Seismology at School in Nepal: - “Working together for earthquake education and better preparedness”

I’m awake before 6 this morning and rewarded with a view from my window not typical of the one I’m used to in rural Cheshire. In truth, this is the first day on our trip that the clouds have parted to reveal the snow covered Himalayas just a few tens of kilometres to the North; specifically, the Annapurna Massif. As a geologist, the beauty of the view is enhanced by contemplating the forces beneath our feet that formed these mountains over the last 50Ma and are still causing them to rise at a rate of over 1 cm per year. Most textbooks classify these as ‘fold mountains’, a name that does not do justice to the constant movement on hundreds of faults which result in the frequent earthquakes both small and large which beset this region. So whilst the views of the Himalayas may be stunning, therein lies the danger. And the reason why we are here in Nepal.

Room with a view: Machhapuchare (6993m @32.2km distance)

Meet you in Kathmandu

The *International Workshop on Educational Seismology* was the brainchild of Shiba Subedi and his PhD supervisor, Prof. Dr. György Hetényi, both from the University of Lausanne’s Institute of Earth Sciences in Switzerland. It was organised as part of the *Seismology-at-School in Nepal* project for Shiba’s doctorate; an ambitious program tasked with implementing and evaluating the feasibility of testing a bottom-up approach to seismology in schools. By helping in facilitating the education of students to understand the hazardous environment in which they live and the possibilities for keeping safe, it is anticipated they will more effectively transfer this knowledge to their communities and future generations. A major part of the plan was to install low-cost seismometers in over 20 schools in western Nepal, and train the teachers on their use and some elementary data processing, as well as updating their geological knowledge. Through this approach alone, it is estimated that over 2000 students between 5 and 18 years of age will directly receive earthquake education within a few months.

The workshop ran from 16th – 17th April 2019 in the lovely tourist city of Pokhara, situated on the shore of Phewa Lake and overlooked by the Himalayas to the north and by the World Peace Pagoda to the south. And peaceful it was, in stark contrast to the clamour that awaited us as we flew into Kathmandu airport two days earlier. Having eventually retrieved our bags from the ‘mountain’ that had been thrown from the luggage carousel whilst we went through the inevitable two-hour paper chase that is immigration, we were met by Shiba who took us to our overnight hotel prior to our onward journey the next day. The late arrival from Hong Kong meant I met the rest of the team the following morning at breakfast

where we had our final briefing before flying off to Pokhara. In addition to Shiba and György (both geophysicists), the team included Dr Anne Sauron, a geophysicist from Sion (Switzerland), and Paul Denton, a seismologist from the BGS and leader of the UK school seismology project. My role was to add a geoscience education perspective to the proceedings at school level.

Opening formalities

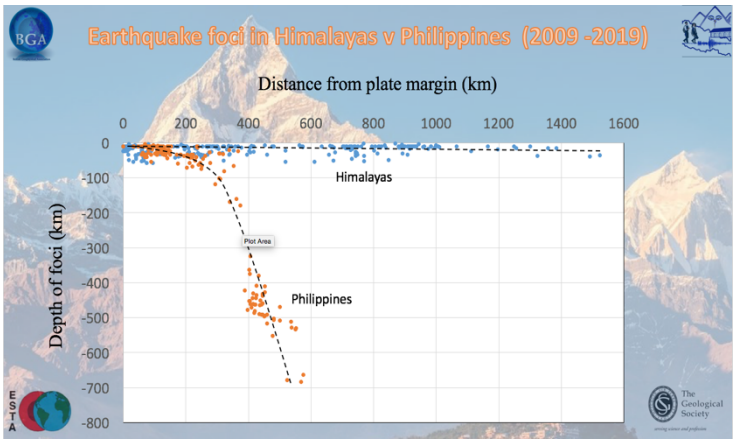
Presided over by the Speaker of the Provincial Assembly, the aims of the workshop were outlined and the keynote speakers formally welcomed at an impressive opening ceremony that was full of symbolism. Of the 96 delegates, 70 were teachers (mainly science, computer science, social subject teachers, as well as school principals), with the remaining delegates representing the Ministry, the army, police forces, National Seismological Centre, with a few university students, and several journalists. In this way it is hoped that those responsible for rescue services in the event of an earthquake and those with authority to adapt the school curriculum will benefit from the workshop.

Formal welcomes at the opening ceremony (photo J. Sauron)

The workshop

Then we got down to business and over the next day and a half a series of presentations and interactive demonstrations from the key speakers, interspersed with open-question sessions, contributed to a memorable teaching and learning experience. In a very religious country, György tackled the difficult issues relating to religious belief versus science, whilst I presented on Earth structure and the plate tectonic background behind Himalayan earthquakes, making use of a selection of *Earth Learning Ideas* (https://www.earthlearningidea.com) and how they might be used to teach these concepts in the classroom.

