January 2012

Vent-Fault Spatial Study of Selected Volcanic Fields of Southwestern North America and Mexico

Michelle Leonard
University of South Florida, meeshrox@hotmail.com

Vent-Fault Spatial Study of Selected Volcanic Fields of Southwestern North America and Mexico

by

Michelle Lynn Leonard

A thesis submitted in partial fulfillment
of the requirements for the degree of
Masters of Science
Department of Geology
College of Arts and Sciences
University of South Florida

Co-Major Professor: Paul H. Wetmore, Ph.D.
Co-Major Professor: Charles B. Connor, Ph.D.
Committee Member: Jeffrey G. Ryan, Ph.D.

Date of Approval:
January 26, 2012

Keywords: tectonics, Big Pine, Coso, Camargo, Jaraguay, San Borja, Michoacán-Guanajuato, Yucca, spatial relationship, Caplinger

Dedication

For my mother.

Acknowledgements

I would like to thank Guy-Luc Levesque for thoughtful reviews throughout the manuscript process. Lane Pitre and Brandon Ashby assisted with essential GIS work. Management at Cardno ENTRIX generously allowed use of my work computer and software during off-hours to complete the data analyses and manuscript writing, specifically Clara Carey in the early stages and Gregg Jones in the latter. My friends at Cardno ENTRIX provided continuous support and kept me sane through many reviews; specifically Amanda Harford, Chelsea Murphy, Brandon Wieme, Jennifer Granberry, David Kelly, Joshua Yates, and Kim Brown. I love my dearest friends Courtney Rapps, Fatin Tutak, and Margie Hagin; thank you for always being there for me. Thank you to Mary Haney and Mandy Stuck at the department for guidance and for answering all of my silly questions. Many thanks are due to my supervisory committee and notably to Paul Wetmore for your persistence, mentorship, and valuable feedback. I am grateful to my husband Matt for his love and support.

Table of Contents

List of Tables	iii
List of Figures	iv
Abstract	vi
Introduction	1
Previous Work	2
Spatial Distribution of Basaltic Volcanism	2
Issues with Volcanic Field Scaling	4
Dike Propagation and Interaction with Pre-Existing Fractures	5
Study Background	8
Methodology	10
Calculations of Error	15
Regional and Local Tectonic Settings	16
Regional Tectonics	17
Basin and Range Province	17
Eastern California Shear Zone	19
Baja Peninsula	20
Trans-Mexican Volcanic Belt	22
Local Geology and Tectonics of Individual Volcanic Fields	25
Big Pine Volcanic Field	25
Camargo Volcanic Field	26
Coso Volcanic Field	27
Yucca Volcanic Field	29
Jaraguay Volcanic Field	30
San Borja Volcanic Field	31
Michoacán-Guanajuato Volcanic Field	32
Results	34
Big Pine Volcanic Field	35
Camargo Volcanic Field	36
Coso Volcanic Field	37
Yucca Volcanic Field	38
Jaraguay Volcanic Field	39
San Borja Volcanic Field	40
Michoacán-Guanajuato Volcanic Field	41
Discussion	42

Spatial Relationships 42
The Role of Map Scale 43
The Role of Source Geometry 44
Volcanism and Faulting as Complimentary Mechanisms 46
Practical Implications 50

Concluding Remarks 52

References 54

Appendix A: Vent Location Data 62

Appendix B: Fault Location Data 79

Appendix C: Additional Fault Graphs 113

List of Tables

Table 1 – Summary Table of Volcanic Field Properties 34

Table A1 – Vent Location Data 63

Table B1 – Fault Location Data 80

List of Figures

Figure 1 – Mixed-Mode Dilation of Cracks in Host Rock 7

Figure 2 – Methodology Illustration 11

Figure 3 – Possible Vent to Fault Spatial Analysis Curves 13

Figure 4 – Regional Location Map of Volcanic Fields 16

Figure 5 – Big Pine Volcanic Field Location Map 25

Figure 6 – Camargo Volcanic Field Location Map 26

Figure 7 – Coso Volcanic Field Location Map 28

Figure 8 – Yucca Volcanic Field Location Map 29

Figure 9 – Jaraguay Volcanic Field Location Map 31

Figure 10 – San Borja Volcanic Field Location Map 31

Figure 11 – Michoacán-Guanajuato Volcanic Field Location Map 32

Figure 12 – Spatial Analysis for Big Pine Volcanic Field 35

Figure 13 – Spatial Analysis for Camargo Volcanic Field 36

Figure 14 – Spatial Analysis for Coso Volcanic Field 37

Figure 15 – Spatial Analysis for Yucca Volcanic Field 38

Figure 16 – Spatial Analysis for Jaraguay Volcanic Field 39

Figure 17 – Spatial Analysis for San Borja Volcanic Field 40

Figure 18 – Spatial Analysis for Michoacán-Guanajuato Volcanic Field 41

Figure 19 – Mantle Wedge Diagram Showing "Hot Fingers" 45

Figure 20 – Spatial Density and Volcanic Rift Zones of the Eastern Snake River Plain 46

Figure C1 – Fault Analysis for the Big Pine Volcanic Field 114

Figure C2 – Fault Analysis for the Camargo Volcanic Field 114

Figure C3 – Fault Analysis for the Coso Volcanic Field 115

Figure C4 – Fault Analysis for the Yucca Volcanic Field 115

Figure C5 – Fault Analysis for the Jaraguay Volcanic Field 116

Figure C6 – Fault Analysis for the San Borja Volcanic Field 116

Figure C7 – Fault Analysis for the Michoacán-Guanajuato Volcanic Field 117

Abstract

Of fundamental concern in volcanic hazard and risk assessment studies of volcanic systems is what role crustal structures might play in the ascent of magma through the crust. What are the processes that govern the spatial distribution and timing of eruptions, especially in populated areas or near sensitive facilities? Many studies have drawn the conclusion that faults play a critical role as easily-exploitable crustal weaknesses along which magma can ascend. Great care must be used when assuming a causative relationship between patterns of vents and faults especially when such relationships may be incorporated into hazard assessment models or other forecasting tools.

This thesis presents a quantitative analysis of vent and fault populations in seven actively-faulted volcanic fields to test whether or not spatial relationships exist between faults and volcanic features. The data generated in this study include map distances acquired by measuring existing geologic maps produced by other scientists. Statistical methods were adapted from a similar study by Paterson and Schmidt (1999) which involved the analysis of pluton-to-fault distances.

The data show that statistical spatial correlations exist between vents and faults in only two of the seven volcanic fields in this study. As a general observation, most vents cluster far from faults in these populations, which could be explained by a variety of natural phenomenon such as suppression of faulting from increased magmatism and magma source geometry differences. Although data some of the data show a spatial correlation, it does not necessarily imply a genetic relationship.

Introduction

A principal goal for most studies of volcanic systems is to understand the processes governing the timing and spatial distribution of eruptions toward the end of producing volcanic hazard and risk assessments for populated areas and critical facilities (e.g. Connor et al., 2009). Of fundamental concern in these studies is what, if any, role do crustal structures play in the ascent of magma from source to surface (e.g. Paterson and Schmidt, 1999). Many studies draw the conclusion that faults play a critical role as easily exploitable crustal anisotropies along which magma can ascend (e.g. Aranda-Gomez et al., 2003). Unfortunately, most of these studies arrive at their conclusions based on qualitative, instead of quantitative, assessments of the spatial relationships between faults and vents. This type of casual analysis has led to an almost universally-accepted belief that volcanism and magmatism in general, is spatially correlated and, causally-linked to fault patterns.

The study reported upon in this thesis involves a quantitative assessment of the spatial relationships between vents and faults based on the map distributions of these features from a variety of volcanic fields throughout the North American Cordillera. The primary goal of this study is to test the idea that vents within volcanic fields with active faults are spatially clustered near those faults. The primary data for this study, map distances and directions between vents and nearest faults, derived from maps generated by other scientists and the statistical methods employed, are adapted from a similar study of plutons and faults by Paterson and Schmidt (1999). While this study is designed to test the widely held assumption of close spatial correspondence between faults and volcanic vents, it is not the aim of this study to confirm or refute specific claims of genetic or causal relationships between such features in the fields studied herein or in general.

Previous Work

Spatial Distribution of Basaltic Volcanism

Spatial correlations of volcanic features have been exhaustively studied with a variety of statistical analyses in order to determine vents alignments or patterns to better predict timing and locations of future eruptions. Authors discussed here laid the groundwork for subsequent studies exploring probability, density, and recurrence rate statistics. This section will give an overview of contributions by authors hoping to better understand patterns and timing of volcanic eruptions. Alignments of vents are commonly studied with the intent of identifying a spatio-temporal pattern that could better predict future eruptions. Statistical analyses will be discussed here in progression through time and will include azimuth and nearest-neighbor methods, the Hough transform method, coupled models (time and space), consideration of how fault dips may influence spatial distribution, the role of scale, and the influence of shallow structural features on spatial patterns of vents.

Several papers were published in quick succession outlining the benefits of azimuthal and nearest-neighbor analyses. Lutz (1986) reviewed the statistical analysis of fracture traces and point-like features using azimuthal distributions to identify orientations of large-scale structures. Lutz (1986) found that the azimuthal analysis was vast improvement upon traditional spatial analyses because it allows for detection of anisotropies and is sensitive to shape and pattern. Wadge and Cross (1988) used a two-point azimuth method for regional scale with a Hough transform method at the local scale to determine alignments while Connor (1990) used two-point azimuth, two-dimensional Fourier and Hough transform analyses. Wadge and Cross (1988) concluded that the Hough transform method was much more successful in identifying regional alignments than the local nearest-neighbor analysis of Lutz (1986). Connor (1990) suggested that the use of his clustering analyses could assist in the study of magma generation and rise as the clustering may be a product of "progressively more localized melting events" instead of alignments by Lutz (1986) and Wadge and Cross (1988).

Additional analyses were developed to include the temporal dimension which allowed researchers to consider migration of melt and changes to the melt source through time within individual volcanic fields. Connor et al. (1992) included data about structural features and suggest that alignments are the result of a correlation of structural features, inferred at depth, which magma may use as a conduit. In another study by Condit and Connor (1996), a nearest-neighbor recurrence-rate model was used to determine long-term volcanic hazards in the Springerville Volcanic Field. This is an example of a source-driven spatio-temporal field where migration of volcanism is tracked using dating and geochemical analysis of lavas. Condit and Connor (1996) suggest that the pattern of volcanism should be viewed with this more complex model than a strictly temporal model like Condit et al. (1989) and that patterns are more likely developed by areas of localized melt generation at the source.

Spatial patterns of structural features such as shallow faults and fractures were analyzed to determine whether melt is organized into alignments of vents by way of these structural influences. Also, the dip of such features may affect the capture, ascent, and location of eruption of dikes at the surface. As explained in research conducted by Connor and Conway (2000), cinder cone alignments may follow fault traces at varying distances based on the fault dip at a local scale. They further say that there are a couple of explanations for vent clustering at this local scale: either because magma supply differs across fields or because crustal structures assist in the development of clusters. However, at a regional scale, distributions do not correlate: "fault densities are rarely high within vent clusters compared to nearby areas" (Connor and Conway, 2000). Another important point made by Connor and Conway (2000) is that larger-volume fields typically have insufficient rates of dike injection and cannot fully accommodate regional strain; the result is increased faulting.

Shallow structural features are again considered with respect to the capture and redirection of magma during ascent. Valentine and Perry (2007) argue that magma captured by faults at Yucca Volcanic Field occurs in the shallow crust “in response of the heterogeneous mantle to regional tectonics” and that this behavior is indicative of a time-predictable field. Also, alignments are due to regional Basin and Range strain, but shallow faults have the ability to reorient melt during ascent (Valentine and Perry, 2007). Furthermore, for every dike that reached the surface, Valentine and Perry (2007) claimed that N-S trending faults captured each one during ascent. According to Valentine and Perry (2007) there are two types of volcanic fields; tectonically controlled fields have “extremely low eruptive volume flux” and shallow faults readily capture ascending dikes while magmatically controlled fields are driven by high magma fluxes where dike injection greatly exceeds regional tectonic strain because of the mantle’s thermal structure and are independent of shallow tectonics.

Issues with Volcanic Field Scaling

Connor et al. (2000) studied the faulting and volcanism at three different scales to determine what scale is appropriate for shallow structural influences at the proposed Yucca Mountain Nuclear Repository. They explain that at a regional scale, the Amargosa Trough would likely be the location of future eruptions. On a sub-regional scale, alignments are common in the area of the proposed repository; at a local scale, faults found around and within Yucca Mountain (normal faults with high slip rates) are known to be amenable to channeling magma (Connor et al., 2000). In this case, the probability of eruptions during the performance interval is studied with respect to three spatial scales.

Dike Propagation and Interaction with Pre-Existing Fractures

It is important to review the physical processes involved with magma ascent and emplacement in the context of the evolution of basaltic volcanic fields to determine if magma could use structural features as conduits and if so, under what conditions. If faults readily capture ascending dikes, vents in this study would be located close to or along fault traces at the surface. Included in this brief description are the mechanisms by which magma leaves the source region, it's ascent through the crust, and the emplacement in the shallow crust or eruption at the surface.

Magma leaves its source region by way of fractures and cracks in the "roof" of the mantle source, forced upward by excess magma pressure (Rubin, 1998). According to Rubin (1998), this is inferred to begin with "grain boundary cracks" that allows microscopic melt to flow between crystals within already partially molten rock. At depth, the initiation of dikes can be seen as "active hydraulic fracturing forced by magma" (Wada, 1994) and unless these dikes occupy pre-existing structures, they create their own fractures in which to intrude. These fractures are unzipped ahead of the fluid-driven crack tip (Rubin, 1998) as long as the excess magma pressure allows.

Once initiated, the dike propagates by way of energy-efficient channelized flow driven by magma buoyancy (Rubin, 1998) or from hydraulic head (e.g. Lister and Kerr, 1991). The channelized flow encourages the widening of the dike as magma ascends; the mechanisms for widening are elastic deformation of the surrounding host rock (Delaney and Gartner, 1997) and non-elastic thermal and mechanical erosion (Rubin, 1995). According to Rubin (1995), the magma pressure and crack orientation are the primary factors that determine whether a dike can enter a pre-existing fracture. Additionally, changes in orientation of a preexisting fracture or the stress configuration could cause the dike to leave that structural feature and initiate the propagation of a new feature.

Rubin (1995) provides detailed mathematical calculations to determine the ability of, and under which conditions must exist for, a dike to exploit pre-existing fractures in areas of active horizontal extension. He concluded that tectonic extension makes it nearly impossible for dikes to propagate because extension increases the depth of neutral buoyancy and increasingly allows for lateral dilation of dikes (or the formation of sills) deeper in the crust. Rubin (1995) also adds that when rocks at depth are held in the ambient stress state near failure (such as in an area undergoing constant normal faulting like the Basin and Range Province), there is increasing chance that normal faulting will suppress the ascent of magma.

Furthermore, Rubin (1995) explains that dikes may intrude an existing crack and exploit it for some distance, including to the surface if possible, if the magma pressure exceeds σ_3. If the magma pressure only slightly exceeds σ_3, then only cracks that are nearly perpendicular the σ_3 will be intruded (Rubin, 1995). However, if magma pressure greatly exceeds σ_3, then the magma can dilate cracks of any orientation (Rubin, 1995). The dike will only follow the pre-existing crack for as long as these conditions exist and may "jump out" of the fracture's path (Rubin, 1995). The orientation of fault planes that could be intruded was estimated to be within 30º of σ_3 at depth for an extensional stress regime (Ziv et al., 2000). However, Ziv et al. (2000) explain that at mid-crustal depths, pore pressures and regional stresses are much greater than rock tensile strength and that those pressures are too great to allow a dike to ascend from lower to mid-crustal depths through a pre-existing fault.

Rubin (1995) also describes the "mixed-mode" dilation and crack propagation ahead of dike intrusion in terms of normal in-line dilation of cracks (Figure 1a), normal in-line dilation with a shear component in the direction of un-zipping (Figure 1b), and the normal in-line dilation with a shear component perpendicular to the direction of un-zipping (Figure 1c). The scenario described in Figure 1b would be analogous to a dike propagating into a normal fault (if the cartoon were rotated counter-clockwise by 90º). If instead, there were a shear component in another direction, as shown in Figure 1c, (and again if rotated the same way) the result would be analogous to a dike propagating into a fracture with lateral shear (such as the geometry found in the Inyo Craters in southern California (Reches and Fink, 1988)).

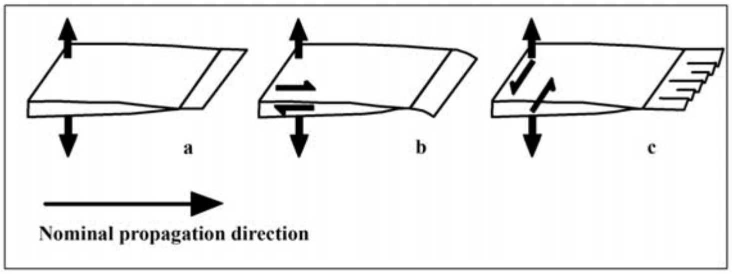

Figure 1. Mixed-Mode Dilation of Cracks in Host Rock. Dilation of cracks ahead of dike propagation where (a) dike propagates without shear, (b) dike propagates with shear perpendicular to crack, and (c) dike propagates with lateral shear. Panel (b) is analogous to a dike propagating into a normal fault. Modified from Rubin (1995).

In general, the physics of dike intrusion into pre-existing fractures and faults has been thoroughly studied, and it has been found to be possible under certain conditions. Ziv et al. (2000) describe the conditions needed for intrusion to occur: 1) the fault should be oriented almost perpendicular to σ_3; 2) magma pressure needs to be much greater than shear stress on the preexisting fracture; and 3) regional stress acting on the dike must be smaller than the rock tensile strength. These factors should be considered when evaluating the possibility for dike intrusion into pre-existing structures.

Conventional wisdom indicates that neutral buoyancy is the mechanism by which magma ceases from ascending through the crust (at the location where the rock and melt densities are equal) (Parsons et al., 1992). However, the variations found in regional and local stresses are a more reliable indicator of dike behavior (Parsons et al., 1992). During ascent, a dike may not settle or intrude horizontally at the point of neutral buoyancy if the internal melt pressure (driving pressure from the source) is more than σ_3 of the country rock (Parsons et al., 1992). A couple of examples where host rocks are less dense than ascending melt is evident where dikes have passed through tuffs or sediments and have ascended to the summit craters of volcanoes (Parsons et al., 1992).

Additionally, in extending tectonic provinces, dikes preferentially intrude vertically and perpendicular to σ_3. If, however, dike intrusion occurs at such a high rate that stresses are reoriented to where σ_3 is vertical, horizontal intrusion may begin (Parsons et al., 1992). For scale reference, if a dike intrudes into an area with extension rates on the order of mm/yr, the strain accommodated by a 10-m-thick dike could take up offset in only days or hours from a fault that would otherwise take time on the order of 1 Ka (Parsons et al., 1992).

Study Background

Paterson and Schmidt (1999) argue that magmatic products (their study looked at plutons and faults) do not require a fault or fracture to reach the surface; the fact that a eruptive products are found at the surface is driven more by source than surficial structural features. They contend that magma does not preferentially channel through faults. Their research included an analysis in which the integrated pluton area was compared to fault spacing and the percent of pluton margins that are touched by faults were calculated in the Armorican Massif of France and Alleghanian plutons in the southern Appalachian Mountains of the United States. Five requirements were laid out by Paterson and Schmidt (1999) that would determine a causative relationship between faults and magmatic products (in their case, plutons): 1) spatial correlation at the surface; 2) apparent geometric relationship; 3) temporal relationship; 4) rates of faulting and intrusion/extrusion must be similar; and 5) mechanism by which magmatic products would be generated, rise, and erupt along the faults must be understood.

My study uses point features and linear fault comparison as Paterson and Schmidt (1999) used two-dimensional pluton areas and linear fault features. The conclusions they drew were about compressional environments and granitic eruptive products. This study will focus mostly on extensional environments with less viscous intermediate to basaltic eruptive products.

Additionally, this study will bin the frequency of proximity of vents to faults instead of using the integral of the mapped pluton area at the surface.

Methodology

The purpose of this study is to characterize the spatial distribution of vents and faults in volcanic fields. The distances between volcanic vents and the nearest faults was measured in each volcanic field and plotted on graphs representing the spatial analysis results. The following section describes the methodology for this thesis project.

This study employed the techniques of Paterson and Schmidt (1999), modified to characterize the spatial distribution of vents and faults within volcanic fields. These techniques involve the analysis of point features (volcanic vents) and linear features (fault lineaments) to determine the extent of spatial patterns between these populations. A desk-top review of published geologic maps was conducted to determine availability of volcanic fields to be studied. The most recent geologic maps and relevant papers were acquired for each of the following volcanic fields: Big Pine (Bateman et al., 1965; Moore et al., 1963; Nelson, 1966; Ross, 1965; Connor and Conway, 2000), Camargo (Aranda-Gomez et al., 2003), Coso (Duffield and Bacon, 1981), Jaraguay (Gastil et al., 1971), Michoacán-Guanajuato (Pasquarè et al., 1991), San Borja (Gastil et al., 1971), and Yucca (Potter et al., 2002; Dohrenwend et al., 1996).

Digital versions of each map were imported into CorelDraw (Figure 3a); only the mapped vents and faults were included, no vents or faults were inferred. Vents of late Pliocene to Quaternary age were marked and numbered for analysis in a separate layer (Figure 3b). The ages were considered because of concerns over accuracy of geologic mapping and alluvium deposition and erosion as many of these areas have very high sedimentation rates. After removing the original map layer (Figure 3c), distances between vents and faults were measured by drawing the shortest

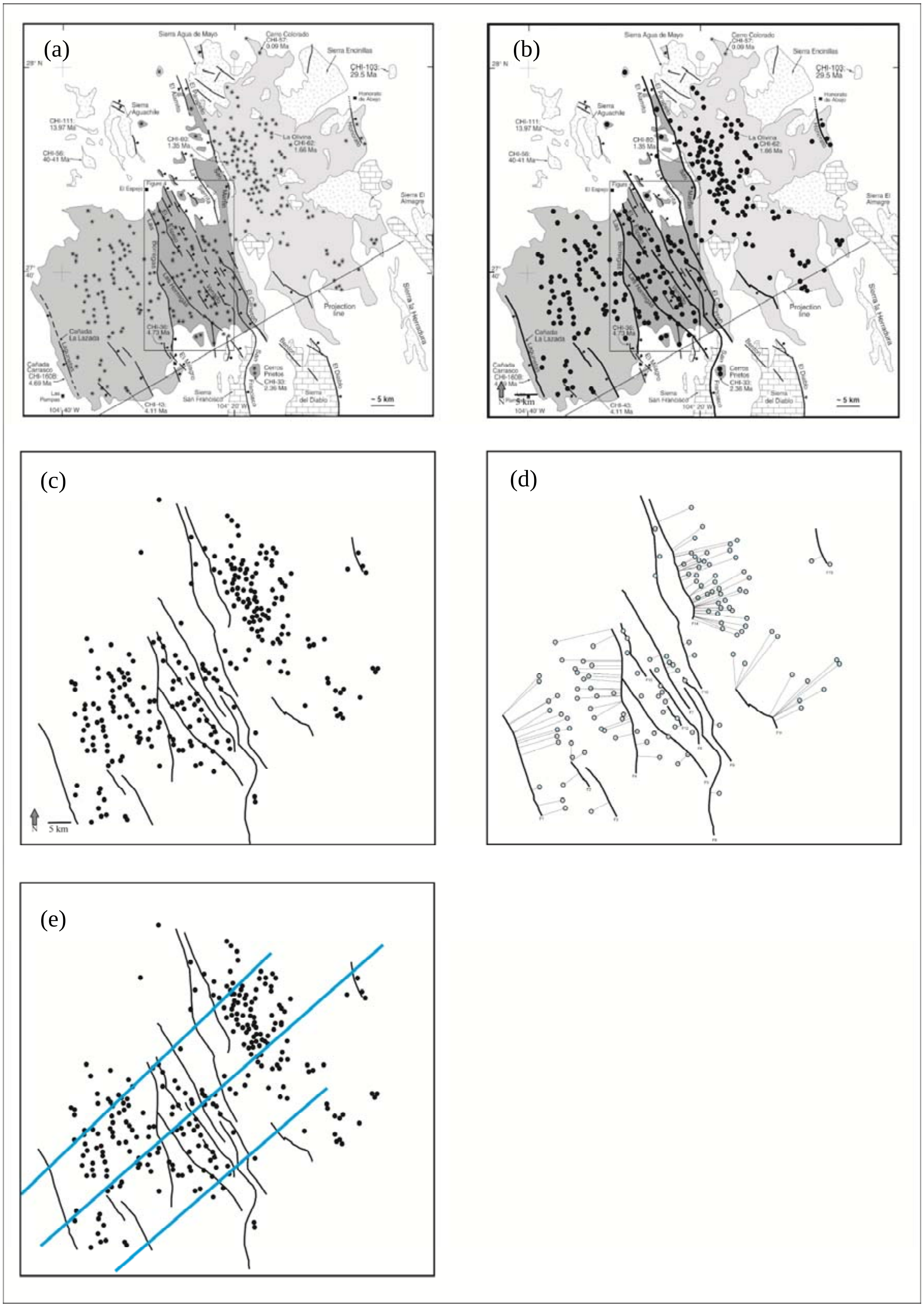

Figure 2. Methodology Illustration. The methodology of this study step-by-step. (a) original map, (b) vents and faults traced over original, (c) original map layer removed, (d) measure distance of vents to nearest fault, and (e) draw lines across field to measure average fault spacing. Base maps from Aranda-Gomez et al. (2003).

straight line from the vent to the nearest fault (Figure 3d). The length of the line was calculated using simple geometry (i.e.: $a^2+b^2=c^2$).

The digitized lines were converted to kilometers using the scale bars provided on the maps. All of the faults were assumed to be perfectly straight for the purpose of fault length calculations but the integrity of the fault trace was preserved to later calculate the vent to fault distances and fault spacing. The azimuths of faults were calculated with simple trigonometry (i.e.: $\tan\Theta$=opposite/adjacent, etc.). The fault spacing for each volcanic field was calculated by drawing between four and ten lines, depending on the size of the field, across the volcanic field and perpendicular to the dominant fault azimuth (Figure 3e). The lines drawn across the volcanic fields were segmented between each fault. Each of these segments were recorded and calculated in the same way the vent-to-fault distances were measured.

The fault spacing distances were averaged for each volcanic field. The traced images in CorelDraw were exported as picture files, added to a Google Earth image, and marked with the place mark function (lat/long). Each latitude and longitude coordinate was recorded from this software (all of the data are in NAD83). Each vent coordinate was then converted into UTM coordinates using Corpscon 6.0 software, developed by the U.S. Army Corps of Engineers (Dewhurst, 1990). Vent-to-fault length measurements were binned, graphed, and fault spacing calculations for each volcanic field were included.

This analysis does not consider alignments of the vents themselves, and only incorporates vent locations and fault traces that were inferred if such data was included on the geologic maps. To include buried features not indicated on each map would require extensive geophysical investigations and is beyond the scope of this study. When faults are discontinuous on the geologic maps, they were assumed to be discontinuous at the surface and were considered as multiple fault traces. It is not the intent of this study to assume when fault traces are continuous beneath alluvium if they are not mapped as such.

The results of this analysis will be presented in a similar fashion to Paterson and Schmidt (1999). Four distinct patterns based on curve shape is presented in Figure 2. Curve 1, a horizontal line, indicates that vents/plutons are uniformly distributed around the field in which a single fault is identified. Curve 2 shows there will be a maximum distance that vents/plutons can occur from each fault where two or more faults exist in a field. The shape of this curve will resemble a smooth plateau at the maxima with a tail decreasing to zero with increasing distance. Curve 3 is bell-shaped with the maximum at zero. This would indicate that vents/plutons statistically occur near faults because most vents would be located close to faults (shorter distances to the left of the graph). In the case type 3 curves, Paterson and Schmidt (1999) explain that the looks of the plots "are largely a function of fault spacing" and that this pattern does not imply that volcanic vents increase toward faults. Curve 4, a bell-shaped curve with a maximum some distance from faults, indicates that vents/plutons are not uniformly distributed and that they do not occur near faults.

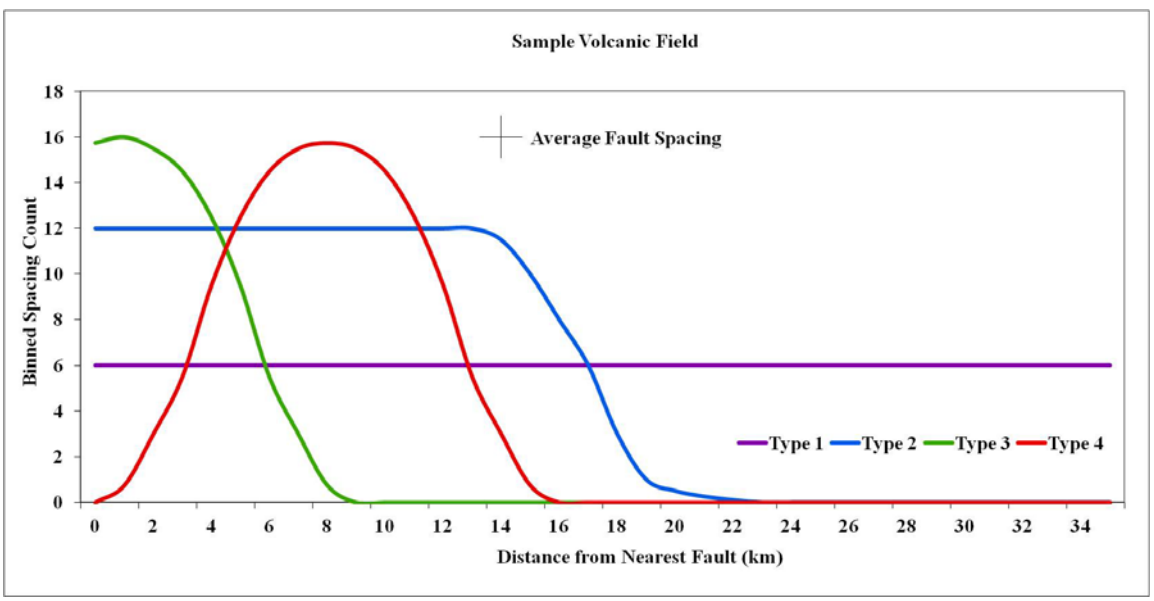

Figure 3. Possible Vent to Fault Spatial Analysis Curves. The potential curves from Paterson and Schmidt (1999); Curve 1 (horizontal line) indicates a uniform distribution; Curve 2 implies a maximum distance of vents with maxima tailing to zero; Curve 3 shows a bell-shaped curve indicating that vents are statistically near faults; and Curve 4 indicates that vent distance and distribution are not uniform. Modified from Paterson and Schmidt (1999).

