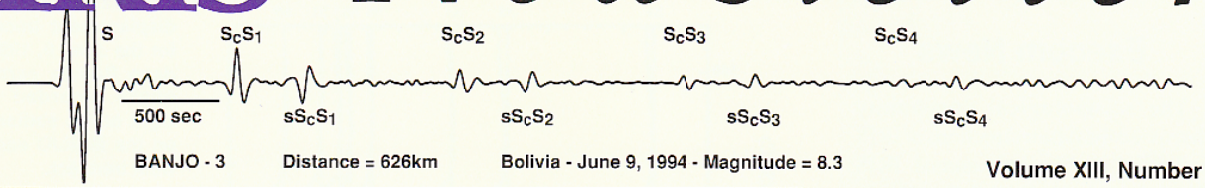
IRIS Newsletter




Volume XIII, Number 3

# Across the Andes and Along the Altiplano: A Passive Seismic Experiment

*Susan Beck[1], Paul Silver[2], George Zandt[3], Terry Wallace[1], Steve Myers[1], Randy Kuehnel[2], Stan Ruppert[3], Lawrence Drake[4], Estela Minaya[4], Pierre Soler[5], Patrice Baby[5], Sergio Barrientos[6], Jose Telleria[7], Mark Tinker[1], and Jennifer Swenson[1]*

Rarely are seismologists lucky enough to deploy a portable seismic array and record a magnitude 8 earthquake less than 600 km away, but that is just what happened last June. We deployed 19 broadband stations during April in central Bolivia (Figure 1). Less than two months later, on June 9, 1994, a $M_W$ = 8.3 earthquake occurred 636 km beneath northern Bolivia. This is the largest deep earthquake to occur since the installation of modern seismic stations and was reportedly felt as far away as Montreal, Canada. This truly amazing earthquake was recorded on our portable broadband array. Our stations are between 570 and 850 km from the mainshock and span an azimuth range of 40°. We recorded the mainshock on-scale at 8 broadband stations and 3 short-period stations providing us with some of the best regional seismograms of a great event ever recorded (Figure 2). We also recorded numerous aftershocks that we are in the process of locating. The largest aftershock on June 9 (Mb=5.4) was well recorded on 17 stations. Many of the aftershocks are too small to be well recorded teleseismically, but are recorded on our regional network. The rupture characteristics of deep earthquakes are a fundamental question in geophysics. Analysis of these data will provide us with a unique view of a deep earthquake, as well as critical information on the number, size, locations and mechanisms of aftershocks.

The array was deployed as a passive source, broadband, seismic experiment in the central Andean Cordillera of Bolivia and northern Chile. This is an international, multi-institutional experiment with participants from the University of Arizona, Carnegie Institution of Washington, and Lawrence Livermore National Laboratory in the U.S., San Calixto Observatory and the National Academy of Science in La Paz, Bolivia, the University of Chile in Santiago, and ORSTROM, a French research organization. Our scientific objectives are to extend our understanding of the deep structure and tectonics of the central Andean Cordillera and in particular the high Altiplano plateau. Our passive source experiment consists of an east-west transect called the BANJO (Broadband ANdean JOint) Experiment

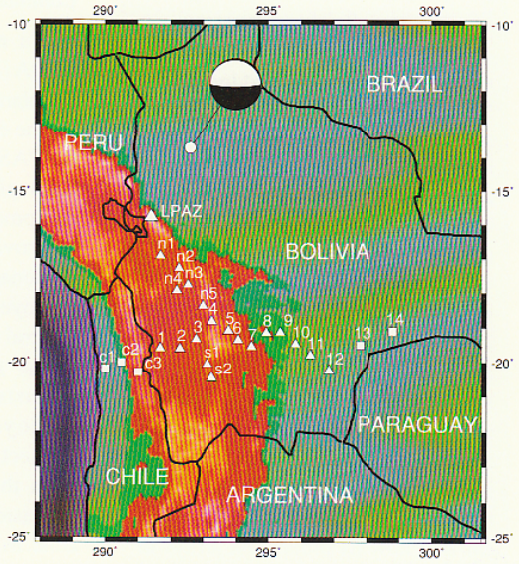



**Figure 1. Map of the Central Andes showing the location of the 19 portable broadband seismic stations (triangles) operating and the stations (squares) to be installed in November, 1994. The location and focal mechanism (from Harvard) of the deep Bolivia event on June 9, 1994, ($M_W$=8.3) is also shown.**

*Continued on page 2*

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## Contents

## Execom News

The seismological community discussed the future directions of IRIS activities at the sixth annual IRIS Workshop, held April 7-9, 1994 in Glendale, California. Speakers were encouraged to look beyond current IRIS activities towards the future of seismic instrumentation and data distribution. Many opportunities to advance seismic data acquisition and analysis were discussed, as well as prospective multi-disciplinary collaborations with other earth scientists.

