

Education

B.A., Earth & Environmental Science,
Wesleyan University, 1985

Graduate Study, Marine Geology &
Geophysics, University of Rhode
Island, 1987-1988

Areas of Specialization

Sediment Profile Imaging

Marine Environmental Sampling

Marine Geology & Geophysics

Side Scan Sonar & Hydrographic
Survey Techniques

Viticulture & Enology

Employment History

2001 - present – Senior Scientist,
Germano & Associates, Inc.,
Olympia, WA office

2000 - 2009: Browning Environmental,
Olympia, WA

1995 - 2000: Scientist, Striplin
Environmental Associates,
Olympia, WA

1988 - 1995: Scientist, Science
Applications International
Corporation, Bothell, WA

1985 - 1988: Research Assistant,
Graduate School of
Oceanography, University of
Rhode Island, Kingston, RI

Experience Summary

Mr. Browning has more than 18 years of experience in the collection, analysis and interpretation of marine environmental and geophysical data supporting monitoring and engineering studies. Mr. Browning is an expert in the use of sediment-profile imaging (SPI) for mapping dredged material deposits, physical benthic habitats and physical processes/disturbances. He has led, managed or supported dozens of SPI surveys throughout the West Coast, Alaska, and Asia and has analyzed and interpreted thousands of SPI images from diverse benthic environments. David has presented several papers on the use of SPI for assessing benthic habitats and physical processes affecting the marine seafloor. From 1991 to 1995, David managed west coast SPI operations for SAIC and implemented Striplin's SPI program from 1995 to 2000.

In addition to SPI, Mr. Browning has served as principal investigator on numerous projects investigating sediment quality, water quality and habitat quality issues in support of dredging, capping and environmental clean-up projects. He is well versed in the methods of sediment acquisition ranging from hollow-stem augering to boxcoring along with the sediment analyses and interpretive criteria required for different regulatory programs throughout the country. Mr. Browning has also led or participated in several biological sampling projects and is highly experienced in biological collection ranging from benthic infauna to crabs and finfish.

WORK EXPERIENCE

• **Environmental Assessment**

City of Portland, OR Downtown Portland Sediment Characterization

For separate studies in 2008 and 2009, Mr. Browning was a subcontractor to Groundwater Solutions Inc., charged with the collection and processing of surface sediment samples and vibracores from the downtown reach of the Willamette River. Mr. Browning was responsible for the geologic logging and core processing of over 100 cores during both surveys.

Lower Willamette Remedial Investigation, Portland, Oregon

From 2004-2008, Mr. Browning was a subcontractor to Integral Consulting responsible for the collection of over 400 vibracores from the Lower Willamette River. Mr. Browning oversaw collections and contributed to the processing and logging of collected cores.

Port of Olympia Post-Dredging/Interim Cap SPI Survey, Olympia, WA

In March 2009, Mr. Browning assisted in the collection of SPI images from a recently dredged area that had an interim cap placed over exposed sediment that had elevated chemical constituents. Mr. Browning was responsible for the analysis of the SPI images to determine cap thickness, mixing between underlying sediments and cap sediments as well as deposition subsequent to cap placement.

Lago Maggiore/Fiume Toce SPI and Plan-View Surveys, Toce/Pallanza, Italy.

In years 2008 and 2009, Mr. Browning assisted in the collection and analysis of over 300 SPI and plan-view sampling stations within Pallanza Bay of the alpine lake Lago Maggiore, the montane river Fiume Toce, and the montane lake Lago Mergozzo. Mr. Browning analyzed all SPI and plan-view photographs from these sampling areas with special detail paid to depositional and fluvial processes throughout the distinct environments.

Augusta Bay SPI Survey, Augusta, Sicily, Italy.

During 2008, Mr. Browning assisted in the collection of sediment profile images from Augusta Bay, Sicily in support of a RI/FS. Mr. Browning analyzed all SPI images collected during this study. Images were analyzed for standard and supplemental SPI parameters with special detail paid to depositional processes and post-depositional mixing due to anthropogenic factors (vessel induced resuspension).