Type-4 curves could also represent the fields in this study that show clusters of vents far from faults. This study incorporates the same presentation of data as Paterson and Schmidt (1999), but the graphs look slightly different. The binned fault-to-vent distance data are represented in bar graphs and the trend line that would best fit these data are represented by the curves referenced above.

On each graph, the fault quarter spacing, average fault spacing, and standard deviation is noted. Because of the nature of faulting in all of the volcanic fields, the standard deviation is large. The fault spacing calculations were an average over the entire volcanic field and included the large and small gaps between faults. For example, the Big Pine Volcanic Field had as little as 500 meters and as much as 18 km spacing between individual faults. The amount of effort involved in calculating different fault spacing for separate areas of each volcanic field is a separate statistical exercise in itself.

Calculations of Error

Sources of error in this study are mostly related to source mapping. Because of the nature of field mapping at the time the data were collected (some in the 1970's), vent locations traced over acquired maps may not precisely line up with locations of vents imported into Google Earth. When possible, the differences in an imported vent location and the aerial image were corrected visually. The error attributed to GIS technology is usually because of differences in a datum or projection. The calculation error of the Corpscon software is described in Dewurst (1990) as "minimal" and primarily in the longitude direction. Furthermore, all calculations of fault strikes, vent-to-fault distances, average fault spacing, etc. were carried to at least three decimal places in degrees-minutes-seconds to reduce the margin of error as much as possible.

The scale was never compromised (aspect ratio) when importing the traced images over the aerial photographs. The aspect ratio of the image file was kept exactly the same as the scale of the original geologic map. The correct scale for each volcanic field map was also verified after importing into Google Earth; the distance measurement tool was used to trace the scale bar of the imported image file. The aspect ratio was constant to maintain proper scaling. Some vents did not perfectly align to the aerial images due to the variable interpretation aspect of field mapping, especially since many of these maps were created before GPS technology became widely available. These data are only as precise as the geologic maps themselves and any errors made during geologic mapping would directly result in errors in the spatial analyses. Short of re-mapping each of these fields, one could use GIS technology combined with detailed photogrammetry and DEM data to fix any discrepancies in geologic maps, but that is beyond the scope of this paper.

Regional and Local Tectonic Settings

The tectonic settings of the volcanic fields within this study can be described in terms of regional and local geology. Descriptions will begin with explanations of regional tectonics of the Basin and Range Province, Baja Peninsula, Trans-Mexican Volcanic Belt, and Eastern California Shear

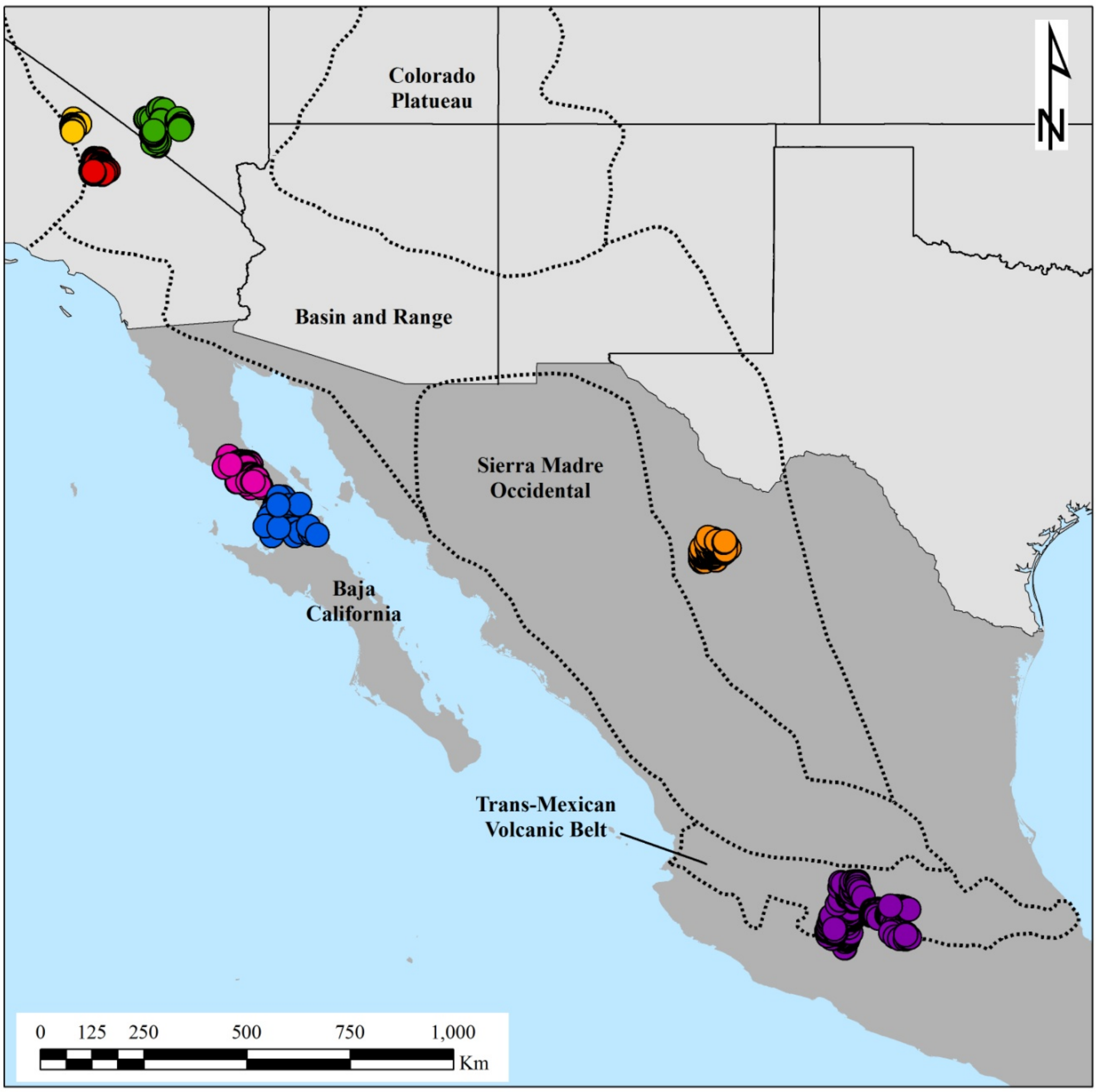

Figure 4. Regional Location Map of Volcanic Fields. Map identifies the relative locations of the volcanic fields and tectonic settings. Vents are represented by colored circles and providence boundaries are outlined with a dotted black line. Volcanic Fields are identified as: Big Pine – Yellow, Camargo – Orange, Coso – Red, Jaraguay – Pink, Michoacán-Guanajuato – Purple, San Borja – Blue, and Yucca – green. Providence boundaries adapted from Thompson and Zoback (1979) and Ferrari et al. (1999).

Zone followed by descriptions of local structural settings for seven volcanic fields: Big Pine, Camargo, Coso, Jaraguay, Michoacán-Guanajuato, San Borja, and Yucca (portrayed in Figure 4).

Regional Tectonics

Regional tectonics for all of the volcanic fields can be described in the context of the geology of the Basin and Range Province, the Baja Peninsula, the Trans-Mexican Volcanic Belt (TMVB), and the Eastern California Shear Zone (ECSZ). The Basin and Range Province covers the majority of the southwestern United States and northern Mexico. Four of the volcanic fields are within the province (Big Pine, Camargo, Coso, and Yucca). Two of these volcanic fields (Big Pine and Coso) are in close proximity to the Owens Valley and Independence faults, the western-most structures of the ECSZ and the Yucca Volcanic Field is located near the Stateline Fault in the eastern-most part of the ECSZ. Two of the volcanic fields, Jaraguay and San Borja, are located on the Baja Peninsula and the Michoacán-Guanajuato is the only volcanic field from this study in the TMVB. All three of these latter locations demonstrate volcanism within syn-subduction-related trans-tensional tectonic settings.

Basin and Range Province

The Basin and Range Province is a large area of the American Southwest that has undergone uplift and extension since the late Cenozoic, a result of which has been widespread volcanism (Cousens, 1996 and McQuarrie and Oskin, 2010). McQuarrie and Wernicke (2005) describe the Basin and Range Province as a 1000-km wide area of extensional deformation that was created by the collapse of a broad region of excessively thickened crust following the progressive end subduction of the Farallon Plate beneath the western margin of the North American Plate. Extension began in the early Miocene as the boundary transitioned to a combination of a Pacific-North American transform boundary at the continental margin and extension within the continent.

In their tectonic reconstruction of the area, McQuarrie and Wernicke (2005) estimate that the average rate of extension is 1 cm/yr since ~30 Ma.

Uplift and extension began with melting and thinning of lithospheric mantle and transitioned to the upwelling of asthenospheric mantle (Valentine and Perry, 2007). Central Basin and Range extension began first, approximately 16 Ma, followed by extension of the northern and southern segments about 10 Ma later (Valentine and Perry, 2007 and McQuarrie and Wernicke, 2005). Extension since ~16 Ma is associated with widespread basaltic volcanism with evidence for an increase in an asthenospheric source (McQuarrie and Oskin, 2010). Morellato et al. (2003) compared the number and spacing of faults within the Basin and Range and found that average large-scale (100 km-long) fault spacing is 13.8 km. The Basin and Range is consistent with other rift zones around the globe in terms of the number and spacing of normal faults.

Valentine and Perry (2007) suggest a more detailed model describing the specific process of melt generation and ascent in the Basin and Range: deformation from extensional strain caused an increase in porosity of lithospheric mantle, enhancing migration of melt to those areas. The continuous strain produced pockets or bands of melt which increase magma pressure. When a critical amount of pressure was exceeded, as determined by rheology and tectonic strain, the melt began a buoyant ascent through the crust. Once these dikes reach the shallow crust, there is the opportunity for faults to capture melt at very shallow depths.

Based on radiogenic isotope and trace element geochemistry, there are two proposed sources for magma in the Basin and Range: ocean-island signatures derived from an asthenospheric mantle source in the northern and southern Basin and Range (including Yucca) and island-arc signatures derived from subduction-enriched lithospheric mantle in the Western Great Basin and Transition Zone (including Big Pine and Coso Volcanic Fields) (Cousens, 1996).

Eastern California Shear Zone

The Eastern California Shear Zone (ECSZ) is a 450 km-long series of strike-slip and normal faults that transfer regional strain between the strike-slip faulting of the San Andreas Fault system through the Mojave Desert to normal faulting as far north as the Owens Valley area (Savage et al., 1990), including the western portion of the Basin and Range Province through southern and central, eastern California and western Nevada. Savage et al. (1990) state that the ECSZ extends at least into Owens Valley and perhaps influences tectonics further north into the northern Basin and Range Province. The ESCZ includes the Death Valley-Furnace Creek Faults, the Hunter-Panamint Faults, Fish-Lake Valley Faults, the Owens Valley-White Mountain Faults, the Garlock Fault (Lee et al., 2001 and Frankel et al., 2007), and the recently-identified Stateline Fault (Mahan et al., 2009).

Many authors have published strain rates for the entire ECSZ, and the most recent rates were calculated with refined Global Positioning System (GPS) measurements, detailed field reconnaissance mapping, LiDAR topographic mapping and cosmogenic ^{10}Be geochrology, and Ground Penetrating Radar (GPR) analysis. The ECSZ accommodates between 20 and 25 percent of the total displacement of the Pacific-North American margin (Frankel et al., 2007 and Dixon et al., 2003), or between 10 and 14 mm/yr (Kirby et al., 2008). The zone of active displacement of the ECSZ is defined from the Mojave Desert north to the Walker Lane region (Kirby et al., 2008).

The Stateline Fault, 40 km southeast of the Yucca Volcanic Field, is a 200-km long fault system along the California-Nevada state line (Mahan et al., 2009). First described by Guest et al. (2007), three dextral strike-slip segments exist: the Amargosa, Pahrump, and Mesquite stretch from the Ivanpah Valley northward into the Amargosa Valley. The long-term slip rate of 2.3 mm/yr, since the mid-Miocene, is based on stratigraphy, geochemical fingerprinting, and geochronology

(Guest et al., 2007). The Amargosa segment has undergone the greatest amount of offset in the Cenozoic, as much as 45 km (Mahan et al., 2009).

The Coso and Big Pine Volcanic Fields are in closest proximity to the Owens Valley and Independence Faults. The Owens Valley Fault, also the northwestern extent of the ECSZ, is 120 km-long, slips between 1 and 3 mm/yr, and has oblique right-lateral movement (Varnell, 2006; Taylor, 2002; Bierman et al., 1991); it accounts for up to 25% of strain throughout the entire ECSZ (Rogers, 2006). The Owens Valley Fault is an integral part of the shear zone, located between the Sierra Nevada Mountains to the west and the Inyo-White Mountains to the east. These two ranges act as the horsts bounding the two-graben system within Owens Valley. According to Varnell (2006), the Owens Valley and the Independence Fault both accommodate slip within the valley. Total offset across the valley over the life of the fault is between 3.8 and 13.3 km, assuming that the slip rate has been constant during the last 3 Ma (Lee et al., 2001).

Baja Peninsula

The Baja Peninsula is a 1,500 km-long peninsula with complex volcanic and structural relationships. Miocene to Quaternary volcanic rocks were erupted syn- and post-subduction of the Farallon plate beneath the North American plate beginning in the early Cenozoic and continuing through the Miocene (Atwater, 1970; Saunders et al., 1987; Pallares et al., 2007). In the Oligocene, two triple junctions (Mendocino and Rivera) were formed by the intersection of a spreading center with the continental margin (Saunders et al., 1987). Each of these triple junctions migrated north and south, respectively (Saunders et al., 1987). In the Miocene, after subduction ceased (Stock and Hodges, 1989 and Atwater and Stock, 1998), the proto-San Andreas transform fault formed to accommodate the offset between them and continued until 5.5 Ma, when the transform boundary migrated into the Gulf of California (Calmus et al., 2003).

Reorganization of fracture zones further to the south caused spreading centers to rotate and led to the eventual consumption or abandonment of the spreading centers between 6.5 and 3.5 Ma (Saunders et al., 1987). This resulted in the eventual cessation of subduction along the coast which allowed the East Pacific Rise (EPR) to propagate and rotate northward, marking the beginning of rifting in the Gulf of California (Saunders et al., 1987; Stock and Hodges, 1989; and Atwater and Stock, 1998). Volcanism within this earlier timeframe is geochemically different from San Borja and Jaraguay magmas, which erupted after subduction ended (Saunders et al., 1987).

According to Saunders et al. (1987), the position and depth of the subducted slab is unknown. The detachment of the slab opened a "slab window" and allowed hot mantle to flow directly beneath the lithosphere (Saunders et al., 1987 and Atwater and Stock, 1998). Negrete-Aranda and Cañón-Tapia (2008) explain that the style and composition of volcanic rocks of the Baja Peninsula changed from calc-alkaline (subduction-related) in the south to adakites and high-Mg andesites (post-subduction in monogenetic fields) in the north around 12 Ma due to the gradual increase in temperature due to asthenospheric mantle rebounding after slab detachment after subduction ended (Negrete-Aranda and Cañón-Tapia, 2008). These changes in temperature and regional stress triggered "the eruption of scattered pre-existing melt pockets" and the opening of a slab window was not responsible for the chemical diversity of volcanism found on the Baja Peninisula (Negrete-Aranda et al., 2010).

Sawlan (1991) indicated that the alkalic lavas of the volcanic fields on the Baja Peninsula were associated with extensional faulting and occurred along bounding faults of small grabens. As we shall see shortly, the lavas did indeed erupt during extensional faulting associated with rift opening. However, the spatial data generated by this study do not support the latter statement that volcanism occurred along faults, at least not in the San Borja and Jaraguay fields.

The lavas of the San Borja and Jaraguay Volcanic Fields range in ages between 10.3 and 0.57 Ma (Calmus et al., 2003). Upon the initial stages of rifting, orogenic magmatism on the southern Baja Peninsula began, and, from about 9 Ma to present day, magmatism shifted to the northern end of the peninsula (Sawlan, 1991). The San Borja and Jaraguay Volcanic Fields represent unique magmas in that they are alkalic with diverse trace element ratios that separate them from intra-plate alkalic magmas (Sawlan, 1991). According to Rogers et al. (1985), the magmas of Baja California rose through the crust quickly with little contamination and only minor fractionation.

Trans-Mexican Volcanic Belt

The Trans-Mexican Volcanic Belt (TMVB) straddles central Mexico as a 250 km-wide belt of magmatism that encompasses major cities including Guadalajara and Mexico City. The entire volcanic belt has a complex tectonic history, combining active subduction of the Cocos and Riviera Plates beneath the North American Plate with the evolution of three components of a rift system (Hasenaka, 1994). Basement rocks consist of felsic intrusive rocks such as grantites, quartz monzonites, and quartz diorites (Hasenaka and Carmichael, 1985a).

The central sector of the TMVB, the area included in this study, has a unique tectonic history since the Miocene. Volcanism in the Miocene through early Pliocene, produced scarce silicic flows and volcanism in the Quaternary marked by mostly basaltic and andesitic activity (although some silicic magmas erupted during this time) in an east-trending left-lateral trans-tensional tectonic environment (Pasquarè et al., 1991). During the late Miocene, Basin and Range extension migrated southward temporarily prior to when the trans-tensional set up began in the Pliocene (Pasquarè et al., 1991). There were three main pulses of tectonism and faulting and by the late Pleistocene, normal and left-lateral faults developed or reactivated and then the widespread basaltic and andesitic volcanism began (Pasquarè et al., 1991).

The rift system at the western-end of the TMVB forms the Michoacán Triangle (Johnson and Harrison, 1990; Hasenaka, 1994). The three limbs of the triple junction are the Tepic-Zocoalco rift zone, the Colima rift zone, and the Chapala rift zone (Hasenaka, 1994). The Chapala rift zone is an east-west trending graben, the failed aulacogen of the rift system, and has no geophysical evidence of recent tectonic activity (Hasenaka, 1994). However, the northern section of the TMVB lies within this area of the Chapala Graben, where east-west trending normal faults have offset medium-sized volcanoes (Hasenaka, 1994).

Volcanic vents of the TMVB are of Neogene to Quaternary age and are the consequence of subduction beginning in the Oligocene. On its northwestern edge, the TMVB overlaps the Sierra Madre Occidental, the location of increased ignimbrite volcanism in the Oligocene (Ferrari et al., 1999). Ferrari et al. (1999) showed that volcanic activity of the Sierra Madre Occidental waned in the Miocene as volcanism of the TMVB began. They attribute this shift in activity to the shallowing of subduction in the mid-Miocene and that this activity occurred in pulses of volcanism across the volcanic belt.

Volcanism associated with the TMVB mimics the present location of the modern arc (Ferrari et al., 2000) but is obliquely offset to the north away from the Middle America Trench (Hasenaka and Charmichael, 1985b; Hasenaka, 1994). Lavas of the TMVB are clearly the product of subduction based on their geochemistries (Hasenaka and Charmichael, 1987; Hasenaka, 1994). The regional distribution of volcanism in relation to the Middle America Trench is described by Hasenaka and Carmichael (1985a and 1985b): 75% of volcanoes are located between 200 km and 300 km from the trench, with the highest density at 250 km from the trench. Changes in composition, age, and volume of cones also trend with proximity to the trench (Hasenaka and Charmichael, 1985a; Connor, 1987a). According to Ferrari et al. (1999), the volcanic arc of the TMVB has migrated since Miocene time: 180 km from the trench in the late Miocene to 110 km from the trench today, presumably from the previously-mentioned change in the angle of decent of the slab.

Local Geology and Tectonics of Individual Volcanic Fields

Big Pine Volcanic Field

The Big Pine Volcanic Field consists of 25 identified basaltic vents within an area of 672 km^2. Figure 5 shows the relative features of the Big Pine Volcanic Field including vent and fault locations. The northern boundary of the field is 2.4 km south of the town of Big Pine, California and the southern boundary is 16 km north of the town of Independence, California. Several papers report that the Big Pine Volcanic Field lies firmly within the boundary of the North American craton based on Sr isotopic studies of eruptive products (Mordick and Glazner, 2006; Ormerod et al., 1991; Glazner and Miller, 1997).

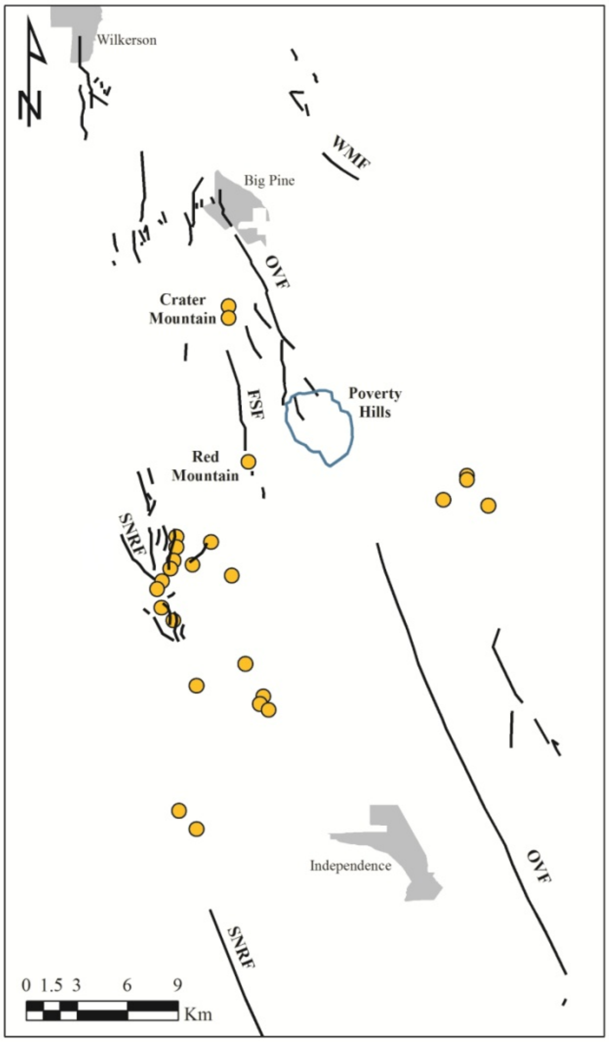

Figure 5. Big Pine Volcanic Field Location Map. Structural map showing relative locations of vents (yellow circles) and faults (black lines). FSF – Fish Springs Fault, OVF – Owens Valley Fault, SNRF – Sierra Nevada Range Front Fault. Adapted from Bateman et al. (1965), Connor and Conway (2000), and Varnell (2006).

Volcanism began around 1.2 Ma and has continued until 100 Ka (Connor and Conway, 2000; Varnell, 2006). According to Mordick and Glazner (2006), basalts of the Big Pine Volcanic Field melted and began crystallization of clinopyroxene at a depth of 45 km, within the mantle, and erupted without ponding in the crust. Since these basalts are among the most primitive in the Basin and Range, and the fact that mantle xenoliths are present, it is known that Big Pine Volcanic Field magmas had a very quick ascent through the crust. Upon initial inspection, the basalt flows of the volcanic field may have erupted through the Owens Valley fault that dominates the valley (Mordick and Glazner, 2006; Biermann et al., 1991). The Poverty Hills are a small gathering of landslide deposits in the center of the valley (Varnell, 2006).

The Big Pine Volcanic Field is confined to the floor of Owens Valley, bounded by the Sierra Nevada Mountains to the west and the Inyo-White Mountains to the east. The surrounding mountains are composed of granitic and meta-sedimentary basement rock and the valley floor consists of down-dropped graben blocks of those mountain ranges with substantial alluvial fill, as much as three kilometers (Varnell, 2006). The granitic basement rock is much shallower in the portion of the valley between the Sierra Nevada Mountains to the west and the Owens Valley Fault striking down the center of the valley (Varnell, 2006).

Camargo Volcanic Field

The Camargo Volcanic Field consists of 260 identified cinder cones near Chihuahua, in northern Mexico (Rojas-Beltran, 1995) covering a total of 3,770 km^2. The field is the most voluminous volcanic field in the Mexican Basin and Range and contains numerous normal faults (Aranda-Gomez et al., 2003). In fact, the center of the field is bounded by northwest to southeast-tending faults within a graben feature; the

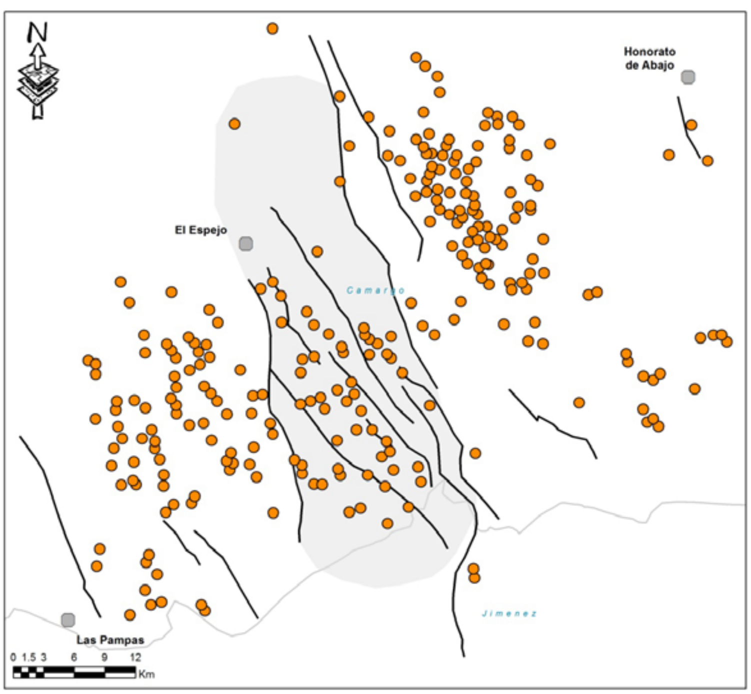

Figure 6. Camargo Volcanic Field Location Map. Structural map showing relative locations of vents (orange circles) and faults (black lines). Shaded region indicates graben feature described in text. Adapted from Aranda-Gomez et al. (2003).

horsts on the northeast and southwest sides have fewer faults. All three of these sections have prevalent volcanism.

Upon inspection of Figure 6, which shows the relative locations of vents and faults in the Camargo Volcanic Field, it is apparent that the central section (graben feature) of the field has a much higher density of faulting and the horsts on either side have a higher accumulation of vents with less faults. The faults of the central graben presumably dip inwards towards the center of the field and do not intersect the outer areas of the field at depth.

Coso Volcanic Field

The Coso Volcanic Field, which is approximately 120 km south of the Big Pine Volcanic Field, is bounded to the west by the Sierra Nevada Mountains, to the north by Owens Valley, and to the east by the southern Inyo Mountains. Figure 7 shows the relative locations of vents and faults within the field. A total of 52 vents were identified for this study over an area of 1,680 km^2.

The Coso Volcanic Field is underlain by interbedded pyroclastic and lava flows of Tertiary to Quaternary age with Mesozoic basement rocks of granitic to gabbroic compositions (Duffield and Bacon, 1981). The entire field is underlain by an active geothermal complex. Faulting in the Coso Volcanic Field is primarily controlled by Basin and Range extension (Roquemore, 1978; Bacon et al., 1980; Roquemore, 1980). Reported Sr isotopic values (Mordick and Glazner, 2006) reveal that the Coso Volcanic Field lies within a transitional or accreted terrain and not on the North American craton.

Bimodal volcanism characterizes the Coso Volcanic Field, with a short pulse of basaltic melt around 4 Ma to 2.5 Ma, followed by repeated, mostly silicic eruptions (i.e.: rhyolite domes/flows) peaking between 1.1 Ma and 40 Ka (Combs, 1980; Duffield et al., 1980; Bacon, 1982; Fialko and

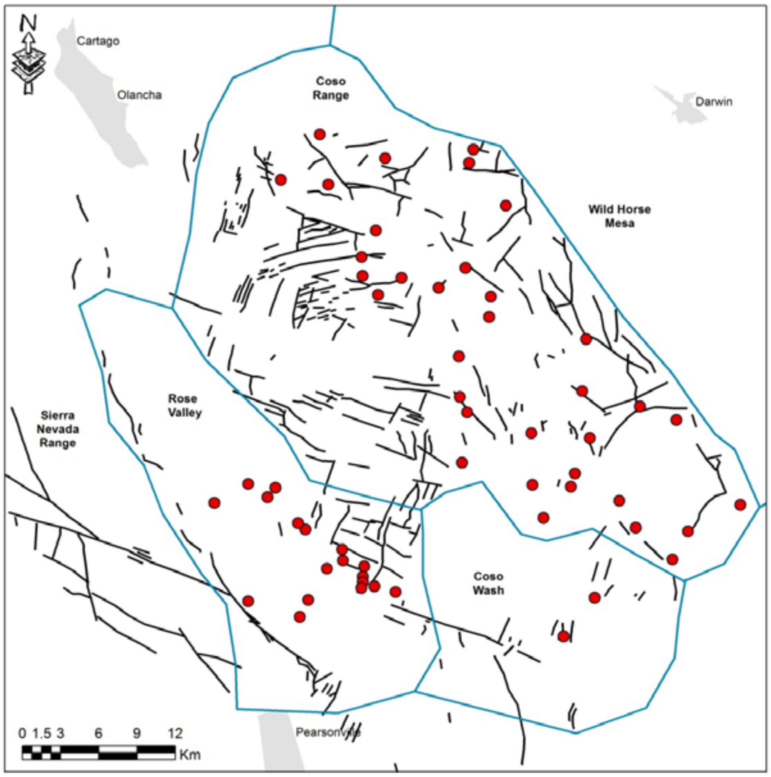

Figure 7. Coso Volcanic Field Location Map. Structural map showing the locations of vents (red circles) and faults (black lines). Adapted from Duffield and Bacon (1981).