In a session devoted to data management, speakers addressed the "weeding and feeding" of seismic data sets, as well as "harvesting" them for scientific consumption. Steve Malone noted that various on-line data servers will offer access to an estimated 15 terabytes of seismic data by the end of 1996. Even so, seismology accounts for less than 0.1% of Internet usage. Alan Levander chaired a session on lithospheric seismology, which illustrated new applications in exploring "blind thrusts" near urban areas and in shallow (<100m) imaging. Danny Harvey chaired a session on recent results from the JSP, which showed how its broadband arrays in Central Asia can detect and locate small seismic events. The last session examined the feasibility of augmenting the GSN with sensors from other fields of geophysics, such as GPS receivers and magnetometers. Such sensors could piggyback on the maintenance and communications infrastructure of the GSN, reducing the overall costs of global geophysical monitoring. At special interest group meetings, participants debated the relative merits of multichannel and miniaturized "walkman" data acquisition systems, communicating the benefits of seismic hazard research to the public, and the future of seafloor seismic observatories. •

*Jeffrey Park, Chair*

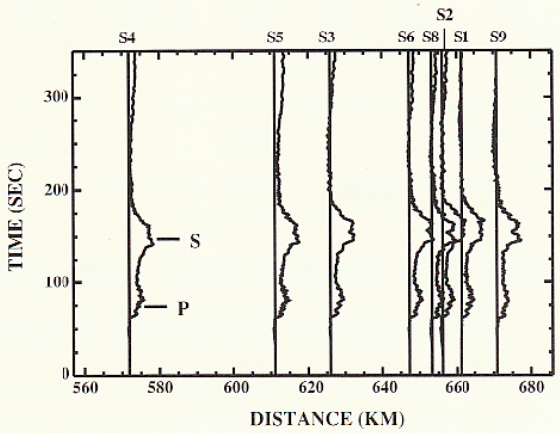


**Figure 2. Broadband displacement traces for the June 9, 1994, deep Bolivia earthquake recorded at eight of the stations on the BANJO east-west transect.**

*Continued from page 1*

and a north-south transect called the SEDA (Seismic Exploration of the Deep Altiplano) Experiment. The equipment for the east-west transect is provided by the PASSCAL program of IRIS and the Carnegie Institution of Washington. The equipment for the north-south transect is provided by Lawrence Livermore National Laboratory. In April, 1994. we deployed a total of 19 stations in the Central Andes.

The BANJO experiment at present consists of 12 stations that are deployed along an east-west transect at 19° – 20°S and extend from the Bolivia-Chile border to the eastern edge of the Sub-Andean zone. In November, 1994, five more stations will be added to the east-west transect, three stations in northern Chile and two stations in the Chaco Plain. The 12 stations presently deployed, consist of Streckeisen STS-2 broadband sensors and Reftek (24 and 16 bit) digital recorders (Figure 3). We are recording a continuous data stream sampled at 10 samples/sec and a triggered data stream sampled at 50 samples/sec. We plan to deploy the stations for 12 – 18 months.

The SEDA experiment consists of seven stations that are deployed in a north-south transect along the spine of the Altiplano, between La Paz and Uyuni, Bolivia. The north-south transect is about 300 km long with a station spacing of approximately 50 km. These stations consist of Guralp CMB-3ESP and 40T sensors and Reftek (16 bit) digital recorders and will be deployed a total of 12 months. We are recording a continuous data stream sampled at 25 samples/seconds. In addition, short-period (2 hz) sensors are operating along side the broadband sensors at three stations.