Woodard Bay Videoprobe Survey, Woodard Bay, Olympia, WA

As a subcontractor to SAIC in 2008, Mr. Browning conducted a videoprobe survey of a former log storage area in Woodard Bay. The videoprobe collected in-situ profiles of the top 6 feet of the sediment column. Mr. Browning was responsible for the analysis of the video probe data to determine the presence and depth of buried logs and changes in sediment lithology.

Saginaw River RI/FS, Saginaw, MI

In 2007 to present, Mr. Browning collected and analyzed sediment profile images from 14 miles of combined river of the Saginaw, Shiawassee and Tittabawassee Rivers in support of a RCRA investigation. Over 800 stations were sampled and 1400 SPI images collected.

Confined Aquatic Disposal Monitoring, Sinclair Inlet, Puget Sound

During the summer of 2002, Mr. Browning performed a sediment profile imaging survey of the confined aquatic disposal borrow pit adjacent to the Puget Sound Naval Shipyard in Bremerton, WA. The survey was performed for the US EPA to investigate the cause of elevated contaminant concentrations found in sediment samples from the nearby seafloor taken after capping operations were completed. The SPI survey showed that the dredged material apron extended over 200 meters beyond the designated CAD pit boundary.

Post-Drilling EIA Monitoring, Caspian Sea

In September 2002, Mr. Browning participated in a comprehensive mapping survey to delineate the footprint of drilling muds/cuttings surrounding three former oil well sites in the Caspian Sea off the coast of Azerbaijan. The sediment profile imaging survey documented the lateralextent of drilling muds on the seafloor in depths from 70 – 500 meters; SPI technology was used at all three sites to map the footprint of the muds. The film was developed immediately on-board following completion of the reconnaissance SPI survey, and the results were used to plan the location of the grab samples taken for sediment chemical and biological analyses.

Wood Waste Investigations, Puget Sound

Mr. Browning assisted in data collection and analyzed all images in SPI surveys at Port Gamble and in the Hylebos waterway for industrial clients to both characterize the extent of wood waste at former log

rafting/transfer sites and assess the status of benthic recovery in these areas. The results from the SPI surveys were used to delineate the extent of wood waste impacts and provide a rapid characterization of the status of the benthic community.

Thorne Bay Bark and Benthic Assessment

Mr. Browning assisted in data collection and analyzed all images for the benthic and sediment profile imaging survey at a former log transfer facility in Thorne Bay, Alaska. As a subcontractor to Tetra Tech for TMDL support to the Alaska Department of Environmental Conservation, Germano & Associates performed all water and sediment sampling in addition to sediment profile and plan-view imaging in June, 2005, to assess the nature and extent of impacts associated with wood waste on the seafloor.

Evaluation of Sediment and Benthos Characteristics at a Proposed LNG Deep Water Port

Mr. Browning assisted in data collection and analyzed all images for a comprehensive sediment profile imaging survey as part of a permit application baseline study for a proposed pipeline route and deepwater port associated with an LNG offloading terminal for a facility on the east coast of the United States. A total of 160 stations were surveyed in July 2005 in a range of water depths between 200-300 feet, and a complete report and interpretation of all profile images was submitted to the client within 30 days following completion of the field survey.

Habitat Restoration Project, Woodard Bay, Puget Sound

Mr. Browning assisted in data collection and analyzed all images for a combination SPI/plan-view survey of a former log storage area in Puget Sound that was scheduled to undergo a restoration for oyster habitat by the Nature Conservancy. The proposed area was surveyed in one day of field work, and the results of the SPI and plan-view camera analysis to determine whether or not the proposed area was suitable for oyster habitat were submitted to the client within 2 weeks of completion of the field work.

