects the island. (Evans 2006).
- In the Leyte area no large historical earthquake has been reported since the 17th century and seismicity appears to be dominated by shallow (<10 km in depth) small magnitude earthquakes. This pattern of seismicity is consistent with the idea that the Philippine Fault in Leyte Island is creeping slowly rather than accumulating strain. Creep movement along the fault in the Leyte area has been measured at about 2.5 cm/year. (Evans 2006).
- The topographic expression of the fault includes fault line scarps, side-hill ridges, pressure ridges parallel to the fault and associated narrow elongate depressions. (Evans 2006).

Arrows indicate 2006 slide (top) and older slides (bottom two).

February 17, 2006 a massive ***rock-slide debris avalanche*** in St. Bernard, Southern Leyte killed 1126 people. The village of Guinsaugon was buried.

Few victim’s bodies were recovered. A small memorial was erected at the landslide margin.

The landslide struck in mid-morning. An elementary school was buried, killing 246 students and 7 teachers. At a gathering to commemorate the anniversary of a Health center 80 women were killed.

Provincial Road cut through debris of an earlier large slide.

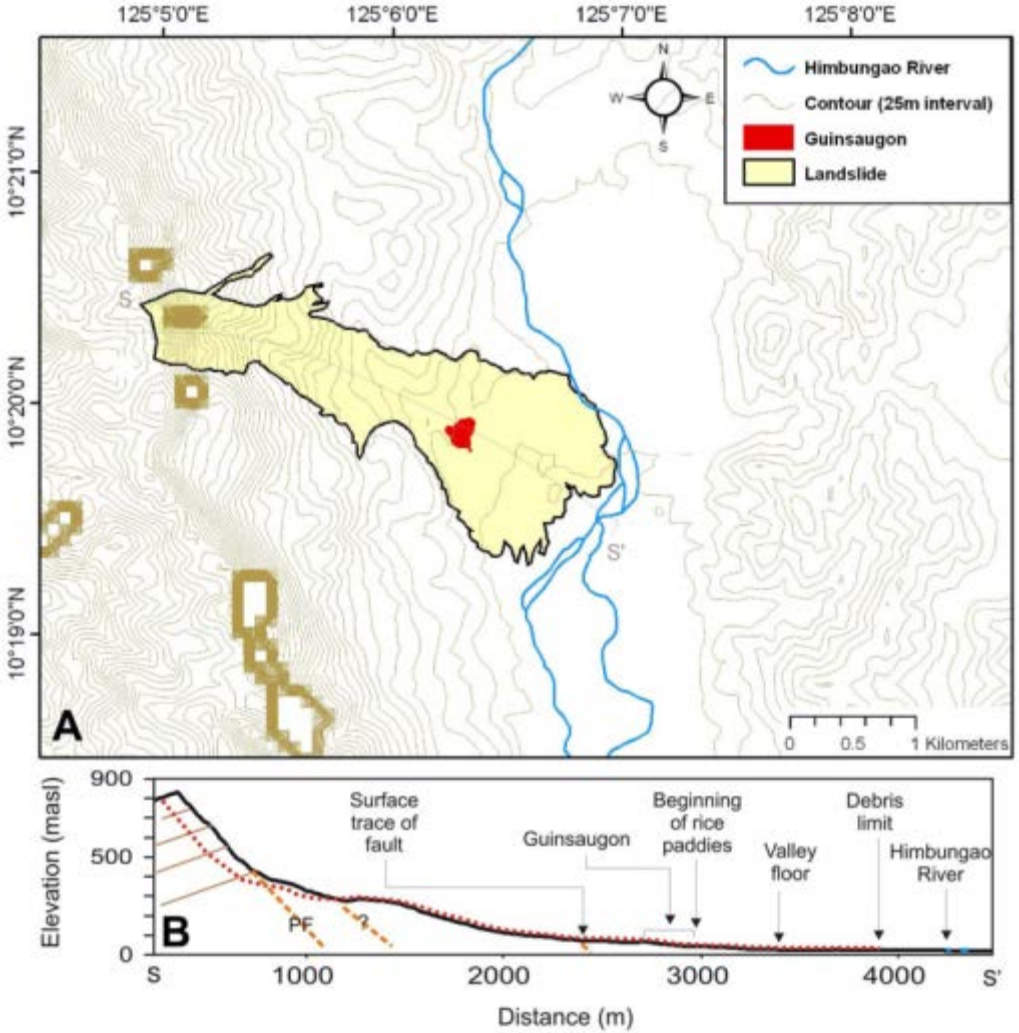
Provincial road cut detail. GPS unit indicated for scale.

Ample evidence of recent small rock falls and large debris flows.

Landslides indicated along barrio road cut in adjacent areas. Wallet indicated for scale.

Close-up of andesitic gravel

Recovery of rice paddies at the margin of run-out



From the Canadian Study: Map of area of Guinsaugon landslide based on SRTM data. Holes are apparent in the digital terrain data along the ridge line (see Appendix for discussion). Outline of the landslide is based on interpretation of ASTER image collected on 1 March 2006 and GPS-controlled field traverses in March 2006. **(B) Profile of** rockslide-debris avalanche based on SRTM data and field measurements in March 2006. Line of profile is marked in Fig. 6b (S-S').

From the Canadian study: Aerial view of the sliding surface showing horizontal striations consistent with strike-slip fault movement. North-South movement

From the Canadian study: View from the surface of the debris toward the source area of the rockslide-debris avalanche. Extensive run-out of avalanche was attributed to the presence of flooded rice paddies.

Causes

- Rock slide was triggered by a period of abnormally high rainfall.
- Slip-face was weakened by the Philippine strike-slip fault.

- Evans, S. G., R. H. Guthrie, N. J. Roberts, and N. F. Bishop (2007), The disastrous 17 February 2006 rockslide-debris avalanche on Leyte Island, Philippines: A catastrophic landslide in tropical mountain terrain, Nat.Hazard Earth Syst. Sci., 7, 89– 101.