The transects are spectacular both in terms of geology and scenery (Figure 4). The east-west transect crosses over the

**Figure 3. Photo showing the solar panel installation at station 5 on the east-west transect, located at an elevation of 4500 m.**

**Figure 4. Photo of the Altiplano Plateau looking west toward the western Cordillera near station 1.**

entire Central Andes perpendicular to the strike of the structural elements. It spans the Western Cordillera, Altiplano Plateau, Eastern Cordillera, Sub-Andean zone, and Chaco Plain, a length of nearly 800 km. The north-south transect, along the length of the Altiplano Plateau, crosses the hingeline of the Bolivian Orocline. The Western Cordillera is an active volcanic arc associated with the subduction of the Nazca Plate beneath the South American plate. The Altiplano, in southern Peru, western Bolivia, and northern Chile forms one of the world's highest and largest plateaus, second only to Tibet, with an average elevation of nearly 4 km, a crustal thickness of 70–80 km, and covers an area of over 600,000 km$^2$. The Eastern Cordillera is a highly folded and faulted terrane with large ignimbrite fields. The Sub-Andean zone is an active fold and thrust belt. The Chaco Plain is relatively underformed and underlain by the Brazilian shield.

We are analyzing local, regional and teleseismic data with a variety of seismological techniques. We find large changes in crustal thickness between the Altiplano and the Sub-Andean zone. We are using deep focus earthquakes within the slab for receiver function analysis to identify converted phases. Figure 5 shows receiver functions for three different stations calculated from an earthquake ($m_b$=6.4) on May 10 located in Argentina at a depth of 605 km. We see variations in the timing of the Ps conversion and presumably the crustal thickness both along strike of the Altiplano and across the tectonic provinces. Station N1 is on the Altiplano and has a Ps conversion 9 seconds after the direct P wave, indicating a depth to Moho of approximately 70–75 km. The Ps conversion occurs at 8.1 seconds for station 2 which is located further south on the Altiplano near the Western Cordillera. Station 11 is located in the Sub-Andean zone and shows a 6 second delay for the Ps conversion suggesting a crustal thickness of approximately 48 km. Using the numerous events within the slab, we are mapping out the variations in crustal thickness.

The origin of the Altiplano, in particular its thick crust (~70–80 km), remains enigmatic, as does its relation to the subduction process. Two end-member models for the formation of the Altiplano have been developed over the years. Both of these attempt to explain, above all else, the extremely thick crust and the high elevations. Probably the best developed model of formation is thickening by distributed crustal shortening (Isacks, 1988; Sheffels, 1990). While conceptually simple, it paradoxically requires overall thinning (weakening) of the lithosphere (Isacks, 1988), caused by asthenospheric upwelling possibly associated with a slab-induced delamination mechanism. In the second model, the thick crust is formed by a significant component of magmatic addition associated with the subduction process: the continental equivalent of island arc volcanism (Thorpe et al., 1980; Kono et al., 1989). The key to understanding the Central Andes is the role of the upper mantle. Our experiment will provide a crucial test of these formation hypothesis, and a general understanding of the mountain building processes of the Central Andes.•

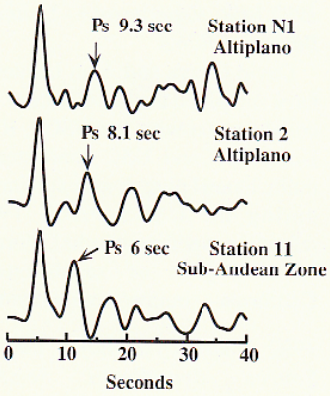


**Figure 5. Receiver functions determined from a deep earthquake on May 10, 1994, at stations 2 and 11 on the east-west line and station N1 on the north-south line. The Ps conversion occurs at 9.3, 8.1 and 6 seconds for stations N1, 2 and 11 respectively suggesting different crustal thicknesses both within the Altiplano and between the Altiplano and the Sub-Andean zone.**

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Isacks, B.L., Uplift of the central Andean plateau and bending of the Bolivian Orocline, *J. Geophys. Res.*, *93*, 3211-3231, 1988.

Kono, M.Y. Fukao, and A. Yamamoto, Mountain building in the Central Andes, *J. Geophys. Res.*, *94*, 3891-3905, 1989.

Sheffels, B.M., Lower bound on the amount of crustal shortening in the central Bolivian Andes, *Geology*, *18*, 807-922, 1990.

Thorpe, R.S., P.W. Francis, and R.S. Harmon, Andean andesites and crustal growth, *Revista Geológia de Chile*, *10*, 55-73, 1980.