Simmons, 2000; and Mordick and Glazner, 2006). The volume of all basaltic flows and rhyolitic domes total around 30 km^3 of volcanic material in the Pliocene and 5 km^3 of material erupted in the Pleistocene (Mordick and Glazner, 2006). Averaged over the lifetime of the volcanic field, Bacon (1982) proposes that eruption rates of basalts are about 2.8 km^3/Ma and rhyolitic rates are around 5.4 km^3/Ma.

Based on phenocryst compositions, the top of the Coso Volcanic Field magma body rose from 10 km around 1 Ma to approximately 5.5 km in the last 100 Ka (Manley and Bacon, 2000). This magma body is a region of partial melt with a system of mafic dikes oriented in a north-south direction (Duffield et al., 1980; Bacon et al., 1984; Wilson et al., 2003; Mordick and Glazner, 2006), in alignment with the regional tectonic stresses. The depth of crystallization for Coso basalts are estimated at 19 km using clinopyroxene thermobarometry (Mordick and Glazner, 2006) and erupted directly from its source through a diapir in the lower and upper crust (Monastero et al., 2005).

Rhyolitic compositions, however, formed from stalled basaltic melt that had enough residence time for the crystals to re-equilibrate and generate the rhyolitic melt (Mordick and Glazner, 2006). All of the above evidence supports the claim by many authors that the current magma body can be found between 5 km and 20 km below the surface (Combs, 1980; Duffield et al., 1980; Reasenberg et al., 1980; Bacon, 1982; Bacon et al., 1984; Manley and Bacon, 2000; Wilson et al., 2003; Mordick and Glazner, 2006).

Yucca Volcanic Field

The Yucca Volcanic Field is a collection of basaltic cones near and within the Crater Flat area of southern Nevada. There are a total of 38 identified volcanic vents in an area that covers 9,216 km^2. Figure 8 below shows the locations of vents and faults within the Yucca Volcanic Field.

Yucca Mountain, within the boundaries of the volcanic field, has gained attention as a proposed nuclear waste repository. Although 38 vents were identified for this study, many existing vents are buried and have only been found using magnetic and gravity data sets. These inferred vents erupted within the last 1 Ma (Connor et al., 2000). Much older buried pyroclastic flows in the vicinity have been dated around 13 Ma, but are unrelated to the volcanic rocks on Crater Flat, which are only as old as 10.5 Ma (Wernicke et al., 1998; Connor et al., 2000).

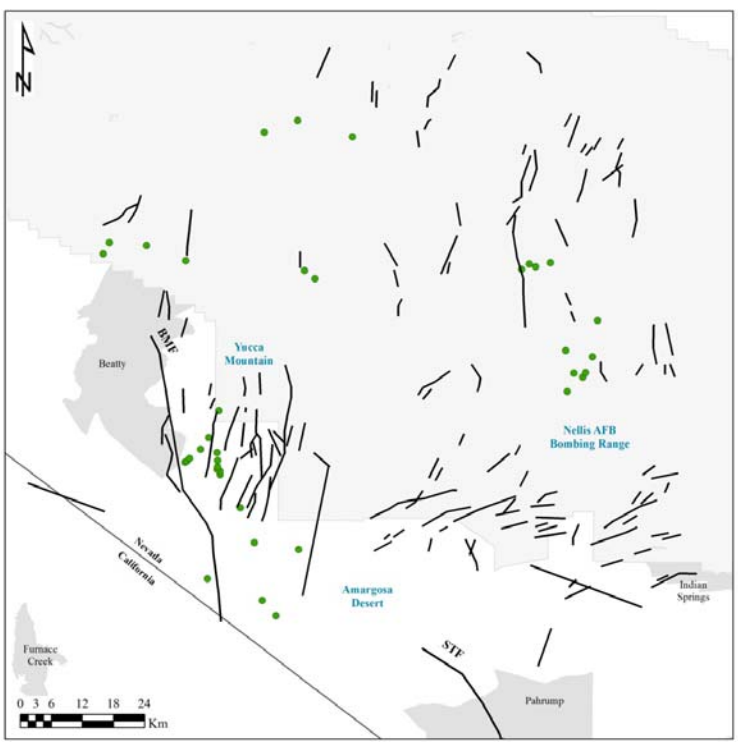

Figure 8. Yucca Volcanic Field Location Map. Structural map showing vents (green circles) and faults (black lines). BMF – Bare Mountain Fault, SLF – Stateline Fault. Adapted from Dohrenwend et al. (1996) Potter et al. (2002), and Mahan et al. (2009).

The ECSZ faults systems closest to the Yucca Volcanic Field are in the Stateline (approximately 40 km to the southeast), the Owens Valley (approximately 140 km to the west), the Panamint Valley-Hunter Mountain (approximately 100 km to the southwest) and the Death Valley-Furnace Creek (approximately 40 km to the southwest); however, these faults do not account for all of the geodetic strain across the Yucca Volcanic Field (Wernicke et al., 2004; Hill and Blewitt, 2006). Using borehole measurements, strain is thought to be accommodated by purely normal faulting within the field itself (Wernicke et al., 1998).

According to Connor et al. (2000) the Yucca Volcanic Field occupies an area of Crater Flat and surrounding areas that are highly populated with normal faulting that cuts ignimbrite and Paleozoic sequences down to an approximate depth of 5 km. Just below that depth, the high-angle normal faults cut into Pre-Cambrian basement rocks and intersect a detachment (Connor et al., 2000).The most active areas for basalt intrusions are Lathrop Wells to the south and Claim Canyon Caldera to the north based on the stress field and the fact that the faults in the immediate vicinity have slipped since the last volcanic event (Parsons et al., 2006).

Jaraguay Volcanic Field

The Jaraguay Volcanic Field is the more northern field of the two on the Baja Peninsula and is described by Calmus et al. (2003) as a volcanic field lying on a flat plateau underlain by Mesozoic granitic basement. The total area of the Jaraguay Volcanic Field is approximately 12,800 km^2 and contains a total of 161 identified vents. Figure 8 above shows the relative locations of vents and faults within the field.

Volcanic samples from Jaraguay Volcanic Field were collected and dated by Saunders et al. (1987); the majority of these rocks are considered to be magnesian andesite with a distinct geochemical signature similar to adakites (Rogers et al., 1985; Calmus et al., 2003). They have a

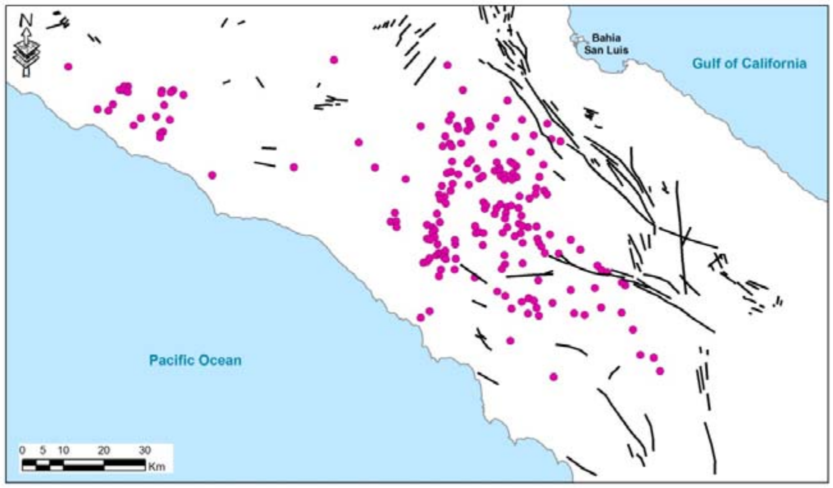

Figure 9. Jaraguay Volcanic Field Location Map. Structural map showing vents (pink circles) and faults (black lines). Adapted from Gastil et al., 1971.

slab-melt imprint, the result of the opening of an asthenospheric window and slab tearing (Saunders et al., 1987) and the resulting Pliocene-Pleistocene volcanism of the Jaraguay Volcanic Field is from the eruption of individual pockets of melt triggered by the change in regional stresses and increased heat flow beneath the plate during the Miocene (Negrete-Aranda et al., 2010).

San Borja Volcanic Field

The San Borja Volcanic Field is south of the Jaraguay Volcanic Field on the Baja Peninsula and has an aerial extent of approximately 11,875 km^2. There are a total of 85 identified volcanic vents in the field. Because of its close proximity, it has similar structural features as the Jaraguay Volcanic Field but the San Borja Volcanic Field is characterized by more isolated lava flows (Calmus et al., 2003).

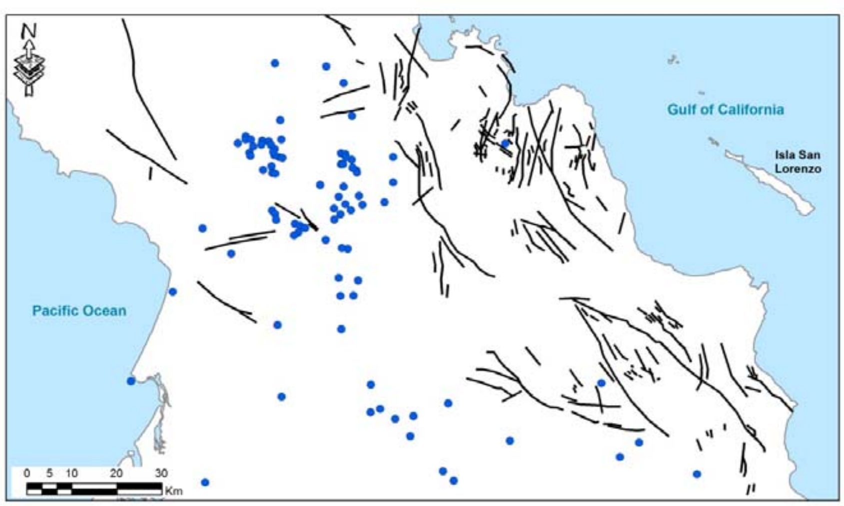

Figure 10. San Borja Volcanic Field Location Map. Structural map illustrating the relative locations of vents (blue circles) and faults (black lines). Adapted from Gastil et al. (1971).

Figure 10 shows the vent and fault location map for the San Borja Volcanic Field. In the southern part of the field, thick lava flows cap wide and flat mesas while in the north, well-preserved scoria cones and flows dominate (Negrete-Aranda et al., 2010). When studying the map patterns of features in the San Borja Volcanic Field, it can be said that there are noticeably fewer vents in the field than the Jaraguay Volcanic Field and the faulting patterns are different because in San Borja, the faults are spread farther apart and have more varied orientations.

Michoacán-Guanajuato Volcanic Field

The Michoacán-Guanajuato Volcanic Field, whose central section encompasses 43,000 km^2 across central Mexico, is contained within the TMVB (Hasenaka and Charmichael, 1985b). Note that this study focuses on the central sector as defined by Pasquarè et al. (1991). The central sector of the Michoacán-Guanajuato Volcanic Field contains 239 identified vents.

Connor (1987b) explains that the distribution of faults and vents within the field are clustered. However, the clusters of faults are found surrounding small lineaments of volcanic vents in the center of the field as shown in Figure 9 above. Connor (1987a) attributes this arrangement to a band of extinct polygenetic volcanoes just trench-ward of the grouping of faults.

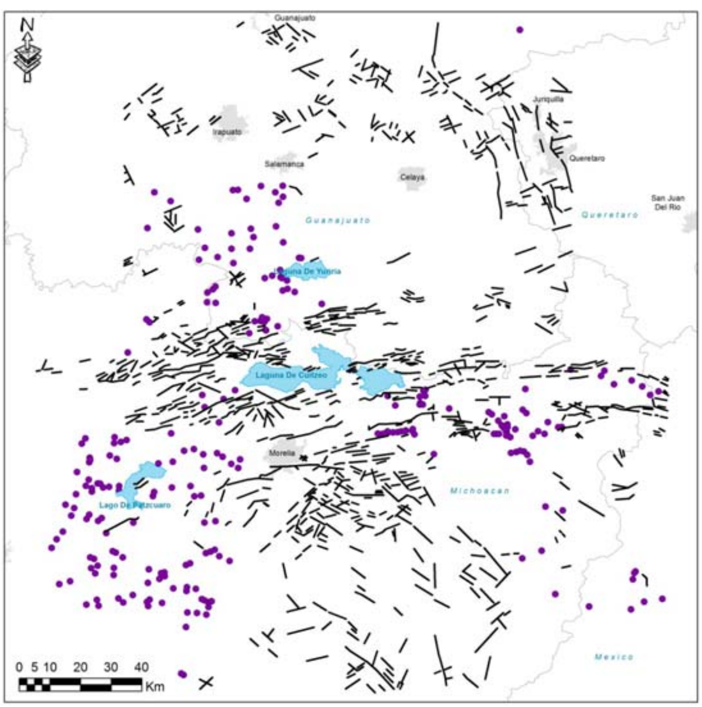

Figure 11. Michoacán-Guanajuato Volcanic Field Location Map. Structural map showing vent (purple circles) and fault (black lines) locations. Adapted from Pasquare et al. (1991).

Based on a cross section from Pasquarè et al. (1991), the central sector of the Michoacán-Guanajuato Volcanic Field is underlain by Mesozoic basement rock at greatest depth, with a shallowing sequence of interbedded and deeply faulted volcanic and sedimentary rocks. The faults are steeply-dipping normal faults that cut all deposits and sequences down to the basement rock (Pasquarè et al., 1991), presumably a function of the trans-tensional tectonic regime of the area. Most recently (Pleistocene and Holocene) left-lateral normal and normal faults developed or reactivated with average NNW to SSW orientations, indicating a slightly oblique extensional tectonic regime in the immediate area of the Michoacán-Guanajuato Volcanic Field (Pasquarè et al., 1991).

Results

Data collected by the methods outlined above are organized in Table 1 by binning the vent-fault distances and comparing the half- and quarter-fault spacing of each volcanic field. Each fault spacing measurement and binning of vent-fault distances were considered throughout each field. The results from each volcanic field are graphed and included in this section with a description of the data. Note: inferred vent locations are not included in this analysis if they were not indicated on geologic maps.

Table 1 – Summary Table of Volcanic Field Properties

Field Name	Areal Extent†	Vent Count	Curve Type	Fault Count	Fault ¼ Spacing[ψ]	Fault ½ Spacing[ψ]	% within ¼ Spacing[º]	% within ½ Spacing[º]
Big Pine	672	25	strong 3	64	0.77	1.54	44	48
Camargo	3,770	261	3-4 combo	15	2.56	5.13	30	48
Coso	1,680	37	strong 3	296	0.39	0.77	51	73
Jaraguay	12,800	160	strong 4	140	2.10	4.20	1	7
Michoacán-Guanajuato	43,000	239	2-3 combo	753	3.45	6.90	33	54
San Borja	11,875	86	strong 4	165	1.35	2.70	0	0
Yucca	9,216	38	2-3 combo	122	1.83	3.66	51	77

† Extent of volcanic field in km^2

ψ Average fault spacing was calculated over length and width of entire volcanic field in km. Half and quarter spacing values are related to the average spacing as explained in the text.

ºThese are the percentages of vents in each field that are located within the ¼ and ½ spacing distances of faults.

Volcanic field parameters are compared in Table 1. The curve type identified is in reference to the possible curve types in Figure 3. The quarter- and half- fault spacing were calculated by dividing the average fault spacing (as described in the Methodology section of this paper) by 4 and 2, respectively. The half spacing is related to vents that occur as far from faults as possible (in between faults) and the quarter spacing is related to vents that are close to faults. Additional data are included in the attached appendices: vent location data, fault location data, and fault orientation data. The orientation data do not relate directly to the content of this thesis, but were easily incorporated into the end of the document.

Big Pine Volcanic Field

Figure 12 shows a type 3 curve with two maxima at less than 0.5 km and at 7 km. The average fault spacing is 3.08 km with a half-spacing of 1.54 km and a quarter-spacing of 0.77 km. The percentage of vents that are located within the field half-spacing is 48 percent and 44 percent of vents are within the quarter-spacing for the Big Pine Volcanic Field. Further inspection of the map in Figure 4 shows that the vents to the southwest edge of the volcanic field are found in a sub-linear pattern along the Sierra Nevada Front Range Fault. A total of nine vents are found within 0.5 km of a fault. Average vent-to-fault spacing is 2.74 km; the median vent-to-fault distance is 1.65; the minimum vent-to-fault distance is 0 km and the maximum is 6.95 km.

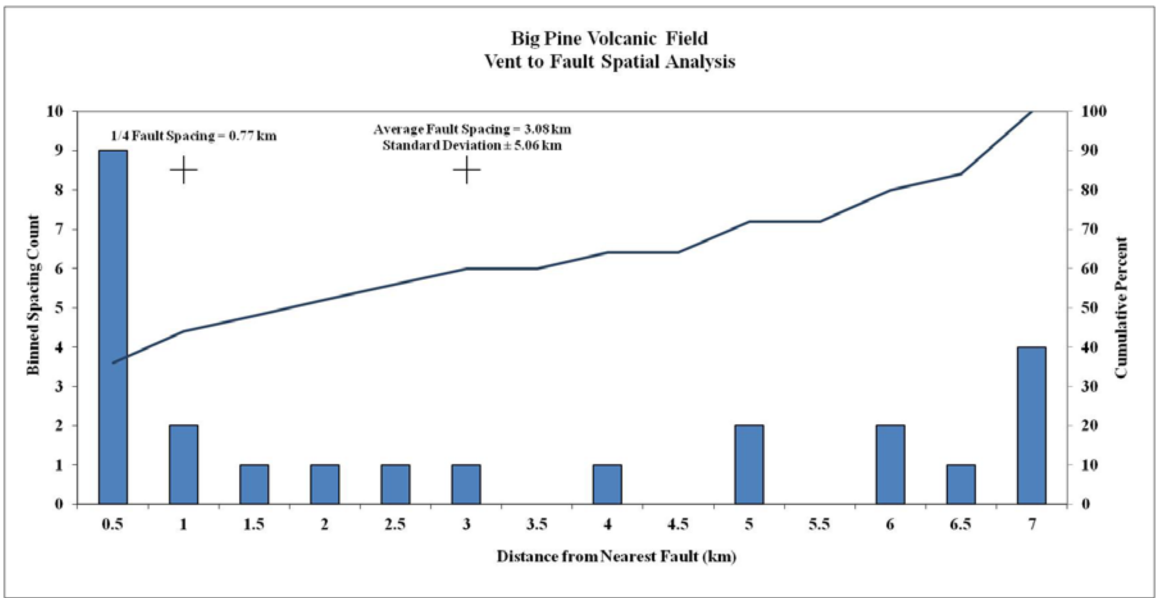

Figure 12. Spatial Analysis for Big Pine Volcanic Field. Strong type-4 curve of binned distances of vents from nearest faults. The cumulative percent of vent distances is represented by the dark blue line.

Camargo Volcanic Field

Figure 14 shows a combination of type 3 and type 4 curves. The average fault spacing is 10.25 km with a half-spacing of 5.13 km and a quarter-spacing of 2.56 km. There are a full 51 percent of vents that are found at or within the fault quarter-spacing and 73 percent of vents are within the half-spacing. The vents closest to faults are indicated by the first few maxima (type 3 curve component) and the other maximum at 7.5 km represent the type 4 curve component. The average vent-to-fault spacing is 5.86 km and the median value for vent-to-fault spacing in the field is 5.39 km. The minimum distance between a vent and its closest fault is 0.00 km and the maximum vent-to-fault spacing is 18.87 km.

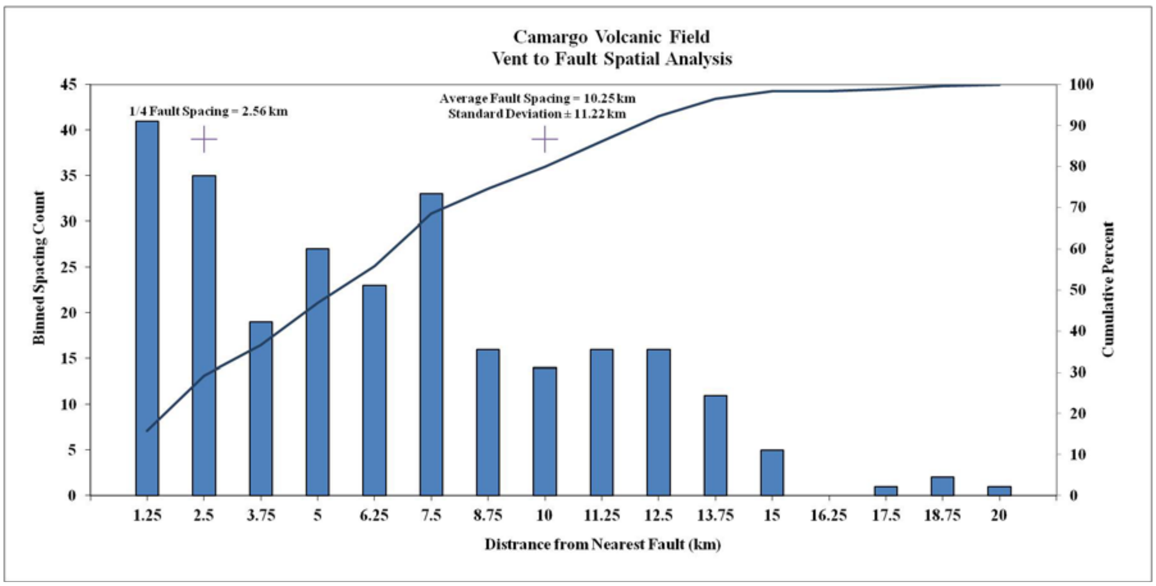

Figure 13. Spatial Analysis for Camargo Volcanic Field. Combination of type-3 and type-4 curves of binned distances of vents from nearest faults. The cumulative percent of vent distances is represented by the dark blue line.

Coso Volcanic Field

Figure 16 indicates a strong type 3 curve. The vent distance maximum occurs at 0.2 km from faults. The average fault spacing is 1.55 km with a half-spacing of 0.78 km and a quarter-spacing of 0.39 km. 30 percent of the vents in the field are within the fault quarter-spacing and 48 percent are located within the field half-spacing. The Coso Volcanic Field location map (Figure 7) shows that many vents occur very close to faults, 54 percent are found within 500 meters of a fault. Vents concentrate in the alluvial valleys (Rose Valley to the southwest and Coso Wash to the northeast) and are less prevalent in the Coso Range (concentration of faults between the two valleys). The Sierra Nevada Frontal Fault does have some surface expression in the Coso Volcanic Field but there are no nearby vents. The average vent-to-fault spacing in the field is 0.85 km and the median spacing between vents and faults is 0.37 km. The minimum spacing between vents and faults is 0.00 km and the maximum vent-to-fault spacing is 5.27 km.

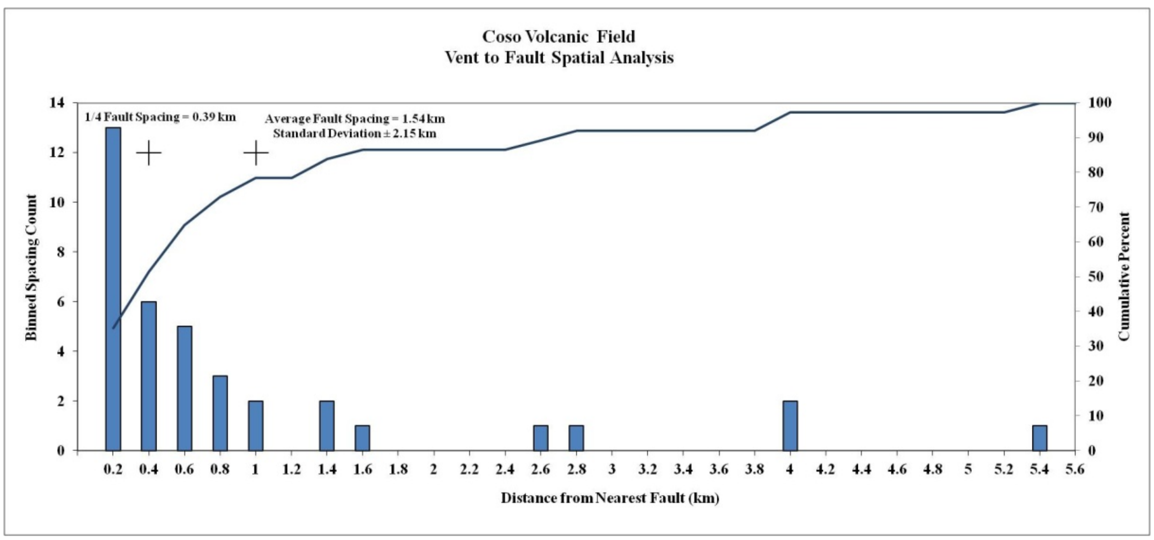

Figure 14. Spatial Analysis for Coso Volcanic Field. Strong type-3 curve of binned distances of vents from nearest faults. The cumulative percent of vent distances is represented by the dark blue line.

Yucca Volcanic Field

Figure 24 shows a combination of type 2 and type 3 curves for the Yucca Volcanic Field. The average fault spacing is 7.3 km with a half-spacing of 3.65 km and a quarter-spacing of 1.83 km. 51 percent of vents are found within the quarter-spacing and 77 percent of vents are located within the half-spacing. The map showing features of the Yucca Volcanic Field (Figure 11) indicates that there are some vents grouped close to faults and others that are located far from faults. This difference can be seen in the combination of curves mentioned above. The maxima at 1 km, 2 km, and 3 km shows that many vents are exactly between faults (type 2 curve) and other vents are located far from faults in loose groups (type 3 curve). The average vent-to-fault spacing for the field is 2.87. The median value for vent-to-fault distance is 1.96 km. The minimum value for spacing between vents and faults is 0.04 km and the maximum vent-to-fault spacing is 12.25 km.

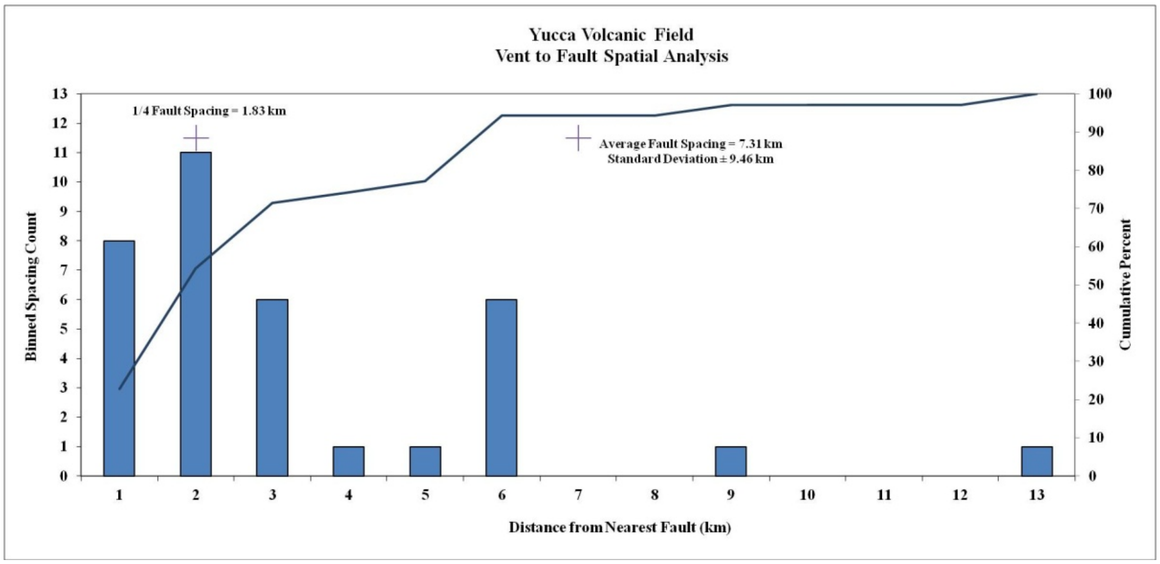

Figure 15. Spatial Analysis for Yucca Volcanic Field. Combination of type-2 and type-3 curves of binned distances of vents from nearest faults. The cumulative percent of vent distances is represented by the dark blue line.

Jaraguay Volcanic Field

Figure 18 shows a strong type 4 curve. The vent distance maximum is found between 8 km and 12 km from faults. The average fault spacing occurs at 7.93 km with a half-spacing of 3.97 km and a quarter-spacing of 1.98 km. Inspection of map patterns (revisit Figure 8) shows that the vast majority of vents in the Jaraguay Volcanic Field are located from faults. Faulting patterns can be seen in Figure 8. Faults are grouped in the northeast and south of the field. A couple of longer faults extend into the main grouping of vents in the center of the field. There are no vents within 2 km of faults. Two main sets of vents are located in the center of the field and to the northwest near the coastline. The average vent-to-fault spacing in the field is 11.21 km and the median value for vent-to-fault spacing is 10.77 km, both values are among the largest of these values in this study (along with San Borja Volcanic Field). The minimum vent-to-fault spacing is 1.5 km, which means that there are no vents located directly on top of faults in the field. The maximum vent-to-fault distance is 30.5 km.