Wyckoff 2002 Operations Maintenance and Monitoring Plan (OMMP), Eagle Harbor, WA

Mr. Browning provided input to the Corps of Engineers, Seattle District regarding chemical and biological monitoring of the Wyckoff/Eagle Harbor East Harbor operable unit. The OMMP Addendum was developed by the Seattle district and input/recommendations were provided to match biological and chemical monitoring (surface and subsurface sediments) to project goals and regulatory requirements.

Capping Demonstration Project, Los Angeles Harbor

As part of a comprehensive capping demonstration project in Los Angeles Harbor being carried out for the US Army Corps of Engineers, Los Angeles District in coordination with the Contaminated Sediments Task Force, Mr. Browning participated in the post-capping monitoring surveys using Sediment Profile Imaging technology in the fall of 2001. Approximately 40 stations were monitored in this time-series to study the effectiveness and impacts of confined aquatic disposal as a management tool for contaminated sediments.

Sediment Profile Imaging Survey, Lower Willamette River

As part of a multi-disciplinary RI/FS investigation of the Lower Willamette River, Mr. Browning analyzed and helped collect the sediment profile images for a baseline characterization of the lower 15.7 miles of the river using sediment profile imaging technology. The report produced from this study was a required deliverable under the Stipulated Agreement for Portland Harbor which was incorporated by reference into the Administrative Order on Consent for the Portland Harbor CERCLA Site. The SPI results provided reconnaissance information on the physical and biological features of surface sediments in the Willamette River from Ross Island to the Columbia River. A total of 514 stations were sampled between November 26 and December 10, 2001.

PSDDA Disposal Site Monitoring

Mr. Browning participated in all SPI monitoring and analyzed the images from the Commencement Bay and Elliott Bay Disposal Sites in 2001 and 2002. Between 50-70 sediment profile imaging stations were sampled at each site, with maps of the dredged material footprint submitted to the client within 24 hours of the field sampling; a comprehensive report on the profile imaging results was submitted within 4 weeks of completion of the field work at each site. Mr. Browning also provided sediment and biological sampling expertise during the 2002, 2001, 1995, 1992 and 1990 monitoring events.

Comprehensive Environmental Impact Baseline Survey, People's Republic of China

Mr. Browning participated in a comprehensive SPI survey in the fall of 2001 as part of a multi-disciplinary environmental impact study for an industrial client in the People's Republic of China. A baseline characterization of an entire bay over 650 km² in area was surveyed using Sediment Profile Imaging as a requirement for building a large industrial coastal facility. Field work was completed within one week, and Mr. Browning analyzed all images within 2 weeks of completion of all field activities.

RCRA Investigation, Soda Lake, WY

Mr. Browning served as task manager for sediment studies for a RCRA facilities investigation of Soda Lake, Wyoming. He collected, analyzed, and reported SPI and water column profile data and provided extensive support for surface sediment sampling, sediment coring and biological collections within the lake. Responsible for reporting sediment quality results in final documents and provided input in developing a conceptual model of the physical and biological dynamics of the lake that was utilized in the Risk Assessment.

SPAWARS PRISM Project: Field Verification of Bioturbation Depths

The Navy is in the process of identifying, assessing, and remediating a large number of coastal facilities with contaminated sediments; as part of this effort, the PRISM project is developing a set of diagnostic tools for characterizing and quantifying in-place contaminant pathways to aid in the effective selection, permitting and monitoring of *in-situ* sediment management strategies. Mr. Browning participated in all sediment profile imaging surveys and performed all image analysis as part of this multidisciplinary, comprehensive program development carried out in San Diego Harbor, CA and Pearl Harbor, Hawaii in 2001-2002.

Ecological Impacts of Potential New Jersey Sand Mining Operations, Minerals Management Service

Mr. Browning performed all image analysis and field collection for the Sediment Profile Imaging (SPI) surveys in 2001 that were done as part of baseline ecological assessment of potential sand resource mining areas off the coast of New Jersey.

