Table 1. Earthquakes of $M \geq 7.5$ plotted in Figure 1 *b*

Year	Latitude (°N)	Longitude (°E)	Magnitude
1891	35.6	136.3	8
1896	39.5	144	8.5
1897	38.1	141.9	8.7
1901	40.6	142.3	7.5
1906	34	137	7.7
1909	34.5	141.5	7.6
1915	38.3	142.9	7.5
1923	35.4	139	7.9
1923	34.9	140.2	7.6
1927	35.8	134.9	7.6
1931	40.4	142.6	7.7
1933	39.2	144.6	8.4
1938	36.4	141.7	7.7
1938	37	142	7.9
1938	37.1	142	7.8
1938	37.2	142.2	7.7
1944	33.7	136	8.1
1946	33	135.6	8.1
1953	34	141.7	7.9
1960	39.8	143.4	7.8
1964	38.4	139.2	7.5
1968	40.9	143.3	8.3
1972	33.3	140.8	7.5
1978	38.02	142.07	7.6
1983	40.44	138.87	7.7
1993	43.06	144.29	7.6
1993	42.71	139.28	7.7
1994	40.56	142.99	7.7
2003	42.21	143.84	8.3
2011	37.52	143.05	9.0
2011	35.92	141.38	7.9
2011	38.27	144.63	7.6

includes a realistic assessment of the hazard that primarily takes into account the knowledge about past tsunamis and the present state of earthquake sources. The probability estimate map prepared by the headquarters of Japan's Earthquake Research Program identifies the source zone of the 11 March earthquake (Miyagi-ken-Oki) as one with 99% probability, for a *M* 7.5 earthquake and an estimated maximum magnitude of 8.0. In fact the 9 March (*Mw* 7.2) earthquake did occur in the postulated location (Figure 3). It is also worth remembering that natural processes turn into major disasters only when they interact with the built environment. Coastal regions are basically interactive zones with various natural processes including infrequent but high impact tsunamis and therefore, the primary concern while locating critical facilities is to leave a buffer zone.

Tsunamis were not considered a serious hazard along the Indian coasts until 2004, although we have archival information of such predecessors on both coasts. For India, the most important lesson to be learnt is regarding the safety of its nuclear plants located on its coastal regions. There are two known sources of tsunamis in our nearby waters: the Sumatra-Andaman and the Makran subduction zones. The Indian nuclear power plants are located sufficiently far from these sources and with the Indian Ocean Tsunami Warning System operational, timely shutdown is possible. However nuclear plants, currently operational or under construction in neighboring countries, located in the vicinity of tsunamigenic sources should be a concern[9]. The Fukushima experience is a reminder that the fallout of such events transcends political boundaries and the concerns are of a global nature. It also calls for a change in our approach to probabilistic risk assessment, incorporating newer inputs and benchmarks.

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Uncovering the genetics of cancer

In 2007, researchers and funding agency representatives from 22 countries agreed to launch an international consortium to study cancer genomics. The International Cancer Genome Consortium (ICGC) has set out its bold plan to decode the genomes from 25,000 cancer samples and create a resource of freely available data that will help cancer researchers around the world. The ICGC published outlines of research design and projects as well as the important ethical framework for this task in April 2010 (ref. 1). In the beginning it was considered that generating comprehensive catalogues of human cancer mutations will require tremendous amount of work and collaboration over the coming years. But studies of breast, liver and pancreatic cancer have already generated datasets which are now available on the ICGC website. Sharing ideas, resources and data across scientific and clinical disciplines will help translate advances in knowledge, which will benefit the future generation of cancer patients.

Cancer incidence and deaths are rising worldwide. It is estimated that in 2007 over 12 million new cases were diagnosed across the planet and approximately 7.6 million cancer deaths occurred; these numbers will rise to an expected 27 million new cases and 17.5 million cancer deaths in 2050 (ref. 2), if our ability to prevent, diagnose and treat cancer does not improve.

Because genomic changes are often specific to a particular type or stage of cancer, systematically mapping the changes that occur in each cancer could provide the foundation for research to identify new therapies, diagnostics and preventive strategies[3]. Therefore, cancer

and genomic researchers and funding agency representatives from 22 countries gathered in Toronto, Canada in October 2007, to discuss strategies to accelerate the comprehensive study of cancer genomes. Attendees agreed that genomic technologies are approaching the stage at which cancer genome analysis will be feasible on a comprehensive and high-throughput scale. Meeting participants enthusiastically endorsed the launching of an international consortium to globally pursue this goal in a coordinated manner.