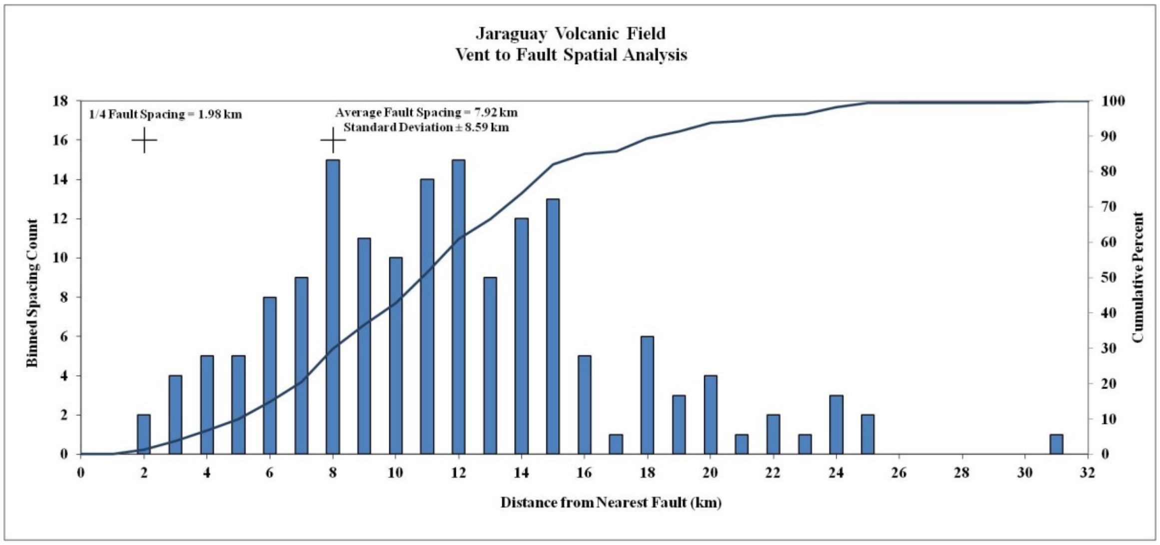

Figure 16. Spatial Analysis for Jaraguay Volcanic Field. Strong type-4 curve of binned distances of vents from nearest faults. The cumulative percent of vent distances is represented by the dark blue line.

San Borja Volcanic Field

Figure 22 shows a strong type 4 curve with a fault distance frequency maxima found around 13 and 14 km. The average fault spacing occurs at 11.30 km with a half-spacing of 5.65 km and a quarter-spacing of 2.83 km. No vents are located within the quarter- or half-spacing within the field. Further inspection of the map in Figure 10 shows that vents in the San Borja Volcanic Field are found far from faults, similar to the Jaraguay Volcanic Field. Some vents are grouped away from faults in the north of the field and others are scattered far from faults in the south of the field. The average vent-to-fault distance for the field is 11.5 km and the median value is 11.46 km. The minimum vent-to-fault spacing is 3.44 km which means that no vents are directly located on any faults in the field. The maximum spacing between vents and faults is 23.53 km.

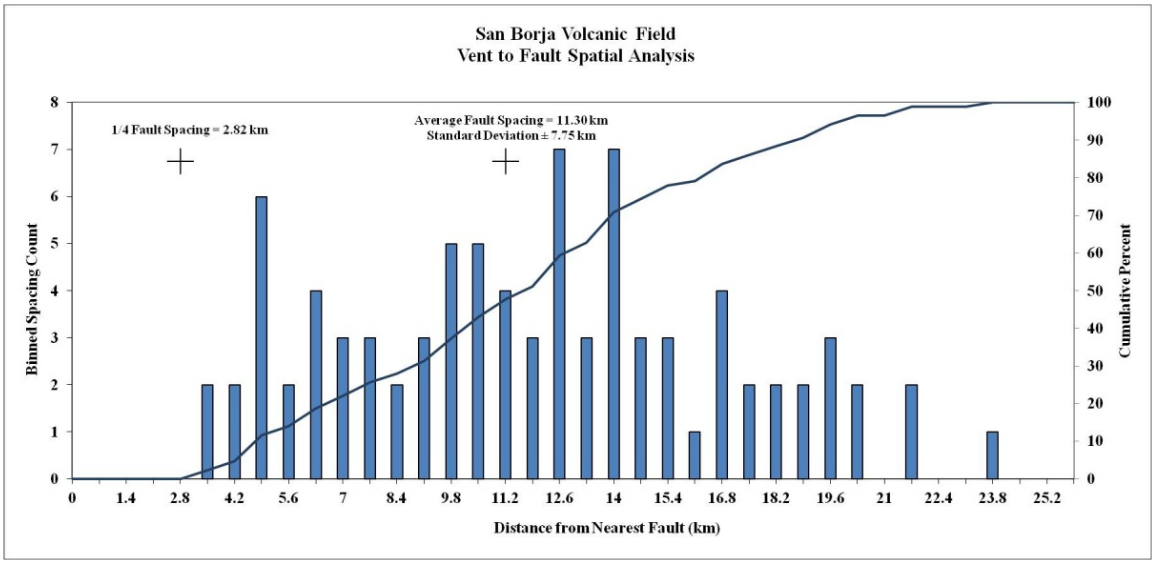

Figure 17. Spatial Analysis for San Borja Volcanic Field. Strong type-4 curve of binned distances of vents from nearest faults. The cumulative percent of vent distances is represented by the dark blue line.

Michoacán-Guanajuato Volcanic Field

Figure 20 shows a combination of type 2 and type 3 curves. The maximum vent to fault distance frequency occurs at 3 km. The average fault spacing occurs at 5.20 km with a half-spacing at 2.6 km and a quarter-spacing at 1.3 km. 33 percent of vents are found within the quarter-spacing and 54 percent of vents are within the half-spacing. Map patterns of the Michoacán-Guanajuato Volcanic Field, from Figure 9, show that vents seem to occur in groups between groups of faults around the field. With the exception of one feature, vents are not found to the north of the field where the Sierra Madre Block encroaches on the edge of the field. Vents located very close to faults are represented by the type 3 curve component (maxima at 2 km and 3 km) and the remaining vents are found away from faults at a variety of distances (type 2 curve component). The average vent-to-fault spacing is 8.91 km. The median value for vent-to-fault distances is 6.47 km. The maximum vent-to-fault value is 41.03 km.

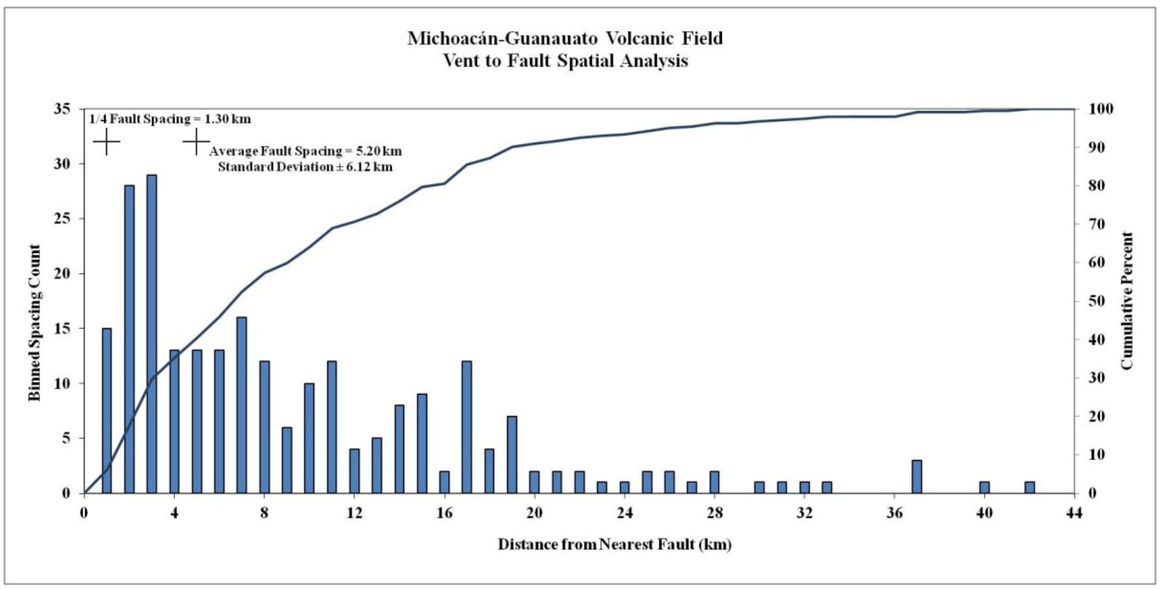

Figure 18. Spatial Analysis for Michoacán-Guanajuato Volcanic Field. Combination of type-2 and type-3 curves of binned distances of vents from nearest faults. The cumulative percent of vent distances is represented by the dark blue line.

Discussion

Graphs from the data in the previous section show the map distances between vents and the nearest fault in each volcanic field. This section will review the spatial relationships within the volcanic fields studied, discuss how scale affects the analysis, relate source geometry with distribution patterns at the surface, outline how magmatism and faulting work as complementary mechanisms in the shallow subsurface, and discuss how all of these factors affect hazard mapping and forecasting.

Spatial Relationships

If spatial relationships exist between vents and faults, data from this study will show a grouping of vents close to faults, as exhibited by a type-3 curve. Combinations of the other curve types indicate spatial patterns where vents are far from faults for various reasons. This subsection will address the interpretation of data from each field using curve type descriptions from Figure 2.

Two of the volcanic fields (Jaraguay and San Borja) in this study show a strong type-4 curve, indicating that there is a statistical correlation where vents occur far from faults at some maximum distance. Two volcanic fields (Big Pine and Coso) exhibit a strong type-3 curve, indicating that vents are statistically close to faults. There were no volcanic fields in this study that showed a type-1 or type-2 curve because in order to have these curve types, there must be as few as only one fault in a field.

The remaining volcanic fields exhibited combinations of type-2, type-3, and type-4 curves, which indicates a range of maxima between vents and faults with more than one component of spacing.

The fields with a combination of curve types-2 and -3 (Yucca and Michoacán-Guanajuato) have groupings of vents far from groupings of faults with a rare group of vents between two closely-spaced faults. The field with a combination of curve types-3 and -4 (Camargo) relates to a group of vents near a group of faults while other vents are gathered in areas of sparse faulting.

The Role of Map Scale

Map distances expressed in the graphs showing the spatial relationships between faults and vents are discussed in the context of local scale. The data can be misleading when considered at larger regional scales, such as when Paterson and Schmidt (1999) explain that if the scale of an entire orogen is considered, it appears that faults and vents cluster close together (one-to-one relationship). But, individual features (faults and vents) are considered in this study, and hence interpretations of spatial/genetic relationships at larger-scales would be inappropriate for the purposes of this study (Paterson and Schmidt, 1999).

The scale at which one performs the analysis affects the interpretation and conclusions if one is not careful. Paterson and Schmidt (1999) show that some geologic relationships may be apparent at a large scale such as for an entire orogen, but relationships at the scale of individual features may not show the same results. A causative relationship may not be appropriate at any scale even if a spatial relationship is found because the geology and structure of the crust must be considered. Furthermore, if a spatial relationship is determined at the scale of a volcanic field, for example, but not for individual volcanic vents and faults, a causative relationship is not appropriate at the sub-regional scale.

Statistical analyses of populations of eruptive centers are useful at regional scales in some studies on the order of those presented in McQuarrie and Oskin (2010) (i.e at the scale of the entire Basin and Range Province) vents and faults seem to cluster very close together in areas throughout the province. However, as with any mapping exercise, a larger scale is offered at the expense of feature resolution (McQuarrie and Oskin, 2010 and Paterson and Schmidt, 1999) and the visual refinement of individual features disappears. The spatial analyses explored for this study are not appropriate at regional scales for the above reasons.

The scale of individual features, however, where distances between vents and faults can be directly measured, is the appropriate scale to interpret the data from this study. Not only are the resolution of volcanic features lost at larger scales, some of the faults and fractures in the fields would disappear because of their short length. Additionally, as Paterson and Schmidt (1999) point out, "the scale at which the [spatial] relationship is strongest may provide information about the scale at which a causative relationship operates." In other words, if a close spatial relationship exists at the scale of individual features, then one should look at those features for clues for a causative relationship, if one exists.

The Role of Source Geometry

In addition to an assessment of the spatial relationships of upper crustal structures and populations of vents within volcanic fields it is, where possible, important to consider the spatial relationship of vent populations to the extent and geometry of regions of retarded seismic velocities in parts of the upper mantle and lower crust (i.e. potential source regions) beneath these volcanic fields. The northeastern Japan arc and Eastern Snake River Plain offer potential alternative explanations for the observed spatial patterns of vents. Source geometry is fundamental to the location of basaltic volcanism in both of these areas and perhaps in the volcanic fields of this study.

The northeastern Japan arc exhibits a similar pattern of vents occurring away from faults as within most of the volcanic fields in this study. The seismic tomography images from Hasegawa

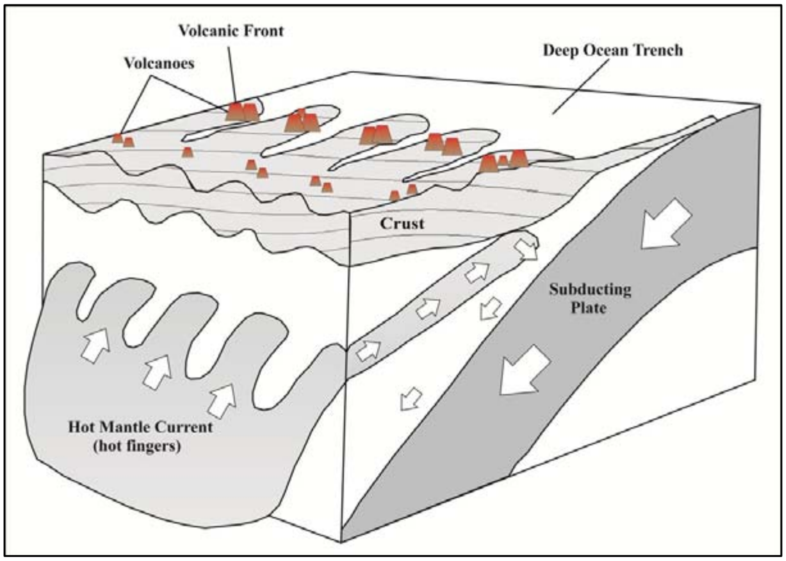

Figure 19. Diagram showing the convection of the mantle wedge during subduction and the segregation of melt into "hot fingers" along the base of the crust. These hot fingers dictate the location and composition of the volcanic front. Figure adapted from Tamura et al. (2009).

et al. (2005) show that the number earthquake foci are greatly reduced directly below volcanoes (areas with a high ratio of P-wave vs. S-wave velocities) within the volcanic arc. These areas outline a low-velocity zone of "hot fingers" that are fed by currents in the mantle wedge (Hasegawa et al., 2005). Basaltic volcanism is concentrated in these areas above the hot fingers where mantle material is melted (Tamura et al., 2009). Rhyolitic calderas are fed by the lateral extension of the hot fingers into surrounding crust, causing the melting of crust between fingers (Tamura et al., 2009). In this case, the magma source (locations of hot fingers) determines the locations and compositions of volcanoes. A similar distribution of vents controlled by a source mantle diapir in the Abu Monogenetic Volcano Group in Southwestern Japan was documented by Kiyosugi et al. (2010) through the study of tomography, spatial density and recurrence rate analyses, and dating of volcanic edifices.

In the Eastern Snake River Plain, Wetmore et al. (2009) describe that the spatial pattern of volcanism is controlled by source geometry. Low-velocity zones exist in mantle tomography maps below major sections of volcanism within the plain (Wetmore et al., 2009). Additionally, faulting in the region is not spatially correlated to volcanism and high-velocity zones are coincident with areas of suppressed volcanism (Wetmore et al., 2009). Source geometry is a

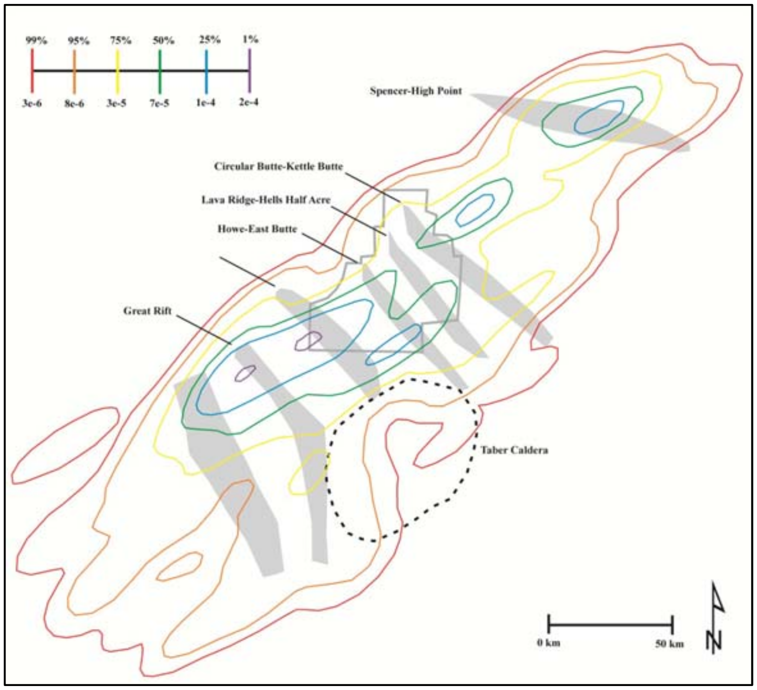

Figure 20. Spatial density plot of buried and exposed vents in the Eastern Snake River Plain as reported by Wetmore et al. (2009) as colored contours. Contour values shown in key at top left. Contours represent total spatial density (for example, 75% of spatial density is within the yellow contour with a value of 3e-5). Also included are the volcanic rift zones as defined by Kuntz et al. (2002) in grey shading. A distinct difference in orientation and frequency of groupings of vents are seen between the two studies. The boundary of the INL is represented by grey outline.

primary driver for dike injection and eruption locations, not shallow structural features (Wetmore et al., 2009).

Patterns of volcanism in the Jaraguay and San Borja Volcanic Fields are thought to be controlled by source melt geometry in that the wide variety of volcanic products is due to small individual pockets of melt that resided in the crust until tectonic changes forced their eruption (Negrete-Aranda and Cañón-Tapia, 2008). The end of subduction marked an increase in temperature from a return to high heat flow in the mantle below the Baja Peninsula (Negrete-Aranda et al., 2010). The melting of the distinct pockets directly caused post-subduction volcanism and determined the spatial distribution of volcanic eruptions (Negrete-Aranda et al., 2010).

Volcanism and Faulting as Complementary Mechanisms

Bursik and Sieh (1989) suggest that the lack of recent (late Quaternary) faulting along the Sierra Nevada Frontal Fault near the Mono and Inyo Craters could be explained by the accommodation of elastic strain from dike intrusion. The Sierra Nevada Frontal Fault runs northwest-southeast along the Sierra Nevada Range and has surface expression near the Mono and Inyo Craters (about 100 km northwest of the Big Pine Volcanic Field) and near Big Pine itself. Parsons and

Thompson (1991) state that normal faulting and magmatic intrusion can both work together in varying degrees to accommodate the same extensional magnitude. Furthermore, dike injection may help to suppress movement along faults (Parsons and Thompson, 1991). This principle is demonstrated in the East African Rift (Parsons and Thompson, 1991), the Eastern Snake River Plain along the wake of the Yellowstone Hotspot (Parsons et al., 1998), and in the following areas that have young volcanism with low seismicity (magmatic intrusions suppressing normal faulting) in the Basin and Range Province: Yucca Mountain, Mono Craters, Coso Mountains, and Valles Caldera in New Mexico (Parsons and Thompson, 1991).

With respect to seismicity and volcanism in the Eastern Snake River Plain, subsurface dikes that trend perpendicular to the axis of the plain accommodate strain aseismically (Parsons et al., 1998). If magma is supplied in generous enough volumes by the source, then dike injection may accommodate strain in the crust through emplacement and inflation perpendicular to least principal stress (Parsons et al., 1998). During periods of reduced dike injection, faulting and seismicity reactivate to accommodate the strain (Parsons et al., 1998).

According to the spatial patterns of vents and faults within the volcanic fields in this study, magmatism and faulting appear to be working together to accommodate tectonic strain. In fact, all of the fields of this study exhibit at least a partial component of groups of vents located far from faults. The suppression of faulting in those areas seems to be accommodating strain by dike dilation and volcanic eruption. The remainder of this subsection is dedicated to discussing how the interplay between magmatism and faulting can explain the spatial correlations in each volcanic field except Jaraguay and San Borja; there are very few or no vents within the quarter- or half-spacing.

The Big Pine Volcanic Field has been repeatedly characterized as having fault-controlled magmatism, and a strong statistical spatial correlation can be drawn from the results of this analysis. The strong type 3 curve result shows that there are only a couple of vents that occur far from faults. The vents associated with Crater Mountain and Red Mountain appear to be specifically clustered near faults along the Sierra Nevada Front Range Fault in this area. The fact that 36 percent of vents are within 500 meters of faults in this area is evidence for a fault-controlled system. However, this is a great example which illustrates that specific geologic mechanisms need be identified before these types of data are further incorporated into hazard analyses.

Based on casual map inspection, Aranda-Gomez et al. (2003) insist that a strong correlation of vents and faults in the Camargo Volcanic Field resulted in magma using faults as conduits to the surface: "given the synchronous nature of faulting and volcanism, most of the active normal faults in the Camargo volcanic field, were perpendicular to σ_3 and were able to provide low-energy pathways for ascending dikes." Although they sufficiently describe that faulting and volcanism are synchronous through contact relationships of relatively older faulted lava flows overlain by younger flows, they offer no evidence of ascending magma's use of faults as "low-energy pathways" other than a basic spatial correlation. For example, in the La Loba domain of the Camargo Volcanic Field, Aranda-Gomez et al. (2003) make the case that the Las Borregas fault system, located in the southwest section of the study area, "acted as a magmatic conduit" because it is "covered by younger volcanoes." However, this area of the volcanic field has the least amount of faulting.

Using the same map from Aranda-Gomez et al. (2003), this study shows that a spatial correlation does not exist for the majority of vents in the field. A type-3 curve component is present in Figure 14; however, most of those data points only represent the vents within the central graben of the field. There are 15 vents that are located within 500 meters of faults in the Camargo Volcanic Field, all of which occur in the graben feature. It appears that spatial distribution may be explained by increased volcanism on the horsts of Camargo Volcanic Field suppressing faulting while decreasing volcanism forced faulting to accommodate the tectonic strain in the graben.

Coso Volcanic Field is the other field in this study that exhibits a strong type-3 curve in this analysis, which means that there is a strong spatial correlation between vents and faults. 54 percent of the vents in the field are within 500 meters of a fault. This does not indicate, however, that melt necessarily used these faults as conduits to the surface. Vent to fault spacing is closest in the Coso Range while vents in the Rose Valley are further from vents. The vents in the Coso Range to the east are Tertiary in age whose flows are heavily faulted; they erupted through Mesozoic basement rocks. The Tertiary and Quaternary vents to the west and south erupted into the Rose Valley and Coso Wash, respectively, and were subsequently buried during a period of elevated sedimentation rates. Geophysical investigations to locate subsurface faulting would allow for better understanding of spatial relationships between vents and buried faults in this area.

In the Yucca Volcanic Field, a combination of type-2 and type-3 curves describes the vent to fault spacing. Again, the type-2 curve component is explained by vents occurring away from faults in a range of distances while the type-3 curve component is evidence of groups of vents close to faults, such as the volcanoes located around Black Cone and Red Cone. This group is located within Crater Flat, which is bounded by the Bare Mountain Fault to the west and a collection of smaller normal faults to the east. Because of the 12 vents within Crater Flat (and Lathrop Wells to the southeast), 10 percent of vents within the field are only 500 meters or less from faults. The older faults and vents, found to the north and east of Crater Flat, are generally far from faults and may not have used the faults as conduits to the surface because of the age differences.

The Michoacán-Guanajuato Volcanic Field exhibits a combination of type-2 and type-3 curves which is explained by vents grouped far from faults in most areas of the field. In a couple of small zones, vents are aligned between and close to faults in the central portion of the study area. In the northwest and southwest sections of the field, groups of vents appear to be suppressing faulting and areas where volcanism is sparse (northeast and south-central sections) there are large groupings of faults. Because of these patterns, there are only two vents that lie within 500 meters of a fault (1 percent).

This thesis describes the analysis of the map distances between vents and faults to characterize the extent to which these features are spatially correlated. Spatial data show a marked pattern in all of the volcanic fields except two: there are groups of vents away from groups of faults. Compared to spatial patterns of volcanism in many extensional environments around the world, the data from this study seem to generally fit well with the tectonic and magmatic model that faulting is suppressed in local areas where volcanism rates are high within these volcanic fields.

Practical Implications

The practical application of these ideas such as source geometry and suppression of earthquakes by dike injection is an integral part of hazard assessment and mapping. One important question this research raises is how researchers would determine whether a vent erupted along a fault. If there is a tendency for faults to capture ascending melt, then such inputs would make hazard models more accurate. But, how close would a vent need to be to a fault to constitute a “hit” based on this research?

In the Big Pine, Camargo, Coso, and Yucca Volcanic Fields, the Basin and Range style faulting has the most vents near faults. In the context of these fields, the vent-to-fault distance data can be used to evaluate how close vents erupt near faults. The criteria that could be used to determine a “hit” in these fields include the dip of the fault and the width of dikes. Fault dips can be resolved using ground-penetrating radar technologies, but this is beyond the scope of this paper.

Dike widths cannot currently be measured within the fields of this study, but we can look at dike widths of other fields in similar tectonic regimes. Wada (1994) estimated that 1 meter wide dikes are formed with mafic melts and some widths reach as much as 100 meters from flood basalt events. Dikes widths have been measured around the world: 1.5 meters in Scotland (with a maximum found at 50 meters wide), 3.5 meters in Iceland, and between 6 and 23 meters formed in the Columbia Flood Basalts (Carrington, 2000). Dufek and Bergantz (2005) used dike widths between 1 and 10 meters in their melt ascent models. Finally, Rubin (1995) estimate dike widths of 10 cm in mantle peridotites, 1 meter widths in Hawaii and in sheeted dike complexes, widths of 4 meters in Scotland, and widths of 30 meters in continental flood basalt dike swarms.

If faults are able to capture ascending magma (sufficient dip) for even a short distance, and the above dike widths are found in the extending terrain of the Basin and Range, it is reasonable to assume that a “hit” with respect to hazard analysis may be on the order of hundreds of meters. Based on the analysis above of vent distances of 500 meters or less, researchers may wish to consider including fault capture of dikes in hazard analysis. The Basin and Range fields have a higher occurrence of vents within 500 meters of faults: Big Pine (36 percent), Camargo (6 percent), Coso (54 percent), and Yucca (10 percent).The take-home message, however, is that further study is needed before assuming any type of genetic or causative relationship exists between vents and faults.

Concluding Remarks

The spatial distributions of vents comprising volcanic fields are of interest to risk assessment and hazard analysis studies. If the probability exists for harm to come to populated areas or sensitive facilities such as nuclear repositories, the understanding of fundamental processes governing timing and aerial extent of eruptions is critical. Many studies are interested in the role of surficial structural features in the ascent of magma and whether these features channel melt to certain areas. An important issue arises when casual qualitative assessments using geologic maps are used to confidently determine that magma exploits these shallow crustal fractures and faults to the surface. A casual relationship between magmatism and structural features has been accepted in literature without a quantitative spatial study.

This thesis includes a quantitative analysis of vent and fault populations in seven actively-faulted volcanic fields to test whether or not spatial relationships exist. The data generated in this study include vent-to-fault spacing acquired by measuring existing geologic maps produced by other scientists. Statistical methods were adapted from a similar study by Paterson and Schmidt (1999) which involved the analysis of distances between mapped eruptive centers and the closest mapped fault traces.

Based on the available data generated by this study, there are four types of curve combinations that describe the seven volcanic fields of this study. The Big Pine and Coso Volcanic Fields have a strong spatial correlation of vents and faults (type 3 curve). Camargo Volcanic Field exhibits a combination curve types (3 and 4) that can be attributed to volcanism suppressing fault activity in a portion of the field. In the center graben of the field, a strong spatial correlation between vents and faults exists, but on the horst features there is little faulting activity that was suppressed by prevalent volcanism. The Jaraguay and San Borja Volcanic Fields both have source geometry (pockets of ponded melt at depth) that dictates the locations of vents far from faults (curve type 4). The Michoacán-Guanajuato Volcanic Field (combination of curve types 2 and 3) may have issues of groups of vents far from faults because of the map scale. At a smaller scale, the individual sections of the field may yield different results, but modifying the analysis would be an immense undertaking. For the purposes of this study, the entire field is not appropriate scale to study the large Michoacán-Guanajuato Volcanic Field. Finally, the Yucca Volcanic Field may exhibit a combination of source geometry in the entire field and suppression of faulting from increased volcanism on Crater Flat to produce a combination of curves types 2 and 3.

Data show that statistical spatial correlations do exist between vents and faults in several of the volcanic fields of this study. As a general observation, some vents are found far from faults in these populations and others are found very close to faults, which could be explained by a variety of natural phenomenon such as suppression of faulting from increased magmatism and magma source geometry differences. Although data from the Big Pine and Coso Volcanic Fields exhibit a strong spatial correlation, it does not necessarily imply a genetic relationship. In this instance, Paterson and Schmidt (1999) warn that other geologic factors such as map scale and subsurface structural investigations must be considered before a causative relationship can be presumed.

References

Aranda-Gomez, J.J., Luhr, J.F., Housh, T.B., Connor, C.B., Becker, T. and Henry, C.D., 2003, Synextensional Pliocene-Pleistocene eruptive history in the Camargo Volcanic Field, Chihuahua, Mexico. Geological Society of America Bulletin 115, 298-313.

Atwater, T., 1970, Implications of plate tectonics for the Cenozoic tectonic evolution of western North America. Geological Society of America Bulletin 81, 3513-3536.

Atwater, T. and Stock, J., 1998, Pacific-North America plate tectonics of the Neogene Southwestern United States: An update. International Geology Review 40, 375-402.

Bacon, C.R., 1982, Time-predictable bimodal volcanism in the Coso range California. Geology 10, 65-69.

Bacon C.R., Duffield, W.A. and Nakamura, K., 1980, Distribution of Quaternary rhyolite domes of the Coso Range, California: Implications for extent of the geothermal activity. Journal of Geophysical Research 85, 2425-2433.

Bacon, C.R., Kurasawa, R.H., Delevaux, M.H., Kistler, R.W. and Doe, B.R., 1984, Lead and strontium isotopic evidence for crustal interaction and compositional zonation in the source regions of Pleistocene basaltic and rhyolitic magmas of the Coso Volcanic Field, California. Contributions to Mineralogy and Petrology 85, 366-375.