**This issue's bannergram:** The tangential component from the June 9, 1994, deep (636 km) Bolivia earthquake ($M_w$=8.3) recorded at station 3 along the BANJO transect. Since the station is almost directly above this deep event, the near-vertical incidence ScS phases dominate on the tangential component. The station is located on the Altiplano 626 km south of the event. • *Susan Beck, University of Arizona*

## New PASSCAL Datasets Available

*Cape Mendocino Calibration Experiment*

Simon Klemperer and B. Beaudoin have submitted the MCKSH data set. In 1993, the USGS detonated four shots to calibrate the seismic network near Cape Mendocino, California. Stanford and the USGS deployed a refraction experiment to utilize these sound sources. The primary objective was to determine recording conditions in this geologically complex region.

*1992 RISC Experiment — Southern Basin and Range*

David Okaya and Alan Levander have submitted the RISC dataset. In collaboration with the USGS, Rice University, and USC conducted a multichannel piggyback experiment during the USGS PACE 1992 refraction experiment in the Colorado River region of southeastern California - southwestern Arizona.

*1992 Pakistan Himalayas Passive Source Broadband Seismic Experiment*

Eric Sandvol and Jim Ni have submitted the PAKH dataset. An 11 broadband station array was deployed in Pakistan across the western Himalayas from September – December 1992. The purpose of this array was to acquire broadband data to provide velocity constraint on the crustal and mantle velocity structure. •

## PASSCAL Workshop

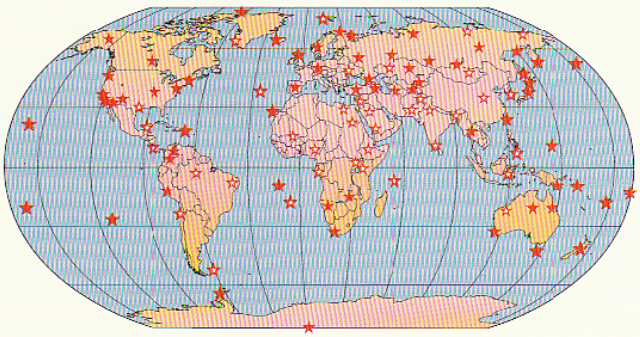
There will be a PASSCAL Workshop for instrument users on December 4, 1994 at AGU. Contact Jim Fowler (jim@iris.edu) for details. •

# GSN Expansion

In response to increasing national interest in a Comprehensive Test Ban Treaty, the United States Congress has provided $21,000,000 in supplemental funding to IRIS and the U.S. Geological Survey for the completion of Global Seismographic Network (GSN) and the continuation of the networks and arrays being developed under the Joint Seismic Program. The supplemental funding was provided through the Department of Defense to the National Science Foundation, which, in turn, is administering the money to IRIS under an authorized Cooperative Agreement. The funding is intended to put the GSN on a fast track by completing the general continental coverage by the end of 1996, and enhancing the coverage in areas of concern for non-proliferation (see the figure below).

Congressional supporters of a Comprehensive Test Ban Treaty view the GSN as a multi-purpose scientific resource that contributes data for basic research, and for the societal applications of monitoring a Comprehensive Test Ban Treaty and mitigating earthquake hazards. Not only do the stations provide a cost-saving and sustainable source of data for monitoring, but the large number of scientists using the data for the full range of purposes creates a strong deterrent against secret testing.

IRIS has developed a siting plan for the use of these funds, and circulated the plan for comment among all agencies concerned with seismic monitoring. In addition, the Arms Control and Disarmament Agency has hosted two meetings for the presentation and review of the IRIS siting plan. IRIS will continue to review this plan to ensure that it maximizes the contribution of the GSN to the monitoring of a future Comprehensive Test Ban Treaty. IRIS welcomes all comments on the siting plan, and will provide it upon request to any interested parties. •




## Global Geophysical Observatories Workshop

Scripps Institution of Oceanography, UCSD, Jet Propulsion Laboratory, and IRIS hosted a one-day workshop in April at IGPP, La Jolla, California which was attended by approximately 50 geodesists and seismologists to discuss the possibility of collocating other geophysical instruments (principally GPS receivers) at IRIS GSN and IDA sites. Discussions included the types of instruments which would best complement seismic and geodetic observations; the problems of data transmission from remote sites; the needs and difficulties of operating regional networks; and the relationship between regional and global networks. It was concluded that collocation of instruments at a global scale provided obvious logistical benefits, but collocation at regional scales provided the most significant scientific benefits. There was considerable discussion of an expanded continuous GPS network in southern California and its integration with regional seismic networks. The workshop was funded by NSF and NASA. •