Post-Disposal Monitoring, Coos Bay, OR

Mr. Browning performed a SPI and plan-view video study to map the extent of a newly placed dredged material deposit (<8 hours after disposal) at three disposal sites at the mouth of Coos Bay, WA. Plan-view video was affixed to SPI frame and the sampling grid was adjusted real-time using real-time information provided by the video. 1999 – 2000.

Wyckoff Superfund Site Monitoring, Eagle Harbor, WA

In 1999-2000, Mr. Browning was Project Manager and principal investigator for Year 5 monitoring of the sediment cap placed at the Wyckoff/Eagle Harbor Superfund Site. Year 5 monitoring included SPI, towed video, sediment core sampling, and surface sediment sampling for benthos and sediment chemistry. In 1994-1995, Mr. Browning was Project Manager for the development of a 10-year monitoring plan to determine the efficacy of the sediment cap placed at the Wyckoff/Eagle Harbor Superfund Site. The plan was prepared under both CERCLA and COE guidance. Elements of long-term monitoring included: bathymetry, subbottom sonar profiling, SPI, towed video, and sediment sampling. After the monitoring plan was accepted, Mr. Browning was

also the Principal Investigator for all physical monitoring during the cap construction at the creosote-contaminated Wyckoff/Eagle Harbor Superfund Site, East Harbor Operable Unit. Physical monitoring included pre-, syn-, and post-placement bathymetry, sediment profile imaging, water quality monitoring, towed underwater video, gravity coring and subbottom sonar profiling.

SPI Survey, Red Dog Mine, AK

In 1998, Mr. Browning was the Project Manager for an SPI survey of proposed dredged material disposal sites in support of Port Facility Expansion at Cominco's Red Dog Mine, Alaska. The SPI survey provided information the benthic resources at the site, aided in the interpretation of benthic infaunal community analysis and served as a pre-dredging and disposal baseline.

Wood Waste Evaluation, Tacoma, WA

In 1998-1999, Mr. Browning evaluated wood waste issues in the Hylebos Waterway, Tacoma, WA by looking at potential toxicity of wood-derived chemicals and estimating the volume percentages of wood waste in areas to be remediated using sediment profile images. SPI wood waste data were ground-truthed to true wood waste volumes and conventional chemistry parameters (e.g. total volatile solids). Estimated percent cover of wood waste throughout the Hylebos using plan-view affixed to the SPI camera frame.

Sediment Characterization and Deposit Study, Fox River, WI

Mr. Browning was responsible for the physical demarcation of sediment deposits in the stretch of the Fox River extending from Little Lake Butte de Morts to DePere. Sediment deposits were identified and measured for lateral extent and thickness using subbottom profiling sonar, dual frequency hydrographic surveying and poling. The data were synthesized and processed to produce isopach maps of deposit thickness. These data were then used to determine the locations of sediment collection to best characterize the deposit in terms of chemical burdens.

Confined Aquatic Disposal Monitoring, US Army Corps of Engineers, Los Angeles District

In 1994 – 1995, Mr. Browning conducted SPI surveys prior to and immediately after the placement of 800,000 CY of contaminated dredged material in a confined aquatic disposal site immediately inside the San Pedro breakwater. Mapped the distribution of construction-related sediments, contaminated sediments, and pertinent physical and biological features at the study area.

Wood Waste Evaluation, Lake Washington, WA

In 1996-1997, Mr. Browning conducted a sediment profile imaging survey of a wood waste and coal tar contaminated site in Lake Washington. Analyzed all SPI images and developed wood waste volume estimation method for SPI images.

Sediment Characterization Investigation, Bellingham, WA

In 1996-1997, Mr. Browning assisted in the collection of sediment samples (vibracore) and compositing of 4 to 16 ft sediment cores for a PSDDA pre-dredge sediment characterization for the Port of Bellingham and U.S. Oil.