Bateman, P.C., Carmar, M.F., Clark, L.C., Jackson, E.D., and Parker, R.L., 1965, Geologic Map of the Big Pine 15-Minute Quadrangle, California, in Bateman, P.C., Pakiser, L.C., and Francis, M., Geology and Tungsten Mineralization of the Bishop District, California, Professional Paper 470: Plate 4. United States Geological Survey.

Bierman, P.R., Gillespie, A., Whipple, K. and Clark, D., 1991, Quaternary geomorphology of Owens Valley, California: Geological Society of America field trip. In: Walawender, M.J. and Hanan B.B. (eds.), Geological excursions in southern California and Mexico: guidebook for the 1991 annual meeting. Geological Society of America, San Diego, p. 199-223.

Bursik, M. and Sieh, K., 1989, Range front faulting and volcanism in the Mono Basin, Eastern California. Journal of Geophysical Research 94, 15587-15609.

Calmus, T., Aguillon-Robles, A., Maury, R.C., Bellon, H., Benoit, M., Cotton, J., Bourgois, J. and Michaud, F., 2003, Spatial and temporal evolution of basalts and magnesian andesites (“bajaites”) from Baja California, Mexico: the role of slab melts. Lithos 66, 77-105.

Carrington, C.R., 2000, Plumbing Systems, Chapter in: Encyclopedia of Volcanology, Academic Press, 219-235.

Combs, J., 1980, Heat flow in the Coso geothermal area, Inyo County, California. Journal of Geophysical Research 85, 2411-2424.

Condit, C.D., Crumpler, L.S., Aubele, J.C., and Elston, W.E., 1989, Patterns of volcanism along the southern margin of the Colorado Plateau: The Springerville Field. Journal of Geophysical Research 94, 7975-7986.

Condit, C.D. and Connor, C.B., 1996, Recurrence rates of volcanism in basaltic volcanic fields: An example from the Springerville volcanic field, Arizona. GSA Bulletin 108, 1225-1241.

Connor, C.B., 1987a, Cinder cone distribution described using cluster analysis and two-dimensional Fourier analysis in the central Trans Mexican Volcanic Belt, Mexico, and in southeast Guatemala to west El Salvador, Ph.D. thesis, Dartmouth College, Hanover, NH, 234.

Connor, C.B., 1987b, Structure of the Michoacan-Guanajuato Volcanic Field, Mexico. Journal of Volcanology and Geothermal Research 33, 191-200.

Connor, C.B., 1990, Cinder cone clustering in the Trans Mexican Volcanic Belt: Implications for structural and petrologic models. Journal of Geophysical Research 95, 19395-19405.

Connor, C.B., Condit, C.D., Crumpler, L.S., and Aubele, J.C., 1992, Evidence of regional structural controls on vent distribution: Springerville Volcanic Field, Arizona. Journal of Geophysical Research 97, 12349-12359.

Connor, C.B. and Conway, F.M., 2000, Basaltic Volcanic Fields, Chapter in: Encyclopedia of Volcanology, Academic Press, 331-343.

Connor, C.B., Stamatakos, J.A., Ferrill, D.A., Hill, B.E., Ofoegbu, G.I., Conway, F.M., Sagar, B. and Trapp, J., 2000, Geologic factors controlling patterns of small-volume basaltic volcanism: Application to a volcanic hazards assessment at Yucca Mountain, Nevada. Journal of Geophysical Research 105, 417-432.

Connor, C.B., Sparks, R.S.J., Diez, M., Volentik, A.C.M., and Pearson, S.C.P., 2009, The nature of volcanism, in Connor, C.B., Chapman, N.A., and Connor, L.J. (eds),Volcanic and Tectonic Hazard Assessment for Nuclear Facilities, Cambridge University Press, 74-115.

Cousens, B.L., 1996, Magmatic evolution of Quaternary mafic magmas at Long Valley Caldera and the Devils Postpile, California: Effects of crustal contamination on lithospheric mantle-derived magmas. Journal of Geophysical Research 101, 27673-27689.

Delaney, P.T. and Gartner, A.E., 1997, Physical processes of shallow mafic dike emplacement near the San Rafael Swell, Utah. Geophysical Society of America Bulletin 109, 1177-1192.

Dewhurst, W.T., 1990, NADCON: The application of minimum curvature-derived surfaces in the transformation of positional data from the North American Datum of 1927 to the North American Datum of 1983. NOAA Technical Memorandum NOS NGS-50, U.S.

Department of Commerce, National Oceanic and Atmospheric Administation, National Ocean Service, Office of Charting and Geodetic Services, 30.

Dixon, T.H., Norabuena, E., and Hotaling, L., 2003, Paleosiesmicity and Global Positioning System: Earthquake-cycle effects and geodetic versus geologic fault slip rates in the Eastern California shear zone. Geology v. 31, 55-58.

Dohrenwend, J.C., Schell, B.A., Menges, C.M., Moring, B.C., and McKittrick, M.A., 1996, Reconnaissance Photogeologic Map of Young (Quaternary and Late Tertiary) Faults in Nevada. In: Singer, D.A. (ed.) An Analysis of Nevada's Metal-Bearing Mineral Resrouces. Nevada Bureau of Mines and Geology Open File Report 96-2, Plate 9-1.

Dufek, J. and Bergantz, G.W., 2005, Lower crustal magma genesis and preservation: a stochastic framework for the evaluation of basalt-crust interaction. Journal of Petrology 46, 1-29.

Duffield, W.A., Bacon, C.R. and Dalrymple, G.B., 1980, Late Cenozoic volcanism, geochronology, and structure of the Coso range, Inyo county, California. Journal of Geophysical Research 85, 2381-2404.

Duffield, W.A. and Bacon, C.R., 1981, Geologic Map of the Coso Volcanic Field and Adjacent Areas, Inyo County, California. Miscellaneous Investigations Series Map I-1200. United States Geological Survey.

Ferrari, L., Lopez-Martinez, M., Aguirre-Diaz, G., and Carrasco-Nunez, G., 1999, Space-time patterns of Cenozoic arc volcanism in central Mexico: From the Sierra Madre Occidental to the Mexican Volcanic Belt. Geology 27, 303-306.

Ferrari, L., Conticelli, S., Vaggelli, G., Petrone, C.M., and Manetti, P., 2000, Late Miocene volcanism and intra-arc tectonics during the early development of the Trans-Mexican Volcanic Belt. Tectonophysics 318, 161-185.

Fialko, Y.A. and Simons, M., 2000, Deformation and seismicity in the Coso geothermal area, Inyo County, California: Observations and modeling using satellite radar interferometry. Journal of Geophysical Research 21, 105.

Frankel, K.L., Dolan, J.F., Finkel, R.C., Owen, L.A., and Hoeft, J.S., 2007, Spatial variations in slip rate along the Death Valley-Fish Lake Valley fault system determined from LiDAR topographic data and cosmogenic ^{10}Be geochronology. Geophysical Research Letters 34, 1-6.

Gastil, R.G., Phillips, R.P., and Allison, E.C., 1971, Reconnaissance Geologic Map of the State of Baja California, Mexico, in Johnson, S.E., Paterson, S.R., Fletcher, J.M., Girty, G.H., Kimbrough, D.L., and Martin-Barajas, A. (eds.), Tectonic Evolution of Northwestern Mexico and the Southwestern United States. Memoir 140: Plates 1-B and 1-C. Geological Society of America.

Glazner, A.F. and Miller, J.S., 1997, A major lithospheric boundary in eastern California defined by isotopic ratios in Cenozoic basalts from the Coso Range and surrounding areas. Geological Society of America Program Abstracts 29, 69.

Guest, B., Niemi, N., and Wernicke, B., 2007, Stateline fault system: A new component of the Miocene-Quaternary Eastern California shear zone. GSA Bulletin 119, 1337-1346.

Hasegawa, A., Nakajima, J., Umino, N., and Miura, S., 2005, Deep structure of the northeastern Japan arc and its implications for crustal deformation and shallow seismic activity. Tectonophysics 403, 59-75.

Hasenaka, T. and Carmichael, I.S.E., 1985a, The cinder cones of Michoacan-Guanajuato, central Mexico: Their age, volume and distribution, and magma discharge rate. Journal of Volcanology and Geothermal Research 25, 105-124.

Hasenaka, T. and Carmichael, I.S.E., 1985b, A compilation of location, size and geomorphological parameters of volcanoes of the Michoacan-Guanajuato Volcanic Field, central Mexico. Geophysica International 24-4, 577-607.

Hasenaka, T. and Carmichael, I.S.E., 1987, The cinder cones of Michoacan-Guanajuato, central Mexico: Petrology and chemistry. Journal of Petrology 28, 241-269.

Hasenaka, T., 1994, Size, distribution and magma output rate for shield volcanoes of the Michoacan-Guanajuato Volcanic Field, central Mexico. Journal of Volcanology and Geothermal Research 63, 13-31.

Hill, E.M. and Blewitt, G., 2006, Testing for fault activity at Yucca Mountain, Nevada, using independent GPS results from BARGEN network. Geophysical Research Letters 33, 14302.

Johnson, C.A. and Harrison, C.G.A., 1990, Neotectonics in central Mexico. Physics of Earth and Planetary Interiors 64, 187-210.

Kirby, E., Anandakrishnan, S., Phillips, F., and Marrero, S., 2008, Late Pleistocene slip rate along the Owens Valley fault, eastern California. Geophysical Research Letters 35, 1-6.

Kiyosugi, K., Connor, C.B., Zhao, D., Connor, L.J., and Tanaka, K., 2010, Relationships between volcano distribution, crustal structure, and P-wave tomography: an example from the Abu Monogenetic Volcano Group, SW Japan. Bulletin of Volcanology 72, 331-340.

Kuntz, M.A., Anderson, S.R., Champion, D.E., Lanphere, M.A., and Grunwald, D.J., 2002, Tension cracks, eruptive fissures, dikes, and faults related to late Pleistocene-Holocene basaltic volcanism and implications for the distribution of hydraulic conductivity in the eastern Snake River Plain, Idaho. Geological Society of America Special Paper 353, 111-133.

Lee, J., Spencer, J. and Owen, L., 2001, Holocene slip rates along the Owens Valley fault, California: Implications for the recent evolution of the Eastern California Shear Zone. Geology 29, 819-822.

Lister, J.R. and Kerr, C., 1991, Fluid-mechanical models of crack propagation and their application to magma transport in dikes. Journal of Geophysical Research 96, 10049-10077.

Lutz, T.M., 1986, An analysis of the orientation of large-scale crustal structures: A statistical approach based on aerial distributions of point-like features. Journal of Geophysical Research 91, 421-434.

Mahan, K.H., Guest, B., Wernicke, B., and Niemi, N.A., 2009, Low-temperature thermo-chronologic constraints on the kinematic history and spatial extent of the Eastern California shear zone. Geosphere 5, 483-495.

Manley, C.R. and Bacon, C.R., 2000, Rhyolite thermobarometry and the shallowing of the magma reservoir, Coso Volcanic Field, California. Journal of Petrology 41, 149-174.

McQuarrie, N. and Wernicke, B.P., 2005, An animated tectonic reconstruction of southwestern North America since 36 Ma. Geosphere 1, 147-172.

McQuarrie, N. and Oskin, M., 2010, Palinspastic restoration of NAVDat and implications for the origin of magmatism in southwestern North America. Journal of Geophysical Research 115, B10401.

Monastero, F.C., Katzenstein, A.M., Miller, J.S., Unruh, J.R., Adams, M.C., and Richards-Dinger, K., 2005, The Coso geothermal field: a nascent metamorphic core complex. GSA Bulletin 117, 1534-1553.

Moore, J.G., Hopson, C.A., and Stone, J.G., 1963, Geologic Map and Sections of the Mount Pinchot Quadrangle, southern Sierra Nevada, California. Bulletin 1130. United State Geological Survey.

Mordick, B.E. and Glazner, A.F., 2006, Clinopyroxene thermobarometry of basalts from the Coso and Big Pine Volcanic Fields, California. Contributions to Mineralogy and Petrology 152, 111-124.

Morellato, C., Redini, F., and Doglioni, C., 2003, On the number and spacing of faults. Terra Nova 15, 315-321.

Negrete-Aranda, R. and Cañón-Tapia, E., 2008, Post-subduction volcanism in the Baja California Peninsula, Mexico: The effects of tectonic reconfiguration in volcanic systems. Lithos 102, 392-414.

Negrete-Aranda, R., Cañón-Tapia, E., Brandle, J.L., Ortega-Rivera, M.A., Lee, J.K.W., Spelz, R.M., and Hinojosa-Corona, A., 2010, Regional orientation of tectonic stress and the stress expressed by post-subduction high-magnesium volcanism in northern Baja California, Mexico: Tectonics and volcanism of San Borja volcanic field. Journal of Volcanology and Geothermal Research 192, 97-115.

Nelson, C.A., 1966, Geologic Map of the Waucoba Mountain Quadrangle, Inyo County, California. Geologic Quadrangle 528. United States Geological Survey.

Ormerod, D.S., Rogers, N.W. and Hawkesworth, C.J., 1991, Melting in the lithospheric mantle: Inverse modeling of alkali-olivine basalts from the Big Pine Volcanic Field, California. Contributions to Mineralogy and Petrology 108, 305-317.

Palleres, C., Maury, R.C., Bellon, H., Royer, J.Y., Calmus, T., Aguillon-Robles, A., Cotton, J., Benoit, M., Michaud, F. and Bourgois, J., 2007, Slab-tearing following ridge-trench collision: Evidence from Miocene volcanism in Baja California, Mexico. Journal of Volcanology Geothermal Research 161, 95-117.

Parsons, T. and Thompson, G.A., 1991, The role of magma overpressure in suppressing earthquakes and topography: Worldwide examples. Science 253, 1399-1402.

Parsons, T., Sleep, N.H., and Thompson, G.A., 1992, Host rock rheology controls on the emplacement of tabular intrusions: Implications for underplating of extending crust. Tectonics 11, 1348-1356.

Parsons, T., Thompson, G.A., and Smith, R.P., 1998, More than one way to stretch: A tectonic model for extension along the plume track of the Yellowstone hotspot and adjacent Basin and Range Province. Tectonics 17, 212-234.

Parsons, T., Thompson, G.A., and Cogbill, A.H., 2006, Earthquake and volcano clustering via stress transfer at Yucca Mountain, Nevada. Geology 34, 785-788.

Pasquare, G., Ferrari, L., Garduno, V.H., Tiabaldi, A. and Vezzoli, L., 1991, Geologic map of the central sector of the Mexican Volcanic Belt, states of Guanajuato and Michoacan, Mexico. Geological Society of America Map and Chart Series MCH072.

Paterson, S.R. and Schmidt, K.L., 1999, Is there a close spatial relationship between faults and plutons? Journal of Structural Geology 21, 1131-1142.

Potter, C.J., Dickerson, R.P., Sweetkind, D.S., Drake, R.M., II, Taylor, E.M., Fridrich, C.J., San Juan, C.A., and Day, W.C., 2002, Geologic Map of the Yucca Mountain Region, Nye County, Nevada. Geologic Investigations Series I-2775. United States Geologic Survey.

Reasenberg, P.A., Ellsworth, W.L. and Walter, A.W., 1980, Teleseismic evidence for a low-velocity body under the Coso geothermal area. Journal of Geophysical Research 85, 2471-2483.

Reches, A. and Fink, J., 1988, The Mechanism of intrusion of the Inyo Dike, Long Valley Caldera, California. Journal of Geophysical Research 93, 4321-4334.

Rogers, G., Saunders, A.D., Terrell, D.J., Verma, S.P. and Marriner, G.F., 1985, Geochemistry of Holocene volcanic rocks associated with ridge subduction in Baja California, Mexico. Nature 315, 389-392.

Rogers, M.J., 2006, Estimating the Pleistocene slip rate of the Owens Valley Fault, California. Unpublished senior thesis, Pennsylvania State University.

Rojas-Beltran, M.A., 1995, El sector nor-oriental del campo volcanico de Camargo, Chihuahua: geologia regional y petrologia de los xenolitos del manto, una comparacion con el campo volcanico de San Quintin, B.C. Unpublished thesis, UASLP, Mexico.

Roquemore, G.R., 1978, Active faults and related seismicity of the Coso Mountains, Inyo County, California. Earthquake Notes 49, 24.

Roquemore, G.R., 1980, Structure, tectonics, and stress field of the Coso Range, Inyo County, California. Journal of Geophysical Research 85, 2434-2440.

Ross, D.C., 1965, Geology of the Independence quadrangle, Inyo County, California. U.S. Geological Survey Bulletin 1181-O.

Rubin, A.M., 1995, Getting granite dikes out of the source region. Journal of Geophysical Research 100, 5911-5929.

Rubin, A.M., 1998, Dike ascent in partially molten rock. Journal of Geophysical Research 103, 20901-20919.

Saunders, A.D., Rogers, G., Marriner, G.F., Terrell, D.J. and Verma, S.P., 1987, Geochemistry of Cenozoic volcanic rocks, Baja California, Mexico: Implications for the petrogenesis of post-subduction magmas. Journal of Volcanology and Geothermal Research 32, 223-245.

Savage, J.C., Lisowski, M. and Prescott, W.H., 1990, An apparent shear zone trending north-northwest across the Mojave Desert into Owens Valley, Eastern California. Geophysical Research Letters 17, 2113-2116.

Sawlan, M.G., 1991, Magmatic Evolution of the Gulf of California Rift. in Dauphin, J.P. and Simoneit, B.R.T. eds, Gulf and Peninsular Province of the Calfornias. American Associstion of Petroleum Geologists Memoir 47, p. 301-370.

Stock, J.M. and Hodges, K.V., 1989, Pre-Pliocene extension around the Gulf of California and the transfer of Baja California to the Pacific Plate. Tectonics 8, 99-115.

Tamura, Y., Nakajima, J., Kodiara, S., and Hasegawa, A., 2009, Tectonic setting of volcanic centers in subduction zones: Three-dimensional structure of mantle wedge and arc crust, in Connor, C.B., Chapman, N.A., and Connor, L.J. (eds), Volcanic and Tectonic Hazard Assessment for Nuclear Facilities, Cambridge University Press, 176-194.

Taylor, T.R., 2002, Origin and structure of the Poverty Hills, Owens Valley fault zone, Owens Valley, California. Unpublished master's thesis, Miami University.

Thompson, G.A. and Zoback, M.L., 1979, Regional geophysics of the Colorado Plateau. Tectonophysics 61, 149-181.

Valentine, G.A. and Perry, F.V., 2007, Tectonically controlled, time-predictable basaltic volcanism from a lithospheric mantle source (central Basin and Range Province, USA). Earth and Planetary Science Letters 261, 201-216.

Varnell, A., 2006, Petrology and geochemistry of the Big Pine Volcanic Field, Inyo County, California. Unpublished senior thesis, 36 pages, California State Polytechnic University.

Wada, Y., 1994, On the relationship between dike width and magma viscosity. Journal of Geophysical Research 99, 17743-17755.

Wadge, G. and Cross, A., 1988, Quantitative methods for detecting aligned points: An application to the volcanic centers of the Michoacan-Guanajuato Volcanic Field, Mexico. Geology 16, 815-818.

Wernicke, B., Davis, J.L., Bennett, R.A., Elosegui, P., Abolins, M.J., Brady, R.J., House, M.A., Niemi, N.A. and Snow, J.K., 1998, Anomalous strain accumulation in the Yucca Mountain area, Nevada. Science 279, 2096-2100.

Wernicke, B., Davis, J.L., Bennett, R.A., Normandeau, J.E., Fredrich, A.M., and Niemi, N.A., 2004, Tectonic implications of a dense continuous GPS velocity field at Yucca Mountain, Nevada. Journal of Geophysical Research 109, B12404.

Wetmore, P.H., Hughes, S.S., Connor, L.J., and Caplinger, M.L., 2009, Spatial distribution of eruptive centers about the Idaho National Laboratory, in Connor, C.B., Chapman, N.A., and Connor, L.J. (eds), Volcanic and Tectonic Hazard Assessment for Nuclear Facilities, Cambridge University Press, 385-405.

Wilson, C.K., Jones, C.H. and Gilbert, H.J., 2003, Single-chamber silicic magma system inferred from shear wave discontinuities of the crust and uppermost mantle, Coso geothermal area, California. Journal of Geophysical Research 108.

Ziv, A., Rubin, A.M., and Agnon, A., 2000, Stability of dike intrusion along preexisting fractures. Journal of Geophysical Research 105, 5947-5961.

Appendix A: Vent Location Data

Appendix A (Continued)

Field Name	ID #	Vent X	Vent Y	Distance to Nearest Fault (km)	Azimuth to Nearest Fault (360 format)
Big Pine	1	-118.300171	37.113858	0.61	21
Big Pine	2	-118.289518	37.030894	1.65	85
Big Pine	3	-118.309583	36.988116	1.21	67
Big Pine	4	-118.319454	36.976065	4.68	57
Big Pine	5	-118.336032	36.953110	6.51	55
Big Pine	6	-118.185492	37.010604	6.65	53
Big Pine	7	-118.172781	37.023510	6.95	71
Big Pine	8	-118.172858	37.021325	6.16	18
Big Pine	9	-118.300187	37.107677	4.85	10
Big Pine	10	-118.161594	37.007662	0.00	0
Big Pine	11	-118.328166	36.990910	0.25	72
Big Pine	12	-118.328166	36.985537	0.26	77
Big Pine	13	-118.329430	36.978267	0.00	0
Big Pine	14	-118.331327	36.973842	0.45	75
Big Pine	15	-118.335752	36.967204	0.55	13
Big Pine	16	-118.338280	36.963065	0.17	36
Big Pine	17	-118.298455	36.970365	0.23	70
Big Pine	18	-118.329746	36.946343	2.22	53
Big Pine	19	-118.291185	36.923270	2.72	22
Big Pine	20	-118.317419	36.911575	3.84	68
Big Pine	21	-118.281703	36.905885	5.72	54
Big Pine	22	-118.283599	36.901776	5.85	49
Big Pine	23	-118.278858	36.898616	6.57	50
Big Pine	24	-118.326586	36.844883	0.25	39
Big Pine	25	-118.317419	36.835084	0.18	84
Camargo	26	-104.602889	27.475336	2.94	81
Camargo	27	-104.584261	27.484256	5.26	72
Camargo	28	-104.574919	27.486786	6.33	73
Camargo	29	-104.589450	27.497447	5.48	73
Camargo	30	-104.578808	27.511464	3.15	85
Camargo	31	-104.588519	27.521850	4.26	55
Camargo	32	-104.586072	27.528733	3.49	60
Camargo	33	-104.632361	27.518483	1.77	67
Camargo	34	-104.629647	27.533914	2.83	71
Camargo	35	-104.536353	27.479108	4.32	63
Camargo	36	-104.539675	27.484233	4.42	63
Camargo	37	-104.571206	27.566289	0.99	21
Camargo	38	-104.564014	27.573303	2.10	34
Camargo	39	-104.548236	27.574433	3.47	50
Camargo	40	-104.545422	27.580472	4.29	49
Camargo	41	-104.573197	27.589581	3.95	0
Camargo	42	-104.572933	27.599183	5.12	1
Camargo	43	-104.597294	27.590867	8.57	72
Camargo	44	-104.610506	27.590417	7.11	75
Camargo	45	-104.600111	27.594339	6.04	30
Camargo	46	-104.619203	27.607417	6.81	73
Camargo	47	-104.599331	27.610764	7.24	24
Camargo	48	-104.616986	27.622942	7.69	70
Camargo	49	-104.576603	27.613058	11.71	74
Camargo	50	-104.609642	27.631342	8.87	68
Camargo	51	-104.592125	27.631389	10.93	69
Camargo	52	-104.580953	27.622661	11.58	71
Camargo	53	-104.580708	27.629075	11.92	69
Camargo	54	-104.583547	27.639139	12.07	69
Camargo	55	-104.613492	27.642119	9.12	60

Appendix A (Continued)

Field Name	ID #	Vent X	Vent Y	Distance to Nearest Fault (km)	Azimuth to Nearest Fault (360 format)
Camargo	56	-104.633481	27.648886	7.50	60
Camargo	57	-104.615425	27.656869	9.79	60
Camargo	58	-104.589203	27.658519	12.50	60
Camargo	59	-104.598989	27.665511	11.93	60
Camargo	60	-104.614608	27.664461	10.35	57
Camargo	61	-104.633203	27.688564	10.38	49
Camargo	62	-104.639761	27.700619	11.06	40
Camargo	63	-104.633061	27.697500	11.18	44
Camargo	64	-104.475781	27.565856	2.81	83
Camargo	65	-104.490642	27.597411	3.92	78
Camargo	66	-104.514528	27.603933	6.42	85
Camargo	67	-104.511256	27.609394	6.14	71
Camargo	68	-104.496736	27.608467	4.42	0
Camargo	69	-104.517244	27.611806	6.66	71
Camargo	70	-104.493239	27.623814	3.54	67
Camargo	71	-104.478381	27.644775	1.77	67
Camargo	72	-104.513311	27.619089	5.88	65
Camargo	73	-104.530506	27.629858	6.82	60
Camargo	74	-104.550364	27.643344	8.41	79
Camargo	75	-104.537561	27.645144	7.00	79
Camargo	76	-104.517064	27.653069	4.47	81
Camargo	77	-104.476178	27.635522	1.15	66
Camargo	78	-104.495050	27.653575	1.89	79
Camargo	79	-104.493928	27.669336	1.63	0
Camargo	80	-104.485258	27.670361	0.58	0
Camargo	81	-104.525592	27.664706	5.23	0
Camargo	82	-104.531089	27.671464	5.81	0
Camargo	83	-104.537031	27.677611	6.52	88
Camargo	84	-104.561614	27.653494	9.52	82
Camargo	85	-104.562069	27.660978	9.43	87
Camargo	86	-104.566675	27.666922	9.88	0
Camargo	87	-104.561739	27.676672	9.42	89
Camargo	88	-104.505075	27.692072	3.03	88
Camargo	89	-104.550128	27.691981	8.15	88
Camargo	90	-104.563444	27.686547	9.66	88
Camargo	91	-104.540867	27.697025	7.10	88
Camargo	92	-104.532211	27.703775	6.17	87
Camargo	93	-104.562256	27.702908	9.55	87
Camargo	94	-104.589503	27.707247	12.67	0
Camargo	95	-104.566117	27.709367	10.00	0
Camargo	96	-104.542139	27.707997	7.33	0
Camargo	97	-104.535064	27.714581	6.51	0
Camargo	98	-104.545667	27.715969	7.67	0
Camargo	99	-104.550872	27.721050	8.26	0
Camargo	100	-104.570303	27.715133	10.47	0
Camargo	101	-104.590425	27.722908	12.79	0
Camargo	102	-104.524975	27.734264	4.99	78
Camargo	103	-104.532531	27.745472	5.10	63
Camargo	104	-104.566014	27.761056	7.96	78
Camargo	105	-104.603208	27.751608	12.30	77
Camargo	106	-104.611150	27.770108	12.92	88
Camargo	107	-104.297522	27.507989	1.98	87
Camargo	108	-104.298442	27.516064	1.51	67
Camargo	109	-104.374406	27.556336	3.22	41
Camargo	110	-104.398600	27.569914	3.68	35

Appendix A (Continued)

Field Name	ID #	Vent X	Vent Y	Distance to Nearest Fault (km)	Azimuth to Nearest Fault (360 format)
Camargo	111	-104.408500	27.566397	4.89	87
Camargo	112	-104.439803	27.591178	1.66	78
Camargo	113	-104.432494	27.590878	2.51	77
Camargo	114	-104.416356	27.598864	1.68	34
Camargo	115	-104.418536	27.604828	1.32	45
Camargo	116	-104.450081	27.600378	0.71	81
Camargo	117	-104.450481	27.607869	0.93	0
Camargo	118	-104.457025	27.612744	0.23	0
Camargo	119	-104.355861	27.570789	0.42	34
Camargo	120	-104.376781	27.589039	0.16	45
Camargo	121	-104.392208	27.599097	0.26	27
Camargo	122	-104.344894	27.593247	1.05	0
Camargo	123	-104.347542	27.606225	1.15	66
Camargo	124	-104.369342	27.603767	1.84	35
Camargo	125	-104.379692	27.615425	1.30	80
Camargo	126	-104.372375	27.620208	0.37	72
Camargo	127	-104.375450	27.628961	0.00	0
Camargo	128	-104.388094	27.639186	0.12	0
Camargo	129	-104.402094	27.639247	1.42	55
Camargo	130	-104.419253	27.629589	0.66	45
Camargo	131	-104.397942	27.656189	0.94	30
Camargo	132	-104.430119	27.657853	1.68	56
Camargo	133	-104.410692	27.664425	2.06	47
Camargo	134	-104.451831	27.661778	0.16	45
Camargo	135	-104.442706	27.664714	1.15	45
Camargo	136	-104.433900	27.667642	2.06	47
Camargo	137	-104.403947	27.670775	0.82	45
Camargo	138	-104.419158	27.674461	1.98	50
Camargo	139	-104.406619	27.681475	0.26	63
Camargo	140	-104.451472	27.689817	2.16	54
Camargo	141	-104.449997	27.701747	1.16	53
Camargo	142	-104.439594	27.704208	0.00	0
Camargo	143	-104.413586	27.707422	1.20	61
Camargo	144	-104.415181	27.712692	1.46	61
Camargo	145	-104.426594	27.723872	2.40	67
Camargo	146	-104.439789	27.732036	1.91	52
Camargo	147	-104.468578	27.734439	0.70	0
Camargo	148	-104.446072	27.743739	1.98	87
Camargo	149	-104.468900	27.757908	0.00	0
Camargo	150	-104.487156	27.764281	0.63	68
Camargo	151	-104.476222	27.770017	0.00	0
Camargo	152	-104.436850	27.797078	1.41	66
Camargo	153	-104.296636	27.618519	1.52	86
Camargo	154	-104.337108	27.660619	0.68	59
Camargo	155	-104.361389	27.689675	0.00	0
Camargo	156	-104.371294	27.702856	1.04	27
Camargo	157	-104.374994	27.706189	2.25	69
Camargo	158	-104.390522	27.705758	0.63	68
Camargo	159	-104.383583	27.715411	1.77	67
Camargo	160	-104.371450	27.721722	1.66	78
Camargo	161	-104.390642	27.719614	1.25	68
Camargo	162	-104.394764	27.723064	0.99	69
Camargo	163	-104.395506	27.729197	1.10	72
Camargo	164	-104.332781	27.723125	2.57	72
Camargo	165	-104.343561	27.731094	1.66	78