An Executive Committee (EXEC) for the preparation of ICGC was established, with representatives of funding agencies from Australia, Canada, China, India, Singapore, the United Kingdom, the United States and the European Commission (Observer Status). Tom Hudson (President and Scientific Director, Ontario Institute for Cancer Research) agreed to provide Secretariat functions for EXEC. The consortium's secretariat is located at the Ontario Institute for Cancer Research, Toronto, Canada, which also operates as data coordination centre[4]. A Scientific Planning Committee composed of leading scientists in the fields of cancer, genomics, ethics and bioinformatics research was also formed. These committees, which were augmented by focused working groups, developed the proposal to provide funding agencies and the scientific community sufficient information to allow them to determine their interest and ability to participate in the consortium[5].

In recognition of numerous challenges that are specific to each tumour type and subtype, it was agreed that the level of organization on which cancer genomics within ICGC will be approached is at the specific cancer type or subtype.

Members consist of Funding members and Research members, each being individual or allied group that will provide a level of funding or scientific expertise sufficient to undertake a cancer genome project involving characterization of a minimum of 500 unique cases for each cancer type or subtype.

Each participating country has a particular tumour type as its primary research target[6]. Australia: pancreatic cancer – ductal adenocarcinoma and ovarian cancer – serous cystadenocarcinoma. Canada: pancreatic cancer – ductal adenocarcinoma and prostate cancer – adenocarcinoma. China: gastric cancer – intestinal and diffuse-type. European Union/France: renal cancer – renal cell carcinoma (focus on but not limited to clear cell subtype). European Union/United Kingdom: breast cancer – ER+ve, HER2–ve. France: breast cancer – subtype defined by an amplification of the *HER2* gene. France: liver cancer – hepatocellular carcinoma (secondary to alcohol and adiposity). Germany: pediatric brain tumours – medulloblasma and pediatric pilocytic astrocytoma. India: oral cancer – gingivobuccal. Italy: rare pancreatic tumours – enteropancreatic endocrine tumours and rare pancreatic exocrine tumours. Japan: liver cancer – hepatocellular carcinoma (virus-associated). Spain: chronic lymphocytic leukaemia – CLL with mutated and unmutated IgVH. United Kingdom: breast cancer – triple negative/lobular/other. USA: TCGA brain cancer – glioblastomamultiforme and colon cancer – adenocarcinoma and leukaemia – acute myeloid leukaemia and lung cancer – squamous cell carcinoma and lung cancer – adenocarcinoma and ovarian cancer – serous cystadenocarcinoma.

Studies of breast, liver and pancreatic cancer have already generated datasets which are now available on the ICGC website. The data housed in the Data Coordination Center, hosted by the Ontario Institute for Cancer Research, are from 22 different cancer projects and recent updates from the ICGC projects in Canada, Australia and the UK. In addition to open access data, ICGC-controlled data can now be retrieved securely by users who have been authorized by the Data Access Compliance Office.

The Wellcome Trust Sanger Institute published the results of the first detailed search for genomic rearrangements in breast cancer genomes and complete genome sequences of a melanoma and small cell lung cancer. Other analyses conducted by the ICGC members in Japan, Australia and Canada have also been made available[7].

Germany will contribute another project to ICGC to study the genetic causes of early prostate cancer. Prostate cancer is known to occur typically in older men. Researchers assume that prostate cancer with hereditary background[8], which is not yet entirely understood, is more likely to occur in men under the age of 50 years. 'Focusing our project on young patients is also very likely to produce findings about the causes of hereditary prostate cancer', mentioned Guido Sauter, Director, UKE's Institute of Pathology and co-coordinator of the research project.

India has taken up comprehensive genomic and associated analyses of the most prevalent Indian cancer, i.e. oral cancer. According to R. Sarin, one of the Principal Investigators and Director, Advanced Centre for Treatment, Research and Education in Cancer, Tata Memorial Centre (ACTREC), Mumbai, the first year was the pilot phase sanctioned from October 2009 to September 2010, with Rs 48 million for the first year.

All the 500 cases will be accrued in ACTREC; associated methylation, transcriptome, IHC and functional analyses will be done at ACTREC and deep re-sequencing at the National Institute of Biomedical Genomics. With the first case enrolled at ACTREC in February 2010, it is expected to complete 50 cases in one year and all 500 cases in three years[9].

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