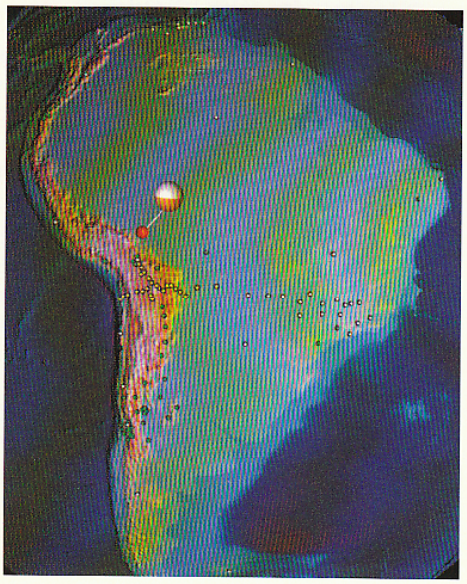
# Scientific ALliance for South America (SALSA)

*Paul Silver, Carnegie Institution of Washington, DTM*

Currently, there is an unprecedented concentration of seismic instrumentation in South America. This represents a unique opportunity for seismology to attack a broad range of problems such as the rupture properties of seismic sources and the relation between seismicity and tectonics (a study area highly publicized by the June 9, 1994 Bolivian deep focus event), and the delineation of crustal and upper mantle structure. In addition to the BANJO and SEDA experiments discussed in the accompanying article, there are two other major portable experiments underway (see figure): the Brazilian Lithospheric Seismic Experiment (CIW-DTM, University of Sao Paolo), ORSTOM Andean Experiment (La Paz, Bolivia: Santiago, Chile). These experiments taken together, and including the permanent stations presently or soon to be deployed, represent an EW transect across the entire South American continent at the latitude of about 20° south, and stations extending NS from La Paz down to southern Chile. In addition to these stations there are regional networks deployed by various countries and the permanent broad band stations of the GSN.

While these data sources were developed for specific, and in most cases, independent purposes, it is clear that for many studies, the combined analysis of these data would be exceedingly valuable. As a means of acheiving this goal, we have established a data coordination center at the University of Chile, Santiago, with support from the University, the Carnegie Institution of Washington, DTM, and IRIS, and with the endorsement of IASPEI. The participants in SALSA will send bodywave travel times to the coordination center, and in return, will receive the combined location as well as the data upon which the location was based.

The immediate task will be to dramatically improve earthquake location in South America. We are also coordinating activities with the NEIC, for the location of larger events. We were very fortunate to have the Bolivian event shortly after the inception of SALSA. This event had several aftershocks, and we are presently attempting to assist in the precise location of these events using SALSA contributed data. SALSA will have many benefits: 1) It provides earthquake location support for portable experiments going on in South America, enhancing the usefulness of these data sets for structural studies. 2) It significantly improves PDE event locations in South America, a region known for large mislocation errors. 3) Perhaps most importantly, the data and locations will represent a shared resource between South American countries and the U.S., thereby fostering Inter-American co-operation and strengthening ties between U.S. and Latin American seismological centers.



**Smaller circles: portable and permanent stations. Yellow: BANJO/SEDA experiment. White: all other broadband stations. The remaining are GSN stations except for LCO (station ~500 km north of Santiago). Green: short period regional networks that will or are reporting phase arrival times to SALSA. The stations of the ORSTOM Andean Experiment (not shown) are interspersed between the EW BANJO stations.**

### Descriptions of Data Sources

1) Portable Experiments: a) BANJO and SEDA experiments (see article on page one). b) BLSP92 - nine STS2's in Brazil (David James, Carnegie, DTM; Marcelo Assumcao, University of Sao Paolo) will be deployed through middle of 1995. c) ORSTOM Bolivian/Chilean deployment (six month period which began in July of 1994, C. Dorbath, PI). Fifty short period vertical and three-component seismographs interspersed between BANJO stations to obtain 10km spacing for the purposes of detailed tomography. Two stations in Chile: STS2; Iquique (IPG, Paris), Las Campanas Observatory, STS2 (Carnegie Institution of Washington, University of Chile).

2) Regional Networks. Thus far we are working with groups from Bolivia (San Calixto Observatory), Peru (IGP, Lima), Brazil (University of San Paolo), Argentina (INPRES), Colombia (INGEOMINAS) and Chile (University of Chile, Santiago). In all, the regional networks in South America constitute about 200 digital stations and thus represent an important data source.