Appendix A (Continued)

Field Name	ID #	Vent X	Vent Y	Distance to Nearest Fault (km)	Azimuth to Nearest Fault (360 format)
Camargo	166	-104.315419	27.736675	4.91	76
Camargo	167	-104.353611	27.751389	1.36	70
Camargo	168	-104.309606	27.752642	6.15	68
Camargo	169	-104.416686	27.858839	0.35	0
Camargo	170	-104.510122	27.910047	10.38	77
Camargo	171	-104.408544	27.890211	0.82	82
Camargo	172	-104.134481	27.642411	7.23	64
Camargo	173	-104.144392	27.646031	6.45	64
Camargo	174	-104.138997	27.649036	7.12	64
Camargo	175	-104.148067	27.657564	6.78	59
Camargo	176	-104.204692	27.663131	3.62	48
Camargo	177	-104.102331	27.675486	12.43	63
Camargo	178	-104.138961	27.683200	9.62	45
Camargo	179	-104.132872	27.689014	10.61	45
Camargo	180	-104.147881	27.686808	9.19	38
Camargo	181	-104.161514	27.699436	10.12	38
Camargo	182	-104.162869	27.706356	10.85	44
Camargo	183	-104.073767	27.717153	18.07	52
Camargo	184	-104.085722	27.722939	18.87	52
Camargo	185	-104.078556	27.723128	18.14	49
Camargo	186	-104.236733	27.715261	6.10	35
Camargo	187	-104.250033	27.717647	5.70	20
Camargo	188	-104.243756	27.734406	7.91	20
Camargo	189	-104.271489	27.732683	7.23	5
Camargo	190	-104.196489	27.758817	13.28	37
Camargo	191	-104.188800	27.761061	14.04	40
Camargo	192	-104.001925	27.769450	16.45	43
Camargo	193	-104.266064	27.769144	14.19	33
Camargo	194	-104.302769	27.870133	0.00	0
Camargo	195	-104.264397	27.763372	10.08	71
Camargo	196	-104.251311	27.763978	11.47	70
Camargo	197	-104.255458	27.769417	10.81	73
Camargo	198	-104.236011	27.778000	12.71	81
Camargo	199	-104.248439	27.777592	11.34	80
Camargo	200	-104.284706	27.767875	7.69	70
Camargo	201	-104.245839	27.790186	11.40	88
Camargo	202	-104.236644	27.807842	12.33	89
Camargo	203	-104.291239	27.773733	6.66	71
Camargo	204	-104.285267	27.785425	6.94	81
Camargo	205	-104.293508	27.782511	6.09	77
Camargo	206	-104.287294	27.786289	4.86	79
Camargo	207	-104.303961	27.786289	8.26	0
Camargo	208	-104.273136	27.803128	6.40	0
Camargo	209	-104.288544	27.800211	5.12	87
Camargo	210	-104.308403	27.793697	4.21	84
Camargo	211	-104.278506	27.807704	7.56	0
Camargo	212	-104.283628	27.809847	6.98	89
Camargo	213	-104.294550	27.807092	5.70	0
Camargo	214	-104.302978	27.805272	4.77	0
Camargo	215	-104.317286	27.802083	3.14	0
Camargo	216	-104.272822	27.816372	8.32	83
Camargo	217	-104.286319	27.819106	6.77	78
Camargo	218	-104.294178	27.819242	5.98	77
Camargo	219	-104.299039	27.814708	5.30	81
Camargo	220	-104.261672	27.826636	9.81	76

Appendix A (Continued)

Field Name	ID #	Vent X	Vent Y	Distance to Nearest Fault (km)	Azimuth to Nearest Fault (360 format)
Camargo	221	-104.247581	27.833933	11.52	74
Camargo	222	-104.247572	27.837503	11.77	72
Camargo	223	-104.258983	27.836367	10.41	70
Camargo	224	-104.265561	27.849422	10.40	65
Camargo	225	-104.294875	27.829917	6.35	66
Camargo	226	-104.312717	27.822069	4.06	66
Camargo	227	-104.337006	27.823581	1.56	63
Camargo	228	-104.308239	27.827442	4.84	66
Camargo	229	-104.319700	27.829703	3.80	63
Camargo	230	-104.299144	27.833486	6.09	66
Camargo	231	-104.310675	27.833547	4.84	63
Camargo	232	-104.328286	27.834250	3.12	63
Camargo	233	-104.297358	27.838072	6.40	63
Camargo	234	-104.298472	27.846253	6.81	63
Camargo	235	-104.305131	27.848711	6.29	62
Camargo	236	-104.319264	27.849128	4.91	54
Camargo	237	-104.331089	27.842489	3.40	52
Camargo	238	-104.330214	27.851944	4.21	51
Camargo	239	-104.340022	27.849886	3.13	59
Camargo	240	-104.349781	27.845842	1.94	57
Camargo	241	-104.304553	27.858922	7.07	54
Camargo	242	-104.314158	27.866083	6.58	73
Camargo	243	-104.339664	27.859417	3.53	73
Camargo	244	-104.337169	27.865533	4.11	82
Camargo	245	-104.354303	27.861589	2.10	71
Camargo	246	-104.295997	27.876275	9.01	70
Camargo	247	-104.315686	27.876575	6.75	79
Camargo	248	-104.328400	27.869400	5.18	81
Camargo	249	-104.335211	27.872406	4.47	81
Camargo	250	-104.313078	27.882158	7.25	74
Camargo	251	-104.325600	27.881967	5.81	70
Camargo	252	-104.294603	27.890594	9.56	72
Camargo	253	-104.335303	27.883686	4.86	69
Camargo	254	-104.340022	27.883436	4.38	68
Camargo	255	-104.363378	27.877350	1.62	69
Camargo	256	-104.322508	27.890539	6.48	69
Camargo	257	-104.342500	27.889522	4.37	61
Camargo	258	-104.374211	27.881819	0.78	63
Camargo	259	-104.320114	27.896308	7.07	65
Camargo	260	-104.337908	27.901200	5.25	77
Camargo	261	-104.349142	27.896150	3.81	78
Camargo	262	-104.372978	27.903636	1.46	61
Camargo	263	-104.342692	27.920161	5.52	60
Camargo	264	-104.391225	27.916067	0.42	56
Camargo	265	-104.328372	27.937931	8.12	61
Camargo	266	-104.330275	27.952017	8.74	65
Camargo	267	-104.416775	27.934578	0.71	81
Camargo	268	-104.341306	27.961050	8.11	65
Camargo	269	-104.349111	27.968653	7.75	64
Camargo	270	-104.476411	27.994617	3.81	78
Camargo	271	-104.241256	27.855544	13.22	66
Camargo	272	-104.247631	27.860622	12.85	63
Camargo	273	-104.250989	27.882108	12.79	63
Camargo	274	-104.230425	27.892208	14.17	74
Camargo	275	-104.266522	27.888303	12.69	71

Appendix A (Continued)

Field Name	ID #	Vent X	Vent Y	Distance to Nearest Fault (km)	Azimuth to Nearest Fault (360 format)
Camargo	276	-104.266489	27.895519	12.87	73
Camargo	277	-104.277361	27.916511	11.81	73
Camargo	278	-104.258069	27.909378	14.27	71
Camargo	279	-104.276728	27.909697	12.36	78
Camargo	280	-104.288325	27.908664	10.89	83
Camargo	281	-104.263867	27.916347	13.91	78
Camargo	282	-104.285608	27.919858	11.62	76
Camargo	283	-104.090725	27.877150	0.59	79
Camargo	284	-104.097072	27.720583	0.52	63
Camargo	285	-104.125214	27.882322	2.60	63
Camargo	286	-104.105336	27.909200	0.71	81
Coso	287	-117.921828	35.989831	0.76	76
Coso	288	-117.831486	35.957013	0.22	85
Coso	289	-117.830842	35.949181	0.59	74
Coso	290	-117.815733	35.945108	0.00	0
Coso	291	-117.816908	35.937779	0.13	3
Coso	292	-117.816813	35.933941	1.31	68
Coso	293	-117.817772	35.929838	1.47	38
Coso	294	-117.808753	35.930954	0.49	41
Coso	295	-117.793599	35.926740	0.10	50
Coso	296	-117.884191	35.993947	0.51	57
Coso	297	-117.878612	36.000759	0.37	85
Coso	298	-117.897712	36.003276	0.29	85
Coso	299	-117.857457	35.971112	2.70	61
Coso	300	-117.874765	36.218405	3.90	78
Coso	301	-117.847135	36.250508	0.19	57
Coso	302	-117.841181	36.215035	0.96	88
Coso	303	-117.738809	36.239969	0.03	75
Coso	304	-117.715677	36.199993	0.02	73
Coso	305	-117.817561	36.163787	0.03	22
Coso	306	-117.763306	36.142046	0.55	23
Coso	307	-117.789493	36.149112	1.30	87
Coso	308	-117.817028	36.150353	5.27	66
Coso	309	-117.726375	36.135656	3.86	76
Coso	310	-117.727543	36.121446	2.41	71
Coso	311	-117.749042	36.093586	0.00	0
Coso	312	-117.595244	36.048684	0.77	2
Coso	313	-117.661682	36.069000	0.68	5
Coso	314	-117.743001	36.053833	0.22	82
Coso	315	-117.656337	36.035740	0.55	49
Coso	316	-117.746675	36.018311	0.00	0
Coso	317	-117.586962	35.969799	0.28	23
Coso	318	-117.861388	35.909321	0.05	11
Coso	319	-117.689158	35.979346	0.81	28
Coso	320	-117.623982	35.972464	0.02	63
Coso	321	-117.597995	35.949933	0.22	37
Coso	322	-117.675039	35.895605	0.12	89
Coso	323	-117.652935	35.922847	0.19	52
Yucca	324	-116.726423	37.109696	5.09	0
Yucca	325	-116.715747	37.127016	3.29	344
Yucca	326	-116.656240	37.123994	4.57	326
Yucca	327	-116.592970	37.098848	0.04	89
Yucca	328	-116.461827	37.310793	12.25	38
Yucca	329	-116.406277	37.328851	8.06	18
Yucca	330	-116.319916	37.304133	5.69	35

Appendix A (Continued)

Field Name	ID #	Vent X	Vent Y	Distance to Nearest Fault (km)	Azimuth to Nearest Fault (360 format)
Yucca	331	-116.402599	37.084126	0.73	271
Yucca	332	-116.385531	37.069802	2.68	302
Yucca	333	-116.052660	37.088015	0.23	244
Yucca	334	-116.039880	37.096899	1.64	247
Yucca	335	-116.030428	37.093112	2.28	246
Yucca	336	-116.005736	37.099938	3.52	43
Yucca	337	-116.016482	37.115589	3.51	70
Yucca	338	-115.931726	37.005305	3.49	261
Yucca	339	-115.985524	36.955360	5.09	111
Yucca	340	-115.942884	36.945954	1.27	128
Yucca	341	-115.954328	36.919189	2.07	84
Yucca	342	-115.973047	36.918541	3.73	86
Yucca	343	-115.959073	36.912886	2.65	71
Yucca	344	-115.984294	36.888204	5.77	65
Yucca	345	-116.462536	36.516964	5.29	48
Yucca	346	-116.484378	36.542022	5.87	82
Yucca	347	-116.571884	36.576809	1.40	87
Yucca	348	-116.423177	36.625748	1.84	97
Yucca	349	-116.494329	36.637119	3.93	15
Yucca	350	-116.510869	36.690197	0.40	252
Yucca	351	-116.546689	36.748012	1.64	107
Yucca	352	-116.545598	36.753525	1.72	102
Yucca	353	-116.552716	36.757695	1.23	276
Yucca	354	-116.550907	36.761234	1.35	277
Yucca	355	-116.549344	36.768305	1.37	281
Yucca	356	-116.551368	36.784202	0.94	284
Yucca	357	-116.606947	36.770855	0.68	260
Yucca	358	-116.603102	36.772994	1.05	262
Yucca	359	-116.579660	36.793551	1.68	99
Yucca	360	-116.565179	36.813660	0.75	100
Yucca	361	-116.547707	36.860752	0.24	269
Jaraguay	362	-114.930033	29.769989	10.47	65
Jaraguay	363	-114.738542	29.623372	9.32	31
Jaraguay	364	-114.671789	29.648258	12.10	9
Jaraguay	365	-114.676578	29.635525	12.85	47
Jaraguay	366	-114.658586	29.624478	13.30	40
Jaraguay	367	-114.655878	29.617281	14.90	43
Jaraguay	368	-114.633225	29.635617	15.34	42
Jaraguay	369	-114.631078	29.629114	13.47	61
Jaraguay	370	-114.628119	29.622169	13.68	58
Jaraguay	371	-114.636408	29.613764	13.93	59
Jaraguay	372	-114.649592	29.585181	14.93	58
Jaraguay	373	-114.684714	29.601211	17.70	67
Jaraguay	374	-114.674678	29.585608	19.48	64
Jaraguay	375	-114.670172	29.578744	19.64	69
Jaraguay	376	-114.690275	29.579000	19.58	67
Jaraguay	377	-114.669936	29.545319	21.23	74
Jaraguay	378	-114.772353	29.506444	20.81	68
Jaraguay	379	-114.681053	29.519475	30.50	68
Jaraguay	380	-114.671528	29.522814	23.54	71
Jaraguay	381	-114.656200	29.517067	22.62	71
Jaraguay	382	-114.796086	29.431850	16.40	66
Jaraguay	383	-114.804989	29.412378	18.85	47
Jaraguay	384	-114.792864	29.412681	17.86	52
Jaraguay	385	-114.792156	29.400336	18.63	54

Appendix A (Continued)

Field Name	ID #	Vent X	Vent Y	Distance to Nearest Fault (km)	Azimuth to Nearest Fault (360 format)
Jaraguay	386	-114.692219	29.491128	17.23	56
Jaraguay	387	-114.673186	29.480739	24.47	59
Jaraguay	388	-114.686167	29.467936	23.19	54
Jaraguay	389	-114.698844	29.471883	24.55	53
Jaraguay	390	-114.695625	29.462081	16.03	15
Jaraguay	391	-114.683533	29.452386	15.47	15
Jaraguay	392	-114.702728	29.430033	14.72	11
Jaraguay	393	-114.696703	29.410906	13.99	21
Jaraguay	394	-114.725192	29.405728	12.70	22
Jaraguay	395	-114.712517	29.399414	13.49	36
Jaraguay	396	-114.707875	29.393233	12.57	32
Jaraguay	397	-114.712875	29.387694	11.99	32
Jaraguay	398	-114.707961	29.378656	11.85	37
Jaraguay	399	-114.724686	29.374878	11.01	38
Jaraguay	400	-114.717308	29.372794	11.58	48
Jaraguay	401	-114.701614	29.362028	11.04	46
Jaraguay	402	-114.733292	29.321592	9.49	44
Jaraguay	403	-114.724311	29.323600	7.98	86
Jaraguay	404	-114.719611	29.331272	7.38	84
Jaraguay	405	-114.704236	29.337858	7.79	77
Jaraguay	406	-114.699369	29.342742	7.50	64
Jaraguay	407	-114.692689	29.341258	7.73	57
Jaraguay	408	-114.685869	29.340689	7.22	54
Jaraguay	409	-114.684564	29.347714	6.91	49
Jaraguay	410	-114.688250	29.334094	7.57	41
Jaraguay	411	-114.683619	29.329189	6.20	60
Jaraguay	412	-114.694536	29.306364	5.31	64
Jaraguay	413	-114.698681	29.292022	5.70	73
Jaraguay	414	-114.664392	29.306472	7.60	58
Jaraguay	415	-114.619725	29.289025	4.29	43
Jaraguay	416	-114.661886	29.329919	2.16	45
Jaraguay	417	-114.662558	29.362214	4.48	34
Jaraguay	418	-114.663592	29.371697	8.38	11
Jaraguay	419	-114.602064	29.360242	9.22	10
Jaraguay	420	-114.616783	29.386403	9.46	38
Jaraguay	421	-114.609331	29.389128	11.42	33
Jaraguay	422	-114.600714	29.386992	11.25	27
Jaraguay	423	-114.618678	29.401967	10.81	24
Jaraguay	424	-114.553183	29.318019	11.84	19
Jaraguay	425	-114.559669	29.307786	6.55	2
Jaraguay	426	-114.575381	29.429533	5.22	22
Jaraguay	427	-114.571817	29.441558	14.97	31
Jaraguay	428	-114.563017	29.450458	18.75	49
Jaraguay	429	-114.601050	29.455844	17.75	49
Jaraguay	430	-114.597647	29.441164	19.67	50
Jaraguay	431	-114.594742	29.448547	14.71	21
Jaraguay	432	-114.554144	29.338239	15.18	21
Jaraguay	433	-114.570258	29.257983	8.60	3
Jaraguay	434	-114.552500	29.247678	5.62	49
Jaraguay	435	-114.538350	29.219861	7.59	52
Jaraguay	436	-114.516178	29.234483	10.50	3
Jaraguay	437	-114.501281	29.242717	9.40	5
Jaraguay	438	-114.488878	29.237542	8.80	5
Jaraguay	439	-114.483364	29.221728	9.30	3
Jaraguay	440	-114.479475	29.282572	10.55	3

Appendix A (Continued)

Field Name	ID #	Vent X	Vent Y	Distance to Nearest Fault (km)	Azimuth to Nearest Fault (360 format)
Jaraguay	441	-114.514267	29.320122	4.22	0
Jaraguay	442	-114.615150	29.529014	6.52	5
Jaraguay	443	-114.609853	29.507953	17.18	57
Jaraguay	444	-114.571228	29.543569	17.82	50
Jaraguay	445	-114.575617	29.524717	13.62	69
Jaraguay	446	-114.564725	29.530044	14.56	67
Jaraguay	447	-114.564225	29.523925	13.54	66
Jaraguay	448	-114.562581	29.513019	14.57	55
Jaraguay	449	-114.552678	29.515739	14.33	58
Jaraguay	450	-114.535589	29.519658	13.41	58
Jaraguay	451	-114.554475	29.505328	12.20	54
Jaraguay	452	-114.527403	29.510842	14.36	59
Jaraguay	453	-114.537839	29.504936	8.53	80
Jaraguay	454	-114.527728	29.535142	9.89	77
Jaraguay	455	-114.579675	29.585089	8.64	80
Jaraguay	456	-114.584769	29.623050	11.61	76
Jaraguay	457	-114.574000	29.641564	11.22	57
Jaraguay	458	-114.515558	29.637850	9.40	59
Jaraguay	459	-114.530336	29.599922	4.59	67
Jaraguay	460	-114.489575	29.602867	6.43	81
Jaraguay	461	-114.459553	29.629356	3.40	68
Jaraguay	462	-114.451050	29.594711	3.61	56
Jaraguay	463	-114.430728	29.590181	1.50	71
Jaraguay	464	-114.496506	29.565778	1.65	70
Jaraguay	465	-114.477014	29.511622	6.27	72
Jaraguay	466	-114.484350	29.487194	5.26	64
Jaraguay	467	-114.466772	29.480411	8.28	43
Jaraguay	468	-114.460136	29.472689	7.73	43
Jaraguay	469	-114.485419	29.473050	7.91	43
Jaraguay	470	-114.499303	29.463544	9.35	43
Jaraguay	471	-114.520886	29.468997	10.77	43
Jaraguay	472	-114.547967	29.444983	11.77	50
Jaraguay	473	-114.539072	29.447778	14.43	48
Jaraguay	474	-114.551217	29.431081	13.71	46
Jaraguay	475	-114.522839	29.442661	15.44	44
Jaraguay	476	-114.516850	29.425414	13.31	43
Jaraguay	477	-114.552767	29.419028	14.05	43
Jaraguay	478	-114.547797	29.399878	15.50	39
Jaraguay	479	-114.483150	29.401622	14.54	39
Jaraguay	480	-114.557894	29.387869	10.29	20
Jaraguay	481	-114.518769	29.386811	12.27	3
Jaraguay	482	-114.502119	29.399844	10.52	48
Jaraguay	483	-114.531725	29.379558	10.74	32
Jaraguay	484	-114.522547	29.407914	11.68	5
Jaraguay	485	-114.515203	29.403150	12.29	37
Jaraguay	486	-114.601800	29.513625	11.68	36
Jaraguay	487	-114.668447	29.496606	14.78	86
Jaraguay	488	-114.468658	29.538392	21.46	82
Jaraguay	489	-114.541108	29.544775	5.06	53
Jaraguay	490	-114.534378	29.540389	10.21	75
Jaraguay	491	-114.481628	29.374553	9.53	78
Jaraguay	492	-114.478269	29.365278	7.96	31
Jaraguay	493	-114.454108	29.383689	6.88	35
Jaraguay	494	-114.514206	29.364981	8.60	23
Jaraguay	495	-114.472750	29.357178	8.49	61

Appendix A (Continued)

Field Name	ID #	Vent X	Vent Y	Distance to Nearest Fault (km)	Azimuth to Nearest Fault (360 format)
Jaraguay	496	-114.465308	29.342858	5.76	36
Jaraguay	497	-114.434558	29.341439	3.11	55
Jaraguay	498	-114.407914	29.371858	2.20	36
Jaraguay	499	-114.387036	29.349936	7.52	32
Jaraguay	500	-114.349089	29.315239	7.05	38
Jaraguay	501	-114.340675	29.305708	5.05	16
Jaraguay	502	-114.327081	29.300119	3.87	13
Jaraguay	503	-114.354567	29.265686	2.88	6
Jaraguay	504	-114.407828	29.261169	6.95	14
Jaraguay	505	-114.287847	29.271569	8.04	45
Jaraguay	506	-114.340892	29.222239	3.95	15
Jaraguay	507	-114.295861	29.210753	10.69	20
Jaraguay	508	-114.270783	29.173183	10.06	26
Jaraguay	509	-114.295156	29.277639	11.84	36
Jaraguay	510	-114.224969	29.111308	2.73	14
Jaraguay	511	-114.211283	29.081397	8.73	73
Jaraguay	512	-114.445883	29.068733	8.07	87
Jaraguay	513	-114.540881	29.148686	10.41	9
Jaraguay	514	-114.254272	29.117433	6.89	60
Jaraguay	515	-114.739097	29.199661	7.54	57
Jaraguay	516	-114.719083	29.214319	13.32	70
Jaraguay	517	-115.018494	29.532778	12.76	59
Jaraguay	518	-114.875303	29.587494	12.24	24
Jaraguay	519	-114.502386	29.208842	11.84	36
Jaraguay	520	-114.400658	29.209439	10.70	9
Jaraguay	521	-114.377081	29.205853	10.88	21
San Borja	522	-113.908733	28.722067	14.42	71
San Borja	523	-113.878008	28.715800	16.74	77
San Borja	524	-113.893192	28.736203	16.43	67
San Borja	525	-113.892956	28.729522	16.11	70
San Borja	526	-113.882642	28.729467	17.00	71
San Borja	527	-113.885769	28.702981	13.86	23
San Borja	528	-113.884108	28.696486	13.41	24
San Borja	529	-113.860033	28.727403	14.44	66
San Borja	530	-113.861928	28.718964	15.03	62
San Borja	531	-113.846853	28.725761	13.47	62
San Borja	532	-113.842589	28.718600	13.61	58
San Borja	533	-113.826306	28.694075	14.20	50
San Borja	534	-113.819764	28.692161	12.61	0
San Borja	535	-113.841403	28.675633	11.08	4
San Borja	536	-113.858311	28.667797	10.52	4
San Borja	537	-113.824014	28.768583	8.50	86
San Borja	538	-113.821642	28.729592	11.46	58
San Borja	539	-113.839517	28.662228	10.05	3
San Borja	540	-113.834122	28.661244	10.00	1
San Borja	541	-113.840331	28.585800	4.61	34
San Borja	542	-113.834667	28.579311	4.96	34
San Borja	543	-113.832186	28.567394	6.12	34
San Borja	544	-113.794358	28.559533	4.31	42
San Borja	545	-113.784503	28.556161	4.80	5
San Borja	546	-113.774264	28.551042	3.57	45
San Borja	547	-113.787400	28.542064	5.72	46
San Borja	548	-113.796089	28.535981	4.89	78
San Borja	549	-113.979725	28.550131	8.26	20
San Borja	550	-113.922178	28.498919	5.78	16

Appendix A (Continued)

Field Name	ID #	Vent X	Vent Y	Distance to Nearest Fault (km)	Azimuth to Nearest Fault (360 format)
San Borja	551	-114.039378	28.422114	7.78	61
San Borja	552	-113.829181	28.354744	4.73	84
San Borja	553	-113.701436	28.346969	17.20	86
San Borja	554	-113.835483	28.697453	13.72	40
San Borja	555	-113.703247	28.413853	19.01	69
San Borja	556	-113.677044	28.414017	21.33	72
San Borja	557	-113.667928	28.445214	15.88	85
San Borja	558	-113.706519	28.449917	20.27	58
San Borja	559	-113.688853	28.508886	9.17	36
San Borja	560	-113.700486	28.510500	8.87	49
San Borja	561	-113.733086	28.526828	5.77	32
San Borja	562	-113.715533	28.567836	6.70	52
San Borja	563	-113.703494	28.578417	7.36	46
San Borja	564	-113.715839	28.589906	7.07	53
San Borja	565	-113.682244	28.586583	10.33	55
San Borja	566	-113.659042	28.597658	10.06	89
San Borja	567	-113.693267	28.598700	10.55	47
San Borja	568	-113.707058	28.614008	10.51	53
San Borja	569	-113.743753	28.637853	9.78	36
San Borja	570	-113.696883	28.634031	12.06	60
San Borja	571	-113.666311	28.615539	12.01	79
San Borja	572	-113.614850	28.602667	6.40	83
San Borja	573	-113.597761	28.643239	9.32	45
San Borja	574	-113.671275	28.666708	12.54	59
San Borja	575	-113.669994	28.663294	12.48	59
San Borja	576	-113.678822	28.672619	12.78	59
San Borja	577	-113.702347	28.679572	13.88	63
San Borja	578	-113.698017	28.679606	13.59	63
San Borja	579	-113.680692	28.688681	11.72	63
San Borja	580	-113.701861	28.701847	12.21	69
San Borja	581	-113.693469	28.699919	11.92	72
San Borja	582	-113.692314	28.693775	12.47	75
San Borja	583	-113.680342	28.776981	4.08	13
San Borja	584	-113.697025	28.843275	5.52	22
San Borja	585	-113.731597	28.877050	7.43	78
San Borja	586	-113.834289	28.883300	14.74	47
San Borja	587	-113.597667	28.694036	4.78	59
San Borja	588	-113.642231	28.234528	19.41	85
San Borja	589	-113.623664	28.185964	19.76	68
San Borja	590	-113.642747	28.178775	21.67	68
San Borja	591	-113.593800	28.165331	18.21	57
San Borja	592	-113.557161	28.171469	15.27	51
San Borja	593	-113.563353	28.130544	17.61	40
San Borja	594	-113.487042	28.197156	9.60	32
San Borja	595	-113.497469	28.059822	19.03	37
San Borja	596	-113.476242	28.040733	18.68	28
San Borja	597	-113.363447	28.121533	11.42	10
San Borja	598	-113.142550	28.088325	9.67	11
San Borja	599	-113.104711	28.117808	6.36	6
San Borja	600	-113.179892	28.237594	3.44	61
San Borja	601	-112.988089	28.054144	8.59	8
San Borja	602	-113.974731	28.037203	10.13	5
San Borja	603	-113.372567	28.721150	3.46	38
San Borja	604	-114.123417	28.241889	23.53	41
San Borja	605	-113.821039	28.210344	16.20	16

Appendix A (Continued)