Bay Farm Borrow Area (BFBA) Investigations, US Army Corps of Engineers, San Francisco District

Between 1991-1994, Mr. Browning was the task manager for a multi-disciplinary environmental survey for U.S. Army Corps of Engineers to determine the suitability of the BFBA as an open water dredged material disposal site pursuant to Section 404 of the Clean Water Act. He was responsible for the coordination and conductance of all sampling surveys and reporting activities. Elements of the seasonal BFBA surveys included precision navigation, sediment profile imaging to determine benthic conditions, collection of sediments for conventional and contaminant chemicals analyses to determine nature and extent of substrate chemical properties, collection of infauna to assess the benthic community structure, in-situ profiling of the water column to determine

seasonal temperature, salinity and dissolved oxygen conditions, characterization of epibenthic, demersal and pelagic faunal populations using gill-nets and otter trawls, measurement of near-bottom tidal currents and passing wave trains, and observations of avian and mammalian fauna throughout the surveys.

Hong Kong Coastal REMOTS® Survey

Between 1996-1997, Mr. Browning participated in a series of Sediment Profile Imaging (SPI) surveys of Hong Kong coastal waters for the Geotechnical Engineering Office (GEO) of the Hong Kong Government's Civil Engineering Department. Mr. Browning evaluated SPI images for the presence of dredged material as well as other biological and geological features.

Biological Monitoring, Grays Harbor, WA

Mr. Browning participated in the collection, identification and enumeration of crabs and fishes in Grays Harbor and Willapa Bay, WA during 1994-1996. He was responsible for preparation of all weekly and synthesis data reports.

PUBLICATIONS/REPORTS

- Germano, J.G., and D.G. Browning. 2006. Marine Log Transfer Facilities and Wood Waste: When Dredging Is Not Your Final Answer. In prep. Proceedings of the Pacific Chapter of the Western Dredging Association, San Diego, CA. June 2006.
- Browning, D.G., and E.C. Revelas. 2004. A SPI-based technique for determining wood waste volumes and effects in marine sediments. Presentation at the SPICE (*Sediment Profile Imaging Colloquium of Experts*) Conference, University of Galway, March 4-5, 2004. Galway, Ireland.
- Browning, D.G., E.C. Revelas, R.A. Hollar, and A. Risko. 1996. Confined Disposal and Capping of Dredged Material in the Long Beach Borrow Area. Abstract. Proceedings of the Pacific Chapter of the Western Dredging Association, Honolulu, HI. Nov. 1996.
- Browning, D.G. and E.C. Revelas. 1996. Development and Application of the Physical Disturbance Index (PDI) for Sediment Profile Images. Abstract. PERS, Pacific Northwest Chapter Proceedings, Olympia, WA.
- Browning, D., P. Cagney and E. Nelson. 1995. Physical Monitoring of Subtidal Cap Construction at the Wyckoff/Eagle Harbor Superfund Site. Puget Sound Research 1995 Proceedings.
- Browning D., D.A. Kendall and E.C. Revelas. 1993. Delineation and Biogenic Reworking of a Dredged Material Deposit Placed at a Deep Water Disposal Site. Abstract. Proc. PNWCSETAC Proceedings May 1993.
- Sichel, S.A., D. Browning and H. Sigurdsson. 1988. Pseudopicrotic MORBs from the Southern Mid-Atlantic Ridge. American Geophysical Union. EOS Transaction. Abs.
- Sigurdsson H., J. Palais and D. Browning. 1986. Petrologic Evidence of Volcanic Degassing, Proceedings of the Norman D. Watkins Symposium on the Environmental Impact of Volcanism. University of Rhode Island, Graduate School of Oceanography, 1986.
- Browning D. 1985. The Petrology of a Suite of Mafic and Ultramafic Nodules from the Pinacate Volcanic Field, Sonora, Mexico. Honors Thesis, Wesleyan University, Middletown, Ct. 76 pp.