3) Permanent stations in South America from IRIS, GEOSCOPE and GTSN: LPAZ (La Paz), NNA (Lima, Peru), CPUP( Asuncion, Paraguay), PLCA (Bariloche, Argentina), PEL (Santiago, Chile), ANT (Antofagasta, Chile), and BDFB (Brazilia, Brazil). All of these are now in operation, or are expected to be operational within the next few months.•

## New Information Products Available

The JSPCenter has submitted three new Information Products since the last newsletter.

*Caucusus Network Information Product*

This Information Product contains waveform and associated event parameters from the Caucasus Network from January 1, 1992–November 9, 1992.

*The Central Asian Waveform Product*

This Information Product contains waveform data to accompany the previously released Central Asian Bulletin and Catalog.

*Chinese Nuclear Test of June 10, 1994*

This Information Product contains waveform data and information from the Chinese Nuclear Test site at Lop Nor on June 10, 1994. •

## GSN Update

Three new borehole stations have been installed in the GSN. The IRIS/ASL team upgraded the existing SRO site BOCO, Bogota, Colombia. The IRIS/IDA team installed new borehole sites on Ascension Island, ASCN, and in Iceland - BORG, Borgarnes, Asbjarnarstadir. BORG is a collaboration with the Icelandic Meteorological Office.

Four new vault stations have been added to the GSN. The IRIS/ASL installed LSZ, Lusaka, Zambia; TSUM, Tsumeb, Namibia; and SDV, Santo Domingo, Venezuela. The IRIS/IDA team installed BRVK, Borovoye, Kazakhstan. •

# IDA Update

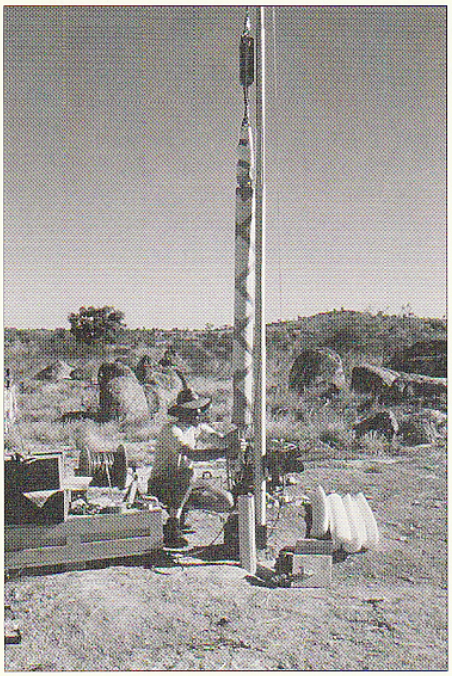
*Holly Given, Project IDA, University of California, San Diego*

Since the last *IDA Update* in IRIS Spring 1994 Newsletter, the IDA staff installed new IRIS GSN stations in Australia, Fiji, Iceland and Kazakhstan. More in-depth information about these stations is available through the tools of the IRIS Data Management System or the IDA Mosaic page (http://www-ida.ucsd.edu/public/welcome.html).

Station WRAB is located on the site of the Warramunga Seismic Array, a 25-km aperture, 41-channel array operated by the Research School of Earth Sciences (RSES), The Australian National University. The site is about 30 km south of the small town of Tennant Creek in the Northern Territory of Australia. Warramunga" is derived from the name of the Aboriginal tribe, now known as the Waramangu, from whom the land is leased; the station code "WRAB" was chosen to be consistent with the code WRA for the RSES array. The broad band KS54000 sensor is installed in a 100 meter deep borehole; an STS-2 instrument in an auxiliary vault about 5 m from the borehole wellhead is used for high-frequency data. Professor Brian Kennett and engineer Doug Christie of RSES handled all aspects of site preparation, including contracting with an Alice Springs company for the borehole drilling. WRAB is accessible in near-real time via international dial. Station tapes arrive within about 12 days of recording at the IDA DCC via standard air mail. The first data day was March 27, 1994 and since that day the station has been expertly operated by Mr. Peter Robinson of RSES and his technical staff who are based in Tennant Creek.