Field Name	ID #	Vent X	Vent Y	Distance to Nearest Fault (km)	Azimuth to Nearest Fault (360 format)
San Borja	606	-113.834867	28.710225	13.27	0
San Borja	607	-113.837775	28.704783	16.74	77
Michoacan-Guanauato	608	-101.493375	19.052461	5.86	68
Michoacan-Guanauato	609	-101.500019	19.056161	6.67	67
Michoacan-Guanauato	610	-101.486061	19.194444	20.85	78
Michoacan-Guanauato	611	-101.426311	19.230522	16.39	59
Michoacan-Guanauato	612	-101.453944	19.235667	19.21	62
Michoacan-Guanauato	613	-101.419556	19.253336	17.32	51
Michoacan-Guanauato	614	-101.420497	19.267322	18.41	47
Michoacan-Guanauato	615	-101.481731	19.237036	23.48	67
Michoacan-Guanauato	616	-101.557061	19.265278	22.06	35
Michoacan-Guanauato	617	-101.410228	19.270581	17.03	7
Michoacan-Guanauato	618	-101.431772	19.272947	16.65	0
Michoacan-Guanauato	619	-101.439508	19.276692	16.32	4
Michoacan-Guanauato	620	-101.484453	19.300522	14.71	23
Michoacan-Guanauato	621	-101.457178	19.307436	13.17	13
Michoacan-Guanauato	622	-101.482961	19.312014	13.49	24
Michoacan-Guanauato	623	-101.523347	19.308294	16.06	35
Michoacan-Guanauato	624	-101.548667	19.344692	14.59	43
Michoacan-Guanauato	625	-101.564686	19.336819	16.36	44
Michoacan-Guanauato	626	-101.598181	19.324983	18.61	45
Michoacan-Guanauato	627	-101.593225	19.275142	18.52	45
Michoacan-Guanauato	628	-101.597617	19.256156	25.36	39
Michoacan-Guanauato	629	-101.600978	19.268536	24.55	41
Michoacan-Guanauato	630	-101.642775	19.288622	26.15	49
Michoacan-Guanauato	631	-101.671364	19.266706	29.85	49
Michoacan-Guanauato	632	-101.685144	19.278819	36.63	56
Michoacan-Guanauato	633	-101.744069	19.256681	36.00	59
Michoacan-Guanauato	634	-101.748950	19.274886	36.08	59
Michoacan-Guanauato	635	-101.779875	19.260800	39.60	59
Michoacan-Guanauato	636	-101.827839	19.329606	41.03	72
Michoacan-Guanauato	637	-101.754061	19.352867	32.84	72
Michoacan-Guanauato	638	-101.699633	19.347914	27.62	67
Michoacan-Guanauato	639	-101.549381	19.355647	13.77	45
Michoacan-Guanauato	640	-101.559422	19.354075	16.88	59
Michoacan-Guanauato	641	-101.595339	19.364797	7.51	36
Michoacan-Guanauato	642	-101.486389	19.378092	6.32	34
Michoacan-Guanauato	643	-101.474233	19.383047	1.13	10
Michoacan-Guanauato	644	-101.427572	19.413203	1.65	65
Michoacan-Guanauato	645	-101.414278	19.417319	1.65	65
Michoacan-Guanauato	646	-101.401094	19.423192	3.02	89
Michoacan-Guanauato	647	-101.387756	19.404064	4.85	64
Michoacan-Guanauato	648	-101.357336	19.389522	8.42	64
Michoacan-Guanauato	649	-101.859792	19.320944	30.92	47
Michoacan-Guanauato	650	-101.765969	19.368503	20.26	39
Michoacan-Guanauato	651	-101.747008	19.375847	18.42	35
Michoacan-Guanauato	652	-101.757269	19.396469	17.28	42
Michoacan-Guanauato	653	-101.768719	19.400456	17.88	47
Michoacan-Guanauato	654	-101.882422	19.428750	26.72	70
Michoacan-Guanauato	655	-101.867678	19.453775	24.41	75
Michoacan-Guanauato	656	-101.849131	19.476381	21.82	80
Michoacan-Guanauato	657	-101.824481	19.524183	18.80	86
Michoacan-Guanauato	658	-101.779200	19.514439	13.91	89
Michoacan-Guanauato	659	-101.745733	19.508433	10.38	88
Michoacan-Guanauato	660	-101.734747	19.517147	9.49	86

Appendix A (Continued)

Field Name	ID #	Vent X	Vent Y	Distance to Nearest Fault (km)	Azimuth to Nearest Fault (360 format)
Michoacan-Guanauato	661	-101.771469	19.527028	13.26	83
Michoacan-Guanauato	662	-101.816028	19.546708	18.33	78
Michoacan-Guanauato	663	-101.841742	19.556739	21.36	76
Michoacan-Guanauato	664	-101.810425	19.587675	19.13	64
Michoacan-Guanauato	665	-101.763797	19.595594	14.36	87
Michoacan-Guanauato	666	-101.763639	19.605350	14.37	87
Michoacan-Guanauato	667	-101.781378	19.612336	14.36	89
Michoacan-Guanauato	668	-101.773189	19.630358	14.78	84
Michoacan-Guanauato	669	-101.747108	19.619361	12.02	88
Michoacan-Guanauato	670	-101.739211	19.618964	11.14	88
Michoacan-Guanauato	671	-101.730708	19.607050	10.30	84
Michoacan-Guanauato	672	-101.807556	19.653500	18.81	78
Michoacan-Guanauato	673	-101.771225	19.682464	16.25	64
Michoacan-Guanauato	674	-101.770178	19.695608	16.80	58
Michoacan-Guanauato	675	-101.768556	19.689056	16.33	61
Michoacan-Guanauato	676	-101.710922	19.702211	12.60	41
Michoacan-Guanauato	677	-101.690556	19.692258	10.28	36
Michoacan-Guanauato	678	-101.712792	19.609481	8.52	84
Michoacan-Guanauato	679	-101.683381	19.611317	5.42	83
Michoacan-Guanauato	680	-101.684156	19.598147	6.00	84
Michoacan-Guanauato	681	-101.583394	19.581719	3.49	41
Michoacan-Guanauato	682	-101.580383	19.593994	4.29	39
Michoacan-Guanauato	683	-101.527664	19.607156	7.24	76
Michoacan-Guanauato	684	-101.472919	19.611711	5.32	7
Michoacan-Guanauato	685	-101.461100	19.581200	2.11	17
Michoacan-Guanauato	686	-101.641850	19.503592	0.79	2
Michoacan-Guanauato	687	-101.431539	19.503675	1.60	34
Michoacan-Guanauato	688	-101.399433	19.508033	2.74	67
Michoacan-Guanauato	689	-101.441319	19.583314	3.38	51
Michoacan-Guanauato	690	-101.433331	19.665119	4.16	66
Michoacan-Guanauato	691	-101.331986	19.665531	4.25	32
Michoacan-Guanauato	692	-101.326272	19.690475	7.05	23
Michoacan-Guanauato	693	-101.352686	19.677478	3.98	46
Michoacan-Guanauato	694	-101.377972	19.698431	5.06	2
Michoacan-Guanauato	695	-101.394108	19.709075	6.50	13
Michoacan-Guanauato	696	-101.435539	19.705553	7.52	32
Michoacan-Guanauato	697	-101.462600	19.720817	7.94	6
Michoacan-Guanauato	698	-101.492008	19.715856	8.67	15
Michoacan-Guanauato	699	-101.525197	19.683986	9.77	48
Michoacan-Guanauato	700	-101.567519	19.678900	6.33	36
Michoacan-Guanauato	701	-101.529872	19.767797	2.42	10
Michoacan-Guanauato	702	-101.388856	19.800250	2.24	86
Michoacan-Guanauato	703	-101.661536	19.748289	6.66	63
Michoacan-Guanauato	704	-101.678244	19.742053	6.41	20
Michoacan-Guanauato	705	-101.698200	19.738986	7.66	34
Michoacan-Guanauato	706	-101.696606	19.756378	6.11	42
Michoacan-Guanauato	707	-101.793708	19.737303	15.83	65
Michoacan-Guanauato	708	-101.782517	19.752606	14.13	70
Michoacan-Guanauato	709	-101.437947	19.881811	2.11	26
Michoacan-Guanauato	710	-101.431297	19.845481	1.19	29
Michoacan-Guanauato	711	-101.375122	19.869583	0.93	23
Michoacan-Guanauato	712	-101.341231	19.895864	2.31	3
Michoacan-Guanauato	713	-101.657814	20.007211	2.10	5
Michoacan-Guanauato	714	-101.299675	20.064150	0.88	83
Michoacan-Guanauato	715	-101.593828	20.097092	1.68	71

Appendix A (Continued)

Field Name	ID #	Vent X	Vent Y	Distance to Nearest Fault (km)	Azimuth to Nearest Fault (360 format)
Michoacan-Guanauato	716	-101.602578	20.105486	2.57	78
Michoacan-Guanauato	717	-101.423772	20.156222	6.64	88
Michoacan-Guanauato	718	-101.398383	20.154433	7.52	30
Michoacan-Guanauato	719	-101.407314	20.194650	6.48	71
Michoacan-Guanauato	720	-101.422567	20.184897	7.97	75
Michoacan-Guanauato	721	-101.399544	20.203003	5.44	79
Michoacan-Guanauato	722	-101.283242	20.099492	0.93	88
Michoacan-Guanauato	723	-101.266492	20.100686	1.67	14
Michoacan-Guanauato	724	-101.250017	20.072767	0.37	17
Michoacan-Guanauato	725	-101.252400	20.074503	0.64	35
Michoacan-Guanauato	726	-101.215881	20.084836	1.98	16
Michoacan-Guanauato	727	-101.254767	20.097364	0.98	21
Michoacan-Guanauato	728	-101.263494	20.105408	2.07	14
Michoacan-Guanauato	729	-101.247656	20.106803	1.77	14
Michoacan-Guanauato	730	-101.261803	20.111858	2.70	14
Michoacan-Guanauato	731	-101.253539	20.227906	0.65	60
Michoacan-Guanauato	732	-101.231703	20.234703	7.93	86
Michoacan-Guanauato	733	-101.206917	20.230350	10.54	90
Michoacan-Guanauato	734	-101.203825	20.227669	10.88	88
Michoacan-Guanauato	735	-101.187714	20.220500	11.19	55
Michoacan-Guanauato	736	-101.208342	20.251664	9.14	55
Michoacan-Guanauato	737	-101.186733	20.195678	10.87	65
Michoacan-Guanauato	738	-101.200967	20.191131	9.24	64
Michoacan-Guanauato	739	-101.165622	20.186806	9.29	25
Michoacan-Guanauato	740	-101.599533	20.376253	6.47	68
Michoacan-Guanauato	741	-101.447908	20.282114	10.71	70
Michoacan-Guanauato	742	-101.430511	20.317411	10.20	47
Michoacan-Guanauato	743	-101.392781	20.289578	6.09	43
Michoacan-Guanauato	744	-101.450569	20.371456	4.26	62
Michoacan-Guanauato	745	-101.579200	20.482086	6.69	61
Michoacan-Guanauato	746	-101.531356	20.456039	2.51	24
Michoacan-Guanauato	747	-101.351622	20.360397	12.59	0
Michoacan-Guanauato	748	-101.351950	20.314206	7.47	1
Michoacan-Guanauato	749	-101.345967	20.271794	2.80	11
Michoacan-Guanauato	750	-101.297822	20.314442	9.31	37
Michoacan-Guanauato	751	-101.286714	20.349222	13.20	31
Michoacan-Guanauato	752	-101.294694	20.374067	15.29	23
Michoacan-Guanauato	753	-101.307517	20.462133	14.83	71
Michoacan-Guanauato	754	-101.347433	20.488419	16.19	74
Michoacan-Guanauato	755	-101.332697	20.488700	16.81	83
Michoacan-Guanauato	756	-101.265122	20.500644	9.60	87
Michoacan-Guanauato	757	-101.200489	20.500839	2.86	79
Michoacan-Guanauato	758	-101.222883	20.482097	5.73	63
Michoacan-Guanauato	759	-101.199711	20.468622	4.77	33
Michoacan-Guanauato	760	-101.212986	20.450989	7.23	35
Michoacan-Guanauato	761	-101.220375	20.380964	13.77	36
Michoacan-Guanauato	762	-101.199253	20.333936	10.71	58
Michoacan-Guanauato	763	-101.152614	20.287619	4.05	83
Michoacan-Guanauato	764	-101.146300	20.287242	3.39	82
Michoacan-Guanauato	765	-101.085611	20.151497	2.47	27
Michoacan-Guanauato	766	-100.351292	19.956833	0.77	3
Michoacan-Guanauato	767	-100.785925	19.894025	1.20	1
Michoacan-Guanauato	768	-100.779800	19.897250	0.94	56
Michoacan-Guanauato	769	-100.796533	19.876561	0.97	83
Michoacan-Guanauato	770	-100.891231	19.878814	0.89	76

Appendix A (Continued)

Field Name	ID #	Vent X	Vent Y	Distance to Nearest Fault (km)	Azimuth to Nearest Fault (360 format)
Michoacan-Guanauato	771	-100.780325	19.878669	2.71	80
Michoacan-Guanauato	772	-100.868950	19.850606	1.86	9
Michoacan-Guanauato	773	-100.795031	19.857397	2.28	29
Michoacan-Guanauato	774	-100.796622	19.853058	2.77	14
Michoacan-Guanauato	775	-100.787525	19.853031	2.34	49
Michoacan-Guanauato	776	-100.709961	19.840969	2.49	2
Michoacan-Guanauato	777	-100.593144	19.830453	2.09	2
Michoacan-Guanauato	778	-100.583694	19.824422	1.82	37
Michoacan-Guanauato	779	-100.920353	19.766983	1.60	12
Michoacan-Guanauato	780	-100.905453	19.766075	1.32	12
Michoacan-Guanauato	781	-100.891914	19.769078	0.98	13
Michoacan-Guanauato	782	-100.891067	19.773586	0.94	15
Michoacan-Guanauato	783	-100.902269	19.767014	0.82	13
Michoacan-Guanauato	784	-100.875728	19.770456	1.38	49
Michoacan-Guanauato	785	-100.862372	19.771272	2.09	53
Michoacan-Guanauato	786	-100.851533	19.773400	1.64	21
Michoacan-Guanauato	787	-100.837817	19.776328	1.53	14
Michoacan-Guanauato	788	-100.841550	19.774442	1.45	14
Michoacan-Guanauato	789	-100.818547	19.774900	1.56	13
Michoacan-Guanauato	790	-100.816772	19.780292	2.00	30
Michoacan-Guanauato	791	-100.812103	19.764661	1.43	89
Michoacan-Guanauato	792	-100.755003	19.706231	1.34	12
Michoacan-Guanauato	793	-100.485181	19.899233	4.03	4
Michoacan-Guanauato	794	-100.547219	19.818719	4.62	16
Michoacan-Guanauato	795	-100.492933	19.837656	5.53	37
Michoacan-Guanauato	796	-100.482258	19.828133	7.02	39
Michoacan-Guanauato	797	-100.564803	19.805175	2.53	64
Michoacan-Guanauato	798	-100.538211	19.794786	5.02	89
Michoacan-Guanauato	799	-100.555239	19.791425	3.31	84
Michoacan-Guanauato	800	-100.537164	19.785908	5.24	80
Michoacan-Guanauato	801	-100.550733	19.785975	3.88	76
Michoacan-Guanauato	802	-100.514547	19.779944	7.81	78
Michoacan-Guanauato	803	-100.539906	19.771067	5.40	86
Michoacan-Guanauato	804	-100.542875	19.776525	5.03	88
Michoacan-Guanauato	805	-100.570764	19.766569	2.36	68
Michoacan-Guanauato	806	-100.577561	19.766142	1.69	55
Michoacan-Guanauato	807	-100.563047	19.766178	3.08	73
Michoacan-Guanauato	808	-100.541642	19.761642	5.38	74
Michoacan-Guanauato	809	-100.529711	19.756294	6.75	72
Michoacan-Guanauato	810	-100.418667	19.800761	2.14	35
Michoacan-Guanauato	811	-100.378006	19.787100	0.59	15
Michoacan-Guanauato	812	-100.387992	19.786086	0.87	42
Michoacan-Guanauato	813	-100.447453	19.773772	4.26	87
Michoacan-Guanauato	814	-100.428508	19.766469	2.44	67
Michoacan-Guanauato	815	-100.463178	19.760839	6.13	74
Michoacan-Guanauato	816	-100.489561	19.713875	10.93	57
Michoacan-Guanauato	817	-100.511764	19.712583	10.85	50
Michoacan-Guanauato	818	-100.527825	19.710053	9.85	43
Michoacan-Guanauato	819	-100.500686	19.716236	11.96	63
Michoacan-Guanauato	820	-100.479217	19.704200	10.32	54
Michoacan-Guanauato	821	-100.471644	19.683481	8.45	64
Michoacan-Guanauato	822	-100.426089	19.551172	3.69	60
Michoacan-Guanauato	823	-100.375206	19.539642	1.86	44
Michoacan-Guanauato	824	-100.437003	19.420000	5.78	58
Michoacan-Guanauato	825	-100.494303	19.397492	1.59	33

Appendix A (Continued)

Field Name	ID #	Vent X	Vent Y	Distance to Nearest Fault (km)	Azimuth to Nearest Fault (360 format)
Michoacan-Guanauato	826	-100.396719	19.291358	9.07	18
Michoacan-Guanauato	827	-100.297100	19.254517	14.26	23
Michoacan-Guanauato	828	-100.173817	19.246586	8.85	35
Michoacan-Guanauato	829	-100.134453	19.269028	4.76	4
Michoacan-Guanauato	830	-100.080897	19.277669	5.97	51
Michoacan-Guanauato	831	-100.159844	19.358747	2.86	65
Michoacan-Guanauato	832	-100.163439	19.354283	3.10	76
Michoacan-Guanauato	833	-100.167739	19.335514	3.62	72
Michoacan-Guanauato	834	-100.251947	19.953722	2.26	21
Michoacan-Guanauato	835	-100.261581	19.938175	3.62	16
Michoacan-Guanauato	836	-100.223458	19.913194	4.87	19
Michoacan-Guanauato	837	-100.171267	19.924256	3.20	45
Michoacan-Guanauato	838	-100.140550	19.907253	3.49	19
Michoacan-Guanauato	839	-100.116714	19.881422	1.45	44
Michoacan-Guanauato	840	-100.092328	19.891881	1.49	81
Michoacan-Guanauato	841	-100.501403	19.962889	13.81	11
Michoacan-Guanauato	842	-101.698575	19.369067	16.69	19
Michoacan-Guanauato	843	-101.672519	19.400097	12.52	12
Michoacan-Guanauato	844	-101.693436	19.414597	11.76	25
Michoacan-Guanauato	845	-101.702356	19.418606	11.80	31
Michoacan-Guanauato	846	-101.721336	19.472103	9.07	62

Appendix B: Fault Location Data

Appendix B (Continued)

Field Name	ID #	Start X	Start Y	End X	End Y	Length (km)
Big Pine	1	-118.379759	37.257765	-118.373513	37.219247	5.57
Big Pine	2	-118.379181	37.231971	-118.376867	37.202475	4.22
Big Pine	3	-118.369812	37.235672	-118.372009	37.233012	0.44
Big Pine	4	-118.368192	37.233590	-118.367961	37.230120	0.48
Big Pine	5	-118.366457	37.229542	-118.366573	37.226997	0.35
Big Pine	6	-118.363450	37.231046	-118.365416	37.226072	0.73
Big Pine	7	-118.374785	37.227922	-118.364838	37.221098	1.46
Big Pine	8	-118.361715	37.152854	-118.359517	37.142906	1.41
Big Pine	9	-118.362062	37.138164	-118.360789	37.135619	0.38
Big Pine	10	-118.350958	37.154242	-118.347603	37.136891	2.47
Big Pine	11	-118.346678	37.196576	-118.347487	37.158868	5.29
Big Pine	12	-118.335805	37.164305	-118.333723	37.158290	0.87
Big Pine	13	-118.337887	37.159909	-118.335805	37.157712	0.38
Big Pine	14	-118.335805	37.157712	-118.335921	37.157596	0.02
Big Pine	15	-118.313944	37.182580	-118.319611	37.156092	3.84
Big Pine	16	-118.323660	37.163842	-118.321346	37.146260	2.51
Big Pine	17	-118.317414	37.168931	-118.317298	37.165693	0.45
Big Pine	18	-118.314753	37.170782	-118.314753	37.166387	0.61
Big Pine	19	-118.314753	37.166387	-118.314638	37.166502	0.02
Big Pine	20	-118.309548	37.172055	-118.307929	37.168469	0.53
Big Pine	21	-118.304921	37.176103	-118.298444	37.156439	2.93
Big Pine	22	-118.296709	37.152160	-118.265131	37.091202	9.29
Big Pine	23	-118.286067	37.115493	-118.277739	37.102191	2.13
Big Pine	24	-118.322850	37.094094	-118.323428	37.084493	1.34
Big Pine	25	-118.290926	37.103463	-118.282829	37.086113	2.60
Big Pine	26	-118.301104	37.090392	-118.291504	37.036722	7.60
Big Pine	27	-118.271725	37.095829	-118.271146	37.061013	4.89
Big Pine	28	-118.259695	37.075587	-118.252408	37.066102	1.55
Big Pine	29	-118.265016	37.066102	-118.260042	37.053147	1.92
Big Pine	30	-118.287687	37.025849	-118.287687	37.023420	0.34
Big Pine	31	-118.282250	37.017406	-118.281556	37.011275	0.86
Big Pine	32	-118.266667	37.250981	-118.264034	37.244728	0.93
Big Pine	33	-118.255147	37.238035	-118.252733	37.232988	0.78
Big Pine	34	-118.267545	37.228051	-118.260523	37.218067	1.59
Big Pine	35	-118.267106	37.228161	-118.259974	37.227722	0.80
Big Pine	36	-118.259206	37.221797	-118.257670	37.215214	0.93
Big Pine	37	-118.249990	37.195575	-118.230680	37.181422	2.93
Big Pine	38	-118.347949	37.154542	-118.344731	37.148200	0.95
Big Pine	39	-118.344218	37.157200	-118.345384	37.152956	0.60
Big Pine	40	-118.344078	37.156360	-118.343006	37.149086	1.02
Big Pine	41	-118.346783	37.148153	-118.346550	37.146195	0.27
Big Pine	42	-118.155690	36.942052	-118.143168	36.902496	5.92
Big Pine	43	-118.148860	36.898085	-118.149429	36.878449	2.72
Big Pine	44	-118.136765	36.893816	-118.129082	36.880583	2.02
Big Pine	45	-118.124102	36.880014	-118.123106	36.874323	1.69
Big Pine	46	-118.120118	36.744699	-118.121825	36.740999	0.55
Big Pine	47	-118.119975	36.757504	-118.221000	36.987726	33.87
Big Pine	48	-118.343201	37.027877	-118.340560	37.019596	1.19

Appendix B (Continued)

Field Name	ID #	Start X	Start Y	End X	End Y	Length (km)
Big Pine	49	-118.348412	37.026021	-118.342844	37.005034	2.99
Big Pine	50	-118.343415	37.014600	-118.341345	37.011245	0.52
Big Pine	51	-118.339346	37.010888	-118.342701	37.002607	1.22
Big Pine	52	-118.357192	36.992685	-118.339632	36.969057	3.91
Big Pine	53	-118.342487	36.996325	-118.339846	36.973697	3.18
Big Pine	54	-118.337347	36.995183	-118.338489	36.987117	1.13
Big Pine	55	-118.335134	36.997325	-118.334421	36.984333	1.85
Big Pine	56	-118.328995	36.995611	-118.331993	36.973982	3.05
Big Pine	57	-118.311935	36.987902	-118.321000	36.977980	1.75
Big Pine	58	-118.329281	36.962132	-118.332493	36.959277	0.56
Big Pine	59	-118.345528	36.953238	-118.342330	36.950611	0.51
Big Pine	60	-118.335191	36.956150	-118.331594	36.944729	1.72
Big Pine	61	-118.329252	36.951696	-118.326854	36.935763	2.29
Big Pine	62	-118.324227	36.944957	-118.323656	36.937134	1.15
Big Pine	63	-118.339874	36.948784	-118.329424	36.936449	2.14
Big Pine	64	-118.310255	36.791445	-118.216965	36.603396	28.85
Camargo	65	-104.700609	27.633829	-104.628801	27.472902	19.69
Camargo	66	-104.573342	27.559136	-104.540644	27.519385	5.58
Camargo	67	-104.546094	27.550160	-104.489352	27.471941	10.55
Camargo	68	-104.481018	27.782895	-104.434214	27.697302	10.98
Camargo	69	-104.498008	27.772637	-104.452487	27.539581	27.39
Camargo	70	-104.478774	27.693135	-104.321373	27.533811	23.92
Camargo	71	-104.393502	27.648896	-104.368176	27.618442	4.45
Camargo	72	-104.426520	27.708522	-104.335478	27.588629	16.58
Camargo	73	-104.364009	27.695379	-104.275852	27.560098	18.30
Camargo	74	-104.361765	27.678068	-104.306627	27.438281	29.64
Camargo	75	-104.266876	27.675183	-104.189297	27.613313	11.38
Camargo	76	-104.351507	27.645049	-104.478132	27.836431	25.10
Camargo	77	-104.444152	27.988702	-104.330349	27.675504	37.75
Camargo	78	-104.427482	27.983893	-104.347660	27.788345	23.95
Camargo	79	-104.117169	27.934205	-104.097293	27.879387	6.54
Coso	80	-118.018485	36.207801	-118.011206	36.188830	2.11
Coso	81	-117.998853	36.170300	-117.997088	36.163462	0.73
Coso	82	-117.996647	36.156623	-117.996647	36.149344	0.77
Coso	83	-118.016059	36.162800	-118.020691	36.141182	2.39
Coso	84	-117.953852	36.138314	-117.916572	36.123535	3.92
Coso	85	-117.923631	36.115814	-117.926498	36.107873	0.87
Coso	86	-117.921425	36.107211	-117.926057	36.093755	1.46
Coso	87	-118.001059	36.097505	-117.999514	36.085813	1.24
Coso	88	-117.908189	36.102137	-117.911719	36.083166	2.00
Coso	89	-117.907748	36.084049	-117.886130	36.077872	2.20
Coso	90	-117.878851	36.094858	-117.881939	36.090887	0.51
Coso	91	-117.872674	36.148903	-117.882821	36.122211	2.94
Coso	92	-117.903116	36.144050	-117.908410	36.132138	1.34
Coso	93	-117.897380	36.150888	-117.905542	36.131697	2.14
Coso	94	-117.895616	36.149123	-117.902675	36.130814	2.01
Coso	95	-117.894292	36.144932	-117.903557	36.124638	2.30
Coso	96	-117.879512	36.155521	-117.882380	36.153535	0.34

Appendix B (Continued)

Field Name	ID #	Start X	Start Y	End X	End Y	Length (km)
Coso	97	-117.871571	36.159491	-117.876203	36.157506	0.49
Coso	98	-117.883483	36.155300	-117.889660	36.154197	0.61
Coso	99	-117.890763	36.151550	-117.883704	36.154197	0.73
Coso	100	-117.918998	36.182433	-117.922087	36.174491	0.88
Coso	101	-117.913484	36.197874	-117.918116	36.182212	1.69
Coso	102	-117.913042	36.190595	-117.915248	36.182212	0.89
Coso	103	-117.915028	36.182212	-117.905542	36.180006	0.94
Coso	104	-117.909072	36.189271	-117.911278	36.183536	0.63
Coso	105	-117.908410	36.186183	-117.909072	36.183095	0.33
Coso	106	-117.902233	36.201183	-117.903557	36.197654	0.39
Coso	107	-117.905101	36.202065	-117.906425	36.200962	0.17
Coso	108	-117.913704	36.203168	-117.914366	36.200521	0.28
Coso	109	-117.899366	36.201404	-117.901792	36.195668	0.64
Coso	110	-117.903116	36.193021	-117.904880	36.186624	0.68
Coso	111	-117.894292	36.211992	-117.902675	36.184418	2.98
Coso	112	-117.886792	36.169197	-117.876203	36.173168	1.10
Coso	113	-117.891645	36.148020	-117.886130	36.150226	0.58
Coso	114	-117.883042	36.149565	-117.876424	36.151770	0.68
Coso	115	-117.933337	36.251037	-117.936646	36.231184	2.17
Coso	116	-117.942602	36.239787	-117.939955	36.217066	2.39
Coso	117	-117.903998	36.227654	-117.905983	36.220595	0.75
Coso	118	-117.903336	36.223022	-117.905763	36.217507	0.62
Coso	119	-117.903116	36.219933	-117.906645	36.208683	1.21
Coso	120	-117.893189	36.242213	-117.879292	36.207139	3.99
Coso	121	-117.889218	36.220816	-117.881277	36.218389	0.81
Coso	122	-117.891645	36.228536	-117.879733	36.222139	1.33
Coso	123	-117.886351	36.234051	-117.886351	36.231404	0.27
Coso	124	-117.882159	36.238463	-117.884145	36.232287	0.67
Coso	125	-117.884145	36.231184	-117.884365	36.229639	0.16
Coso	126	-117.887674	36.230522	-117.880395	36.228978	0.72
Coso	127	-117.858115	36.250596	-117.823923	36.204051	5.94
Coso	128	-117.856130	36.209786	-117.831864	36.204051	2.54
Coso	129	-117.843997	36.233831	-117.855468	36.225669	1.43
Coso	130	-117.799437	36.246625	-117.827894	36.240890	2.96
Coso	131	-117.834291	36.250816	-117.838041	36.249493	0.39
Coso	132	-117.813335	36.236257	-117.820173	36.228316	1.05
Coso	133	-117.803849	36.228536	-117.791717	36.225669	1.21
Coso	134	-117.770981	36.241551	-117.802967	36.220154	3.95
Coso	135	-117.798114	36.221698	-117.794143	36.210007	1.33
Coso	136	-117.794143	36.217727	-117.783555	36.215301	1.11
Coso	137	-117.783775	36.225889	-117.787525	36.216845	1.01
Coso	138	-117.829659	36.215963	-117.782231	36.204933	4.74
Coso	139	-117.788187	36.206257	-117.792599	36.192580	1.54
Coso	140	-117.826350	36.213095	-117.811349	36.213536	1.45
Coso	141	-117.773187	36.197433	-117.760613	36.191256	1.38
Coso	142	-117.766790	36.172506	-117.771202	36.171624	0.44
Coso	143	-117.870909	36.199198	-117.858115	36.193462	1.37
Coso	144	-117.858997	36.193242	-117.859880	36.185080	0.85

Appendix B (Continued)