One piece of independent research, as currently undertaken by UK students using GIS as part of their A-level geology course, demonstrates the distribution of earthquake foci in the Himalayas compared with the adjacent Philippines. This indicates that subduction in the former is much shallower than the latter, possibly accounting for the current lack of active volcanoes in the Himalayas.



The distribution of earthquake foci along two contrasting plate boundaries

Paul's interactive sessions on earthquake waves, using audience participation and oversized slinky springs, went down very well as did his working seismometers during the breaks. Shiba then outlined the "Seismology at School in Nepal" project in which seismometers were to be later installed in delegates schools. He explained the need to include earthquake education in the curriculum and that installing and training teachers in the use of the seismometers in the classroom was a first step towards promoting earthquake awareness in Nepali schools. And right on cue, during the afternoon session, the previously installed pilot school seismometer in the network detected a 4.5 magnitude event between Kathmandu and Pokhara. Practical advice regarding evacuation and teaching earthquake preparedness was given during Anne's sessions supported by two excellent cartoon videos that bring to home the importance of good seismic education in earthquake prone areas. All presentations were well received and any language barrier was overcome by clarifications and translations from English to Nepali and vice versa.

Paul explains seismic waves (photo J. Sauron)

For me, one of the most stimulating parts of the workshop was the breadth and depth of understanding and interest shown during the Open Session Questions. These ranged from the scientific - such as "do plates always move in the same direction?" - to the philosophical – "why do mythological explanations of earthquakes usually involve animals?". Clearly we had sparked some thought and were similarly challenged.

The workshop finished with a formal closing ceremony in the presence of the Minister for Industry, Tourism, Forest and Environment with votes of thanks and presentations to the presenters and 'slinky springs', certificates and other teaching materials to the delegates. One delegate in particular summed up the groups response to our efforts with these words; "Our hearts are yours, as you are more worried about Nepal's earthquake safety than we are"! When asked to say a few words of thanks on behalf of the presenters I recalled that Pokhara is the training centre for recruits to the famous Gurkha regiments in the British Army whose name originates from the town of Gorkha; the epicentre of the devastating 7.8 magnitude Gorkha earthquake that struck Nepal on 25th April 2015 killing 9000 people. The fourth anniversary of this event, coming just a week after the workshop, brought into sharp focus the vital need for this project. Following the group photograph the proceedings generated into a frenzy of 'selfies' with delegates determined to get their own individual mementos.

The next step

With the workshop behind us we had planned to help Shiba install the first of the 22 school seismometers. In fact, the next day coincided with a local transport strike and our plans to travel to the Shree Shanta Secondary School were all but thwarted until Shiba had the foresight to contact the Chief of Police, who had attended the workshop, and who promptly placed a police jeep at our disposal! Not for the first time did it became clear just how well connected and respected Shiba was in his community.

Nepal Police to the rescue!

After an interesting ride around the lake over rough tracks, we arrived at the school to be warmly welcomed by the children and school staff. Installation of the first seismometer was always going to be tricky but eventually a suitable location on the ground floor was established, the concrete floor drilled, and the seismometer connected to a permanent power supply and the internet. The installation gave some of us time to teach the children. Whilst Paul explained the physics of how seismic waves are transmitted and monitored, Anne, György and I demonstrated the practical procedures of an earthquake drill. On completion the children were awarded “Earthquake - Be Aware” stickers which they seemed to appreciate.

Anne engaging with Shree Shanta Secondary students

Shiba - One down, 21 to go!

Just how many geophysicists does it take to install a seismometer?

During subsequent school visits Shiba has been able to install a further 21 seismometers in schools throughout western Nepal and his dream of establishing a seismic network of school-based seismometers in Nepal is now a reality.

Final thanks and thoughts

The success of the project was the culmination of many hours of planning by György and Shiba - arranging sponsorship, sorting all the admin etc - most of which I can only imagine! To them goes the credit. With an international team spread between the UK and Switzerland, preparation was achieved by e-mail and skype meetings, in order that our presentations did not overlap and were mindful of the sensibilities of the local people, their culture, and their resources. One such discussion revolved around whether they would have access to spaghetti for one of the investigations into earthquake magnitude and indeed, whether food should be used in this way!

The event was sponsored by a number of organisations but in particular the University of Lausanne's Faculty of Geosciences and Environment who, with the Royal Astronomical Society, provided equipment for the seismic network, and the American Geophysical Union, that enabled the school teachers to participate. I am particularly grateful for the British Geophysical Association for their contribution towards my expenses and the acquisition of slinky springs for each school.

It will be up to Shiba to eventually measure and evaluate the long-term impact of the workshop and the Seismology at School in Nepal program but, for me, I can only think that this event has already contributed to earthquake-safer communities in Nepal. I leave with very fond memories of the welcome we received, the friendships fostered and a job well done.

And who could forget that inspiring view from my window! Namaste.

Pete Loader

peteloader@yahuoo.co.uk

Further details of the *Seismology at School in Nepal* project can be found at www.seismoschoolnp.org