Station MSVF began routine operation on May 24, 1994. This station is located on the main island of Fiji, Viti Levu, at the Monasavu Dam complex, a facility of the Fiji Electrical Authority (FEA). The station is reached via an eight hour jeep ride from Suva, Fiji's capital. Our host institution is the Mineral Resources Department of Fiji. The choice of site was dominated by the desire to maximize distance from the ocean, but Monasavu is also an excellent site because of its isolation, geology, and logistical support. Much of the fill of the crushed-rock dam is quartz monzanite quarried from a large local intrusion, and the drilling log confirms that the KS54000 instrument is emplaced within the monzanite. The site is usually rainy and overcast, with an annual rainfall of 360 cm/year. The station is operated by two permanent FEA staff members who are stationed at Monasavu. Tapes typically make it to the IDA DCC in within about 10 days of recording. Director Alfred Simpson, Trevor Jones, and Dr. Graeme Wheller of the MRD were instrumental in working out the details of use-of-site and site preparation; MRD Seismologist Gajendra Prasad and technician Kitione Draunidalo have overseen the technical aspects of the station since installation. The borehole was drilled by IGNS of New Zealand. A radio data link to Suva is planned which will make data immediately available to the MRD staff and the IRIS SPYDER system.

Station BORG, just shy of the Arctic Circle in Western Iceland, began operation on July 31. The station is located at Asbjarnarstadir, 35 km NE of the town of Borgarnes (since Asbjarnarstadir is at least as difficult to say as Akureyri, the location of the WWSSN station in Iceland, the station code is based on Borgarnes). The station was sited with the help of Dr. Pall Einarsson of the Science Institute of University of Iceland and Dr. Ragnar Stefansson of the Icelandic Meteorological Office (IMO). IMO operates a high-frequency regional network, the SIL (Southern Iceland) Network, to monitor regional volcanic hazard and seismicity of South Icelandic Seismic Zone. BORG is also a new site of the SIL network; a vault about 5 m from the borehole wellhead houses an STS-2 sensor which provides high-frequency



**IDA technician, Todd Johnson, with the KS 54000-IRIS borehole seismometer, Warramunga Array, Northern Territory, Australia.**

triggered channels for the GSN station but is also the basic sensor for the SIL data acquisition system. The borehole for the KS54000 was drilled into basement basaltic rocks about 5 million years old. Real-time data requests travel over Internet to a node at IMO in Reykjavik which calls the BORG workstation when a data request is received. Pall Einarsson arranged for the borehole drilling and Dr. Steinunn Jakobsdottir of IMO supervised the vault construction and helped coordinate the installation with UCSD personnel. BORG is located on a private farm owned by Asbjorn Sigurgeirsson and Kristine Siemsen, who with their three children are proving to be expert station operators. Mr. Sigurgeirsson mails the data tapes on his weekly trip into Borgarnes, and they reach the IDA DCC about eight days later. The family took it all in stride when a group of San Diegans showed up with 4,000 pounds of equipment and filled their basement with recording equipment. We're grateful.

Station BRVK at the Borovoye Observatory in northern Kazakhstan became operational on September 5. Formerly a Soviet military facility for nuclear monitoring, Borovoye is now under jurisdiction of the National Nuclear Center (NNC), a new governmental organization created to manage the various nuclear facilities inherited by Kazakhstan after the breakup of the Soviet Union. STS-1's and GS-13's are installed on a pier in a vault at the bottom of 15 meter deep shaft in granite. Dr. G.A. Batyrbekov, Director General of the NNC, Drs. V.C. Lampey and V. F. Maryenko of the Borovoye Observatory, and Dr. Olga Tupkina of the NNC provided crucial logistical support during installation, which was carried out with support from the firm VULCAN in Obninsk. David Chavez's installation trip also included a visit to the site of the first Soviet nuclear explosion in August, 1949; he reports that "ground zero is a shallow depression on an otherwise totally flat plain, and since it is the lowest point in the area it gets more water and is full of colorful flowers; although there is plenty of grass, the ground itself is mostly a crust of black glass".

At the time of writing, an IDA team is preparing to leave for the installation trip to Ascension Island (ASCN) in the Atlantic Ocean, and a drilling team from New Zealand has set up operations at Horse Pasture Meadow on the Island of St. Helena in the South Atlantic (SHEL).