Field Name	ID #	Start X	Start Y	End X	End Y	Length (km)
Coso	145	-117.862747	36.182874	-117.847085	36.188168	1.61
Coso	146	-117.847085	36.188168	-117.815320	36.179786	5.55
Coso	147	-117.821717	36.180227	-117.821497	36.168535	1.22
Coso	148	-117.858115	36.180889	-117.839585	36.185962	1.91
Coso	149	-117.843556	36.183536	-117.839144	36.184639	0.44
Coso	150	-117.840909	36.181109	-117.834953	36.184197	0.66
Coso	151	-117.829879	36.182874	-117.863850	36.173609	3.42
Coso	152	-117.861865	36.182653	-117.862306	36.173830	0.91
Coso	153	-117.863189	36.173388	-117.863189	36.168535	0.50
Coso	154	-117.887233	36.160594	-117.827011	36.174933	6.02
Coso	155	-117.875542	36.153756	-117.800982	36.165888	7.34
Coso	156	-117.802746	36.163462	-117.811791	36.164565	0.88
Coso	157	-117.758187	36.147579	-117.762599	36.142285	0.69
Coso	158	-117.781790	36.145373	-117.786643	36.135447	1.13
Coso	159	-117.809144	36.132138	-117.788187	36.127726	2.08
Coso	160	-117.794805	36.127726	-117.806496	36.129049	1.14
Coso	161	-117.789731	36.148020	-117.826350	36.140741	3.67
Coso	162	-117.812452	36.143829	-117.829438	36.148903	1.73
Coso	163	-117.833629	36.154638	-117.852600	36.149785	1.90
Coso	164	-117.852600	36.149785	-117.852380	36.149344	0.05
Coso	165	-117.851056	36.149785	-117.841129	36.147138	1.00
Coso	166	-117.827011	36.138756	-117.831203	36.138314	0.41
Coso	167	-117.848188	36.146476	-117.858777	36.143388	1.07
Coso	168	-117.854585	36.142726	-117.862527	36.139858	0.82
Coso	169	-117.861865	36.136329	-117.836276	36.143609	2.59
Coso	170	-117.851718	36.142506	-117.854144	36.133020	1.01
Coso	171	-117.855909	36.131697	-117.848188	36.133902	0.78
Coso	172	-117.856791	36.132800	-117.863409	36.131035	0.66
Coso	173	-117.863409	36.128608	-117.856350	36.129932	0.69
Coso	174	-117.860762	36.127505	-117.855688	36.129049	0.51
Coso	175	-117.852159	36.127947	-117.843997	36.128167	0.79
Coso	176	-117.841129	36.131697	-117.838482	36.131917	0.26
Coso	177	-117.833850	36.135226	-117.838262	36.134344	0.44
Coso	178	-117.846644	36.138314	-117.840468	36.139417	0.61
Coso	179	-117.828997	36.126844	-117.822600	36.127285	0.62
Coso	180	-117.835615	36.126623	-117.839806	36.125520	0.42
Coso	181	-117.840026	36.126844	-117.848850	36.123535	0.92
Coso	182	-117.838482	36.122652	-117.829438	36.118902	0.96
Coso	183	-117.866056	36.119123	-117.858777	36.122432	0.78
Coso	184	-117.856571	36.119343	-117.849953	36.121549	0.68
Coso	185	-117.848850	36.120667	-117.841129	36.122432	0.77
Coso	186	-117.844218	36.119343	-117.840909	36.120226	0.33
Coso	187	-117.861424	36.142506	-117.865174	36.113167	3.10
Coso	188	-117.855247	36.127947	-117.862968	36.113167	1.70
Coso	189	-117.828335	36.120446	-117.838262	36.104564	1.92
Coso	190	-117.827453	36.116476	-117.822820	36.113829	0.52
Coso	191	-117.797893	36.119785	-117.781570	36.115373	1.64
Coso	192	-117.776275	36.136329	-117.784658	36.107431	3.16

Appendix B (Continued)

Field Name	ID #	Start X	Start Y	End X	End Y	Length (km)
Coso	193	-117.753554	36.119785	-117.749804	36.111182	0.96
Coso	194	-117.741422	36.156844	-117.717598	36.138976	2.95
Coso	195	-117.738775	36.087137	-117.730392	36.065298	2.42
Coso	196	-117.729730	36.073240	-117.726642	36.058901	1.54
Coso	197	-117.723113	36.057136	-117.715612	36.040813	1.87
Coso	198	-117.752451	36.068828	-117.742304	36.054931	1.74
Coso	199	-117.740760	36.054931	-117.723774	36.034636	2.73
Coso	200	-117.768775	36.084931	-117.770099	36.077872	0.74
Coso	201	-117.767893	36.079637	-117.768113	36.075887	0.39
Coso	202	-117.809805	36.079196	-117.762599	36.073019	4.61
Coso	203	-117.801864	36.071696	-117.755098	36.063975	4.62
Coso	204	-117.772084	36.067725	-117.776716	36.054931	1.40
Coso	205	-117.791496	36.058019	-117.775393	36.051622	1.69
Coso	206	-117.783996	36.052725	-117.773628	36.049416	1.06
Coso	207	-117.785981	36.051622	-117.774511	36.047430	1.19
Coso	208	-117.789952	36.048975	-117.777158	36.044783	1.31
Coso	209	-117.789952	36.060666	-117.798335	36.046327	1.69
Coso	210	-117.832306	36.063975	-117.794143	36.053386	3.88
Coso	211	-117.840247	36.069048	-117.830541	36.066401	0.99
Coso	212	-117.850174	36.068607	-117.835173	36.062651	1.57
Coso	213	-117.838262	36.065519	-117.842453	36.061328	0.59
Coso	214	-117.859438	36.066401	-117.837820	36.056695	2.33
Coso	215	-117.866497	36.061989	-117.845982	36.056034	2.11
Coso	216	-117.882601	36.062431	-117.856791	36.046989	3.02
Coso	217	-117.895616	36.078754	-117.895174	36.066181	1.33
Coso	218	-117.908851	36.069048	-117.872453	36.053828	3.87
Coso	219	-117.871571	36.055592	-117.872233	36.044783	1.14
Coso	220	-117.886351	36.056034	-117.872453	36.051180	1.43
Coso	221	-117.875983	36.045445	-117.843115	36.026254	3.82
Coso	222	-117.831423	36.052504	-117.801643	36.041916	3.08
Coso	223	-117.807820	36.031327	-117.780246	36.020518	2.89
Coso	224	-117.782011	36.040813	-117.779364	36.020518	2.15
Coso	225	-117.792820	36.040813	-117.786202	36.024489	1.84
Coso	226	-117.827232	36.017651	-117.812011	36.014783	1.50
Coso	227	-117.857233	36.023606	-117.838041	36.019195	1.93
Coso	228	-117.746495	36.039489	-117.743848	36.030886	0.93
Coso	229	-117.770099	36.037724	-117.768996	36.024268	1.43
Coso	230	-117.778481	36.030445	-117.756201	36.015445	2.65
Coso	231	-117.770761	36.041695	-117.774290	36.005297	3.88
Coso	232	-117.781790	36.006180	-117.760834	36.002209	2.06
Coso	233	-117.764363	36.002209	-117.768775	35.992282	1.11
Coso	234	-117.770099	36.003753	-117.774290	35.992724	1.21
Coso	235	-117.778702	36.004636	-117.787967	35.973091	3.58
Coso	236	-117.778261	36.003312	-117.790393	35.984341	2.30
Coso	237	-117.836718	36.020298	-117.843776	35.995591	2.68
Coso	238	-117.848850	35.990959	-117.852600	35.979488	1.25
Coso	239	-117.847085	35.989194	-117.850394	35.971767	1.90
Coso	240	-117.876203	35.976179	-117.874218	35.966694	1.00

Appendix B (Continued)

Field Name	ID #	Start X	Start Y	End X	End Y	Length (km)
Coso	241	-117.836056	35.992944	-117.812011	35.988753	2.37
Coso	242	-117.827011	35.988312	-117.839365	35.960738	3.17
Coso	243	-117.832526	35.971326	-117.819070	35.967135	1.37
Coso	244	-117.824364	35.979267	-117.807820	35.976179	1.64
Coso	245	-117.811570	35.977723	-117.802967	35.975738	0.86
Coso	246	-117.793923	35.994488	-117.806055	35.963385	3.47
Coso	247	-117.812673	35.975297	-117.815982	35.968679	0.76
Coso	248	-117.815761	35.966253	-117.803188	35.959635	1.39
Coso	249	-117.797673	35.975959	-117.782672	35.971988	1.51
Coso	250	-117.776496	35.975076	-117.783555	35.959855	1.73
Coso	251	-117.784437	35.969561	-117.779584	35.968017	0.49
Coso	252	-117.797232	35.980150	-117.809805	35.934487	5.00
Coso	253	-117.800320	35.960738	-117.782452	35.951693	2.02
Coso	254	-117.838923	35.962502	-117.806055	35.947502	3.54
Coso	255	-117.802526	35.945076	-117.788628	35.936473	1.61
Coso	256	-117.833629	35.948605	-117.815982	35.942208	1.83
Coso	257	-117.816423	35.942208	-117.820394	35.934046	0.93
Coso	258	-117.817305	35.937134	-117.820835	35.926325	1.17
Coso	259	-117.787967	35.921031	-117.789070	35.917061	0.43
Coso	260	-117.708333	36.061328	-117.710539	36.051401	1.05
Coso	261	-117.704583	36.059784	-117.704362	36.054710	0.53
Coso	262	-117.713627	36.056695	-117.711201	36.053828	0.38
Coso	263	-117.711862	36.038386	-117.711421	36.031327	0.73
Coso	264	-117.995323	36.081622	-117.976132	36.031548	5.69
Coso	265	-117.974146	36.046107	-117.973264	36.037945	0.90
Coso	266	-117.972382	36.024268	-117.958043	36.013680	1.89
Coso	267	-117.948337	35.989856	-117.944587	35.981473	0.94
Coso	268	-118.065251	36.057578	-118.038118	35.991400	7.37
Coso	269	-118.083781	36.015665	-118.003485	35.964488	9.44
Coso	270	-118.067236	35.983238	-117.910616	35.924561	16.33
Coso	271	-117.945469	35.970885	-117.931572	35.955002	2.19
Coso	272	-117.979220	35.958532	-117.967529	35.954341	1.21
Coso	273	-117.976352	35.955223	-117.966205	35.950370	1.10
Coso	274	-117.983191	35.952135	-117.972161	35.947061	1.19
Coso	275	-117.933337	35.883089	-117.902454	35.873163	3.17
Coso	276	-117.900248	35.913310	-117.889439	35.904266	1.40
Coso	277	-117.924293	35.955002	-117.850394	35.871398	11.51
Coso	278	-117.888115	35.899854	-117.882380	35.891251	1.05
Coso	279	-117.885468	35.898972	-117.880174	35.892354	0.86
Coso	280	-117.897601	35.906472	-117.889880	35.904487	0.77
Coso	281	-117.863409	35.881325	-117.850835	35.866766	2.08
Coso	282	-117.848629	35.871839	-117.850835	35.856177	1.69
Coso	283	-117.848850	35.858162	-117.853262	35.853089	0.68
Coso	284	-117.838482	35.869633	-117.851497	35.862354	1.47
Coso	285	-117.855688	35.870957	-117.856130	35.863898	0.73
Coso	286	-117.841350	35.862354	-117.845762	35.855736	0.81
Coso	287	-117.838262	35.861030	-117.842232	35.854192	0.81
Coso	288	-117.835835	35.855515	-117.840688	35.853309	0.52

Appendix B (Continued)

Field Name	ID #	Start X	Start Y	End X	End Y	Length (km)
Coso	289	-117.946793	35.901399	-117.911057	35.855515	5.89
Coso	290	-118.004588	35.909781	-117.962676	35.883531	4.89
Coso	291	-118.008559	35.926325	-117.942822	35.895443	7.17
Coso	292	-118.062604	35.980150	-118.061280	35.973753	0.68
Coso	293	-118.047383	35.975517	-118.048486	35.956326	1.99
Coso	294	-118.030618	35.971988	-118.036353	35.949929	2.37
Coso	295	-118.018265	35.967797	-118.005029	35.906472	6.55
Coso	296	-118.028633	35.930075	-118.008338	35.922355	2.17
Coso	297	-118.042971	35.953238	-118.010544	35.933384	3.76
Coso	298	-117.832526	35.864118	-117.845541	35.839853	2.84
Coso	299	-117.827232	35.840295	-117.832526	35.829044	1.28
Coso	300	-117.822820	35.834339	-117.827232	35.825735	0.99
Coso	301	-117.829217	35.821985	-117.827232	35.825515	0.41
Coso	302	-117.818408	35.834339	-117.824144	35.820441	1.55
Coso	303	-117.755981	35.841397	-117.755760	35.834559	0.74
Coso	304	-117.794143	35.805882	-117.792158	35.797941	0.85
Coso	305	-117.802085	35.910002	-117.787305	35.903825	1.56
Coso	306	-117.797011	35.917943	-117.717818	35.889045	8.23
Coso	307	-117.713186	35.908678	-117.721348	35.890810	2.02
Coso	308	-117.712304	35.895001	-117.713186	35.891913	0.33
Coso	309	-117.705024	35.893016	-117.706789	35.888604	0.49
Coso	310	-117.707671	35.885295	-117.691347	35.877354	1.78
Coso	311	-117.710318	35.888825	-117.717157	35.881766	0.99
Coso	312	-117.748701	35.898972	-117.745392	35.887501	1.25
Coso	313	-117.772525	35.906472	-117.769658	35.906252	0.31
Coso	314	-117.773408	35.903604	-117.775172	35.896545	0.82
Coso	315	-117.762157	35.879780	-117.761054	35.872722	0.74
Coso	316	-117.678994	35.907354	-117.683406	35.895884	1.27
Coso	317	-117.675685	35.905149	-117.678774	35.893237	1.33
Coso	318	-117.668185	35.906913	-117.669950	35.891031	1.66
Coso	319	-117.667744	35.848236	-117.670832	35.835221	1.42
Coso	320	-117.665979	35.844706	-117.667744	35.829927	1.60
Coso	321	-117.723995	35.881986	-117.704362	35.804559	8.45
Coso	322	-117.645023	35.973753	-117.656714	35.956988	2.07
Coso	323	-117.650758	35.947943	-117.654729	35.934267	1.47
Coso	324	-117.641494	35.950591	-117.646126	35.935370	1.64
Coso	325	-117.639729	35.931840	-117.645905	35.923899	1.02
Coso	326	-117.623184	35.925664	-117.624729	35.923899	0.24
Coso	327	-117.617449	35.927428	-117.621861	35.921031	0.79
Coso	328	-117.597155	35.937796	-117.596272	35.920811	1.78
Coso	329	-117.618111	35.962723	-117.604655	35.949708	1.87
Coso	330	-117.635538	35.976620	-117.628479	35.967576	1.16
Coso	331	-117.677671	36.006621	-117.678994	36.001547	0.54
Coso	332	-117.559875	35.997135	-117.583478	35.972209	3.64
Coso	333	-117.581051	36.031768	-117.567154	36.013018	2.37
Coso	334	-117.563404	36.023606	-117.574213	36.020959	1.08
Coso	335	-117.566713	36.021621	-117.560095	35.997135	2.74
Coso	336	-117.584140	36.052504	-117.581272	36.043460	0.98

Appendix B (Continued)

Field Name	ID #	Start X	Start Y	End X	End Y	Length (km)
Coso	337	-117.647891	36.030004	-117.649655	36.022504	0.80
Coso	338	-117.659362	36.036180	-117.653406	36.023827	1.41
Coso	339	-117.587449	36.056916	-117.646126	36.028239	7.08
Coso	340	-117.659362	36.047872	-117.662450	36.041474	0.73
Coso	341	-117.671053	36.047872	-117.665759	36.034857	1.52
Coso	342	-117.669950	36.042798	-117.669288	36.038607	0.44
Coso	343	-117.686715	36.048313	-117.690024	36.046107	0.39
Coso	344	-117.690465	36.048313	-117.689362	36.040592	0.81
Coso	345	-117.669509	36.072799	-117.645464	36.054048	3.03
Coso	346	-117.601346	36.075225	-117.647008	36.056034	4.85
Coso	347	-117.641273	36.053828	-117.646567	36.052063	0.54
Coso	348	-117.693112	36.095961	-117.692671	36.085372	1.18
Coso	349	-117.686274	36.094417	-117.681200	36.092652	0.52
Coso	350	-117.675465	36.098828	-117.674803	36.095961	0.30
Coso	351	-117.629361	36.095299	-117.623184	36.059122	3.93
Coso	352	-117.660906	36.109858	-117.615243	36.081843	5.31
Coso	353	-117.633773	36.108534	-117.610170	36.082063	3.61
Coso	354	-117.638185	36.127064	-117.638185	36.104564	2.52
Coso	355	-117.654067	36.136550	-117.641052	36.098608	4.14
Coso	356	-117.685391	36.152653	-117.659803	36.105446	5.56
Coso	357	-117.692009	36.155079	-117.669068	36.108976	5.37
Coso	358	-117.686715	36.135888	-117.679435	36.122873	1.54
Coso	359	-117.680538	36.128829	-117.670171	36.130814	1.02
Coso	360	-117.682524	36.177800	-117.674803	36.171403	1.00
Coso	361	-117.674803	36.177359	-117.669288	36.131697	4.84
Coso	362	-117.706348	36.141844	-117.696642	36.123314	2.16
Coso	363	-117.717157	36.162800	-117.703701	36.147138	2.09
Coso	364	-117.705686	36.178241	-117.723774	36.153535	3.12
Coso	365	-117.753775	36.176918	-117.738995	36.171844	1.52
Coso	366	-117.761716	36.181550	-117.753334	36.168094	1.61
Coso	367	-117.744951	36.196330	-117.747819	36.174271	2.38
Coso	368	-117.701053	36.200080	-117.728848	36.175153	3.76
Coso	369	-117.704362	36.219272	-117.698627	36.186624	3.50
Coso	370	-117.708995	36.225448	-117.746054	36.226551	3.60
Coso	371	-117.706568	36.221036	-117.719583	36.224786	1.31
Coso	372	-117.719804	36.239345	-117.722671	36.224786	1.54
Coso	373	-117.731054	36.246404	-117.734142	36.239345	0.79
Coso	374	-117.734363	36.239345	-117.727524	36.237581	0.68
Coso	375	-117.754878	36.244860	-117.754878	36.224566	2.12
Yucca	376	-116.689318	37.221000	-116.749911	37.183847	7.12
Yucca	377	-116.683568	37.236037	-116.705682	37.188270	5.36
Yucca	378	-116.595552	37.211269	-116.603513	37.130330	8.31
Yucca	379	-116.642877	37.070620	-116.653050	37.023737	4.90
Yucca	380	-116.638896	37.069293	-116.634916	37.017988	5.29
Yucca	381	-116.603071	37.022411	-116.612801	36.989239	3.52
Yucca	382	-116.666318	36.991008	-116.544246	36.492545	53.31

Appendix B (Continued)

Field Name	ID #	Start X	Start Y	End X	End Y	Length (km)
Yucca	383	-116.489844	36.748632	-116.516381	36.691576	6.40
Yucca	384	-116.457557	36.745536	-116.473037	36.667693	8.17
Yucca	385	-116.484094	36.716787	-116.497805	36.673442	4.71
Yucca	386	-116.610147	36.899011	-116.608820	36.856109	4.40
Yucca	387	-116.634916	36.852128	-116.646858	36.800822	5.52
Yucca	388	-116.641108	36.819841	-116.615013	36.718556	11.42
Yucca	389	-116.561053	36.908299	-116.565034	36.887512	2.17
Yucca	390	-116.504882	36.919357	-116.503555	36.886185	3.45
Yucca	391	-116.477017	36.926876	-116.475248	36.888838	3.90
Yucca	392	-116.432346	36.941029	-116.460210	36.721652	23.22
Yucca	393	-116.512843	36.868051	-116.537611	36.791092	8.27
Yucca	394	-116.554861	36.882204	-116.563264	36.864070	2.03
Yucca	395	-116.551323	36.859205	-116.571226	36.744209	12.00
Yucca	396	-116.500459	36.866282	-116.501344	36.857878	0.87
Yucca	397	-116.481883	36.863186	-116.473037	36.741998	12.68
Yucca	398	-116.503555	36.839744	-116.507978	36.798169	4.29
Yucca	399	-116.481883	36.819841	-116.490286	36.778266	4.54
Yucca	400	-116.488517	36.806130	-116.482767	36.782246	2.52
Yucca	401	-116.510189	36.776939	-116.488517	36.794630	2.77
Yucca	402	-116.514612	36.778708	-116.545130	36.686711	9.99
Yucca	403	-116.453134	36.825148	-116.434557	36.805688	2.68
Yucca	404	-116.419962	36.834437	-116.429692	36.799053	3.75
Yucca	405	-116.397847	36.839744	-116.408462	36.790650	5.14
Yucca	406	-116.461537	36.828244	-116.439865	36.781362	5.25
Yucca	407	-116.454461	36.801707	-116.498690	36.690692	12.41
Yucca	408	-116.382809	36.787554	-116.354503	36.762785	3.73
Yucca	409	-116.356714	36.763228	-116.402270	36.537659	23.61
Yucca	410	-116.880564	36.734301	-116.746363	36.684332	13.93
Yucca	411	-115.810332	36.748572	-115.788322	36.764634	2.69
Yucca	412	-115.794866	36.742029	-115.747872	36.751547	4.64
Yucca	413	-115.763933	36.734891	-115.771666	36.717639	1.92
Yucca	414	-115.791297	36.717639	-115.813307	36.698009	2.93
Yucca	415	-115.812712	36.720019	-115.828178	36.698009	2.71
Yucca	416	-115.784753	36.704552	-115.876957	36.655774	10.27
Yucca	417	-115.819255	36.677784	-115.844240	36.662317	2.89
Yucca	418	-115.819255	36.657558	-115.900752	36.626625	8.49
Yucca	419	-115.764528	36.647445	-115.794866	36.641497	2.99
Yucca	420	-115.743113	36.644471	-115.775830	36.636143	3.27
Yucca	421	-115.715749	36.576062	-115.794866	36.552267	8.29
Yucca	422	-115.765123	36.573682	-115.785348	36.564164	2.18
Yucca	423	-115.794866	36.619487	-115.824609	36.610564	3.01
Yucca	424	-115.844240	36.600451	-115.882311	36.588554	3.87
Yucca	425	-115.969162	36.481478	-115.990577	36.417233	7.26
Yucca	426	-116.005448	36.590933	-115.810927	36.517765	20.22
Yucca	427	-115.925736	36.565949	-115.938229	36.552862	1.81
Yucca	428	-115.900157	36.554646	-115.945367	36.532636	4.92
Yucca	429	-115.920977	36.662912	-115.931090	36.626030	3.98
Yucca	430	-115.942987	36.648040	-115.998310	36.639117	5.42

Appendix B (Continued)

Field Name	ID #	Start X	Start Y	End X	End Y	Length (km)
Yucca	431	-115.958454	36.659938	-115.991766	36.650420	3.36
Yucca	432	-115.975110	36.664696	-115.997120	36.658153	2.23
Yucca	433	-115.996525	36.674809	-115.944177	36.672430	5.06
Yucca	434	-116.009612	36.667076	-116.056607	36.654584	4.71
Yucca	435	-116.101816	36.635548	-116.111334	36.608779	2.90
Yucca	436	-116.118473	36.636738	-116.097058	36.581415	6.09
Yucca	437	-116.031027	36.707527	-116.052443	36.681948	3.34
Yucca	438	-116.023889	36.686707	-116.066125	36.678378	4.16
Yucca	439	-116.005448	36.693250	-115.963213	36.696819	4.09
Yucca	440	-115.958454	36.719424	-115.993551	36.700388	4.05
Yucca	441	-116.009612	36.755116	-116.023294	36.728347	3.05
Yucca	442	-116.030433	36.711691	-116.139293	36.667076	11.47
Yucca	443	-116.149406	36.658153	-116.163682	36.650420	1.59
Yucca	444	-116.177364	36.637928	-116.182718	36.614728	2.44
Yucca	445	-116.224954	36.653394	-116.243989	36.639712	2.31
Yucca	446	-116.249938	36.645661	-116.260051	36.636143	1.38
Yucca	447	-116.246964	36.632574	-116.277897	36.615918	3.44
Yucca	448	-116.108955	36.692655	-116.194021	36.658748	9.06
Yucca	449	-116.023294	36.800326	-116.032217	36.783075	1.97
Yucca	450	-116.041140	36.786049	-116.080401	36.753331	5.06
Yucca	451	-116.120852	36.820551	-116.129180	36.800326	2.23
Yucca	452	-116.158329	36.761065	-116.170821	36.738460	2.62
Yucca	453	-116.133344	36.721804	-116.284440	36.672430	15.67
Yucca	454	-116.192831	36.721209	-116.222574	36.689681	4.42
Yucca	455	-116.165467	36.777721	-116.182123	36.743219	3.89
Yucca	456	-116.177364	36.898479	-116.192831	36.880633	2.36
Yucca	457	-116.145242	36.930006	-116.201159	36.887771	7.04
Yucca	458	-116.107765	36.941904	-116.097652	36.893720	5.41
Yucca	459	-115.769882	37.013882	-115.757389	36.956775	5.97
Yucca	460	-115.762148	36.942499	-115.753820	36.919299	2.51
Yucca	461	-115.771071	36.941309	-115.771071	36.923463	1.83
Yucca	462	-115.790702	37.010908	-115.785943	36.941904	7.11
Yucca	463	-115.809143	36.942499	-115.821635	36.922273	2.40
Yucca	464	-115.882906	36.946068	-115.872198	36.911566	3.82
Yucca	465	-115.934659	37.034108	-115.928116	37.015667	1.99
Yucca	466	-115.944177	37.065636	-115.934659	37.044221	2.38
Yucca	467	-115.961428	37.194721	-115.940608	37.147132	5.26
Yucca	468	-115.823420	37.229224	-115.827584	37.162599	6.89
Yucca	469	-115.907296	37.282167	-115.923952	37.224465	6.12
Yucca	470	-115.844240	37.289305	-115.879932	37.261941	4.43
Yucca	471	-116.023889	37.217326	-116.046494	37.184014	4.04
Yucca	472	-116.031622	37.202455	-116.014371	37.005554	20.36
Yucca	473	-116.133939	37.223870	-116.126801	37.182229	4.31
Yucca	474	-116.132749	37.166168	-116.161303	37.098353	7.46
Yucca	475	-116.145836	37.119768	-116.150001	37.099543	2.11
Yucca	476	-116.229118	37.056118	-116.235661	37.025185	3.29
Yucca	477	-115.846619	37.310720	-115.850783	37.250639	6.53
Yucca	478	-115.843645	37.335704	-115.853758	37.316669	2.17

Appendix B (Continued)

Field Name	ID #	Start X	Start Y	End X	End Y	Length (km)
Yucca	479	-115.882906	37.336894	-115.895398	37.315479	2.49
Yucca	480	-115.897183	37.321428	-115.909080	37.305366	2.00
Yucca	481	-115.907890	37.325592	-115.917408	37.310720	1.77
Yucca	482	-115.920383	37.374371	-115.939418	37.320238	5.81
Yucca	483	-115.934064	37.378535	-115.945962	37.355335	2.63
Yucca	484	-116.013182	37.324402	-116.018535	37.307151	1.83
Yucca	485	-116.004853	37.305366	-116.036381	37.223870	9.40
Yucca	486	-115.997715	37.316074	-116.007233	37.243500	7.62
Yucca	487	-116.011397	37.486205	-115.986413	37.448729	4.73
Yucca	488	-116.135724	37.481446	-116.148811	37.455272	2.95
Yucca	489	-116.162493	37.439806	-116.185098	37.389837	5.88
Yucca	490	-116.177959	37.369017	-116.189857	37.350576	2.27
Yucca	491	-116.202944	37.348197	-116.199374	37.320238	2.87
Yucca	492	-116.354634	37.493939	-116.376644	37.441591	5.73
Yucca	493	-116.280276	37.435047	-116.281466	37.398165	3.76
Yucca	494	-116.273138	37.418391	-116.273733	37.389242	2.97
Yucca	495	-116.259456	37.153081	-116.236851	37.112630	4.67
Yucca	496	-116.242800	37.106681	-116.235661	37.076938	3.12
Yucca	497	-116.406387	37.138209	-116.406387	37.109061	2.98
Jaraguay	498	-115.550630	29.872054	-115.535972	29.877551	1.54
Jaraguay	499	-115.546762	29.870426	-115.532308	29.873276	1.43
Jaraguay	500	-115.533733	29.852918	-115.520907	29.865336	1.85
Jaraguay	501	-115.520500	29.855768	-115.515818	29.859025	0.58
Jaraguay	502	-115.523554	29.849661	-115.526811	29.846607	0.46
Jaraguay	503	-115.565084	29.839889	-115.519075	29.853325	4.68
Jaraguay	504	-115.514596	29.850882	-115.526404	29.841110	1.57
Jaraguay	505	-115.473066	29.826860	-115.459223	29.811591	2.16
Jaraguay	506	-115.458001	29.821567	-115.444972	29.807723	1.99
Jaraguay	507	-115.165719	29.863127	-115.178568	29.842783	2.58
Jaraguay	508	-115.142876	29.849564	-115.127529	29.855989	1.65
Jaraguay	509	-115.159294	29.723929	-115.175356	29.718218	1.67
Jaraguay	510	-115.101830	29.732852	-115.085769	29.709295	3.04
Jaraguay	511	-115.085412	29.709295	-115.085769	29.708581	0.09
Jaraguay	512	-114.961561	29.718932	-114.966915	29.708938	1.23
Jaraguay	513	-114.946214	29.690021	-114.900171	29.680028	4.63
Jaraguay	514	-114.926940	29.683240	-114.949426	29.680741	2.27
Jaraguay	515	-114.927654	29.671461	-114.916232	29.671818	1.10
Jaraguay	516	-114.933365	29.669320	-114.973696	29.668963	3.94
Jaraguay	517	-114.974767	29.663966	-114.953709	29.661468	2.05
Jaraguay	518	-114.837353	29.845638	-114.843421	29.837429	1.08
Jaraguay	519	-114.828073	29.847423	-114.834855	29.837786	1.25
Jaraguay	520	-114.815224	29.854204	-114.823434	29.841355	1.63
Jaraguay	521	-114.809514	29.855632	-114.815938	29.840641	1.78
Jaraguay	522	-114.795237	29.859915	-114.805588	29.843853	2.04
Jaraguay	523	-114.769182	29.869195	-114.787385	29.845995	3.12
Jaraguay	524	-114.761330	29.850278	-114.785243	29.823152	3.79
Jaraguay	525	-114.785243	29.823152	-114.793452	29.800309	2.84
Jaraguay	526	-114.737773	29.838143	-114.752764	29.828863	1.78

Appendix B (Continued)

Field Name	ID #	Start X	Start Y	End X	End Y	Length (km)
Jaraguay	527	-114.706721	29.851706	-114.742413	29.819940	4.93
Jaraguay	528	-114.744554	29.810303	-114.773822	29.779251	4.46
Jaraguay	529	-114.742056	29.788888	-114.775606	29.749984	5.40
Jaraguay	530	-114.706007	29.776039	-114.752407	29.715006	8.13
Jaraguay	531	-114.593578	29.913810	-114.592150	29.902031	1.31
Jaraguay	532	-114.582870	29.914880	-114.582513	29.909883	0.56
Jaraguay	533	-114.566809	29.910240	-114.564310	29.901674	0.98
Jaraguay	534	-114.556101	29.895964	-114.554316	29.876690	2.16
Jaraguay