We are sad to report that a wildfire burned through the grounds of UCSD's Cecil and Ida Green Piñon Flat Observatory on July 3, 1994. Fire fighters saved the recording trailers and other structures on site; most underground equipment such as the IDA vault and borehole installations, the OSN prototype borehole installation, and the strainmeter mon-umentation electronics survived. However the above-ground vacuum conduits for the 1 km long laser strainmeters were destroyed. IRIS/IDA station PFO continued to run on battery backup during the fire, recording extreme values on the vault temperature channels and strange excusions of the STS-1's. •

## Technical Working Group Meeting

There will be a meeting of the Joint Seismic Program Technical Working Group during AGU on Wednesday, December 7th at 5:00 pm in the ANA Hotel. Those interested in participating in the IRIS JSP, or who are interested in learning more about the JSP, are invited to attend this meeting. We request those who plan to attend the meeting send email to danny@jspc.colorado.edu. •

the IRIS CONSORTIUM

The IRIS Newsletter is published quarterly by The IRIS Consortium. Please address your letters or inquires to:

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The Incorporated Research Institutions for Seismology (IRIS) is a consortium of over 80 research institutions with major commitments to research in seismology and related fields. IRIS operates a facilities program in observational seismology and data management sponsored by the National Science Foundation. Major funding for IRIS programs is provided by the National Science Foundation through its Division of Earth Sciences and the Air Force Office of Scientific Research.

The IRIS Newsletter welcomes contributed articles. Articles should be less than 1000 words and four figures. Please send articles or requests for submission of articles to the address listed above.

Executive Editor: David Simpson (simpson@iris.edu)
Production Editor: Denise Dillman Crump (denise@iris.edu)

## Calendar

**DECEMBER**

**5-9** AGU, San Francisco, California

**6-7** AGU Union Session
IRIS 10th Anniversary
"Earth Structure from Crust to Core"

**6** IRIS Annual Board of Directors Meeting, ANA Hotel

## New Members

IRIS welcomes as new members: IGPP at Los Alamos National Laboratory, Leigh House, representative and University of Alabama, Dennis Harry, representative. IRIS also welcomes as new foreign affiliates: University of Queensland, Australia, Steve Hearn, representative; Masaryk University, Czech Republic, Petr Firbas, representative; Academy of Sciences, Albania, Betim Muco, representative; and Universidade de Brasilia, Brazil, Joao Willy Rosa, representative.•

# Seventh Annual IRIS Workshop
## Grand Teton National Park, Wyoming

The seventh Annual IRIS Workshop will be held from June 21-24, 1995 at Jackson Lake Lodge in Grand Teton National Park, Wyoming. Located 28 miles from Jackson Hole Airport and 22 miles from the south gate of Yellowstone, this resort hotel offers comfortable conference and lodging facilities as well as spectacular views of the Grand Tetons skyline. Daily nonstop air service to Jackson Hole Airport is available from Denver and Salt Lake City.

A major focus of the workshop will be presentation and discussion of the next IRIS five year proposal 1996-2001. The Executive Committee is now working with the IRIS staff to develop a proposal, plan, and budget. A Science Plan Task Force has been appointed. IRIS members are being requested to prepare one page summaries of examples of the use of IRIS data and facilities.

Field trips are being planned to both the Teton Range and Yellowstone National Park. Hiking, fishing, horseback riding, scenic float trips, golf, and tennis are among the many activities available on-site and nearby. Look for more information in the Newsletter spring issue. See you in Wyoming! •

# PEPP Seeks IRIS Participation

The Princeton Earth Physics Project (PEPP), an IRIS educational initiative led by Guust Nolet and Bob Phinney at Princeton University, has received the go-ahead from NSF for its new three year program to develop hardware, software, classroom materials and to equip some 200 schools nationwide with broadband seismometers before 1997.

The interest from physics and Earth science teachers is overwhelming. Word of mouth has created a waiting list of teachers and many had to be turned down for the summer workshop held at Princeton last June. This fall, a second generation of low cost broadband sensors will be tested, and the prototype network will be extended from three to ten schools early in 1995. IRIS members who wish to remain informed on the progress of the school network should ask for the PEPP Newsletter by email to Laurie Wanat (wanat@weasel.princeton.edu).

In November, IRIS will issue a request for proposals and select two IRIS members to conduct 1995 workshops for prospective PEPP teachers. The RFP will be sent to all members of the IRIS Board of Directors. For 1995, there is a preference for universities in the western or southern U.S. to ensure an optimum geographical coverage. Six more universities will be invited to participate in 1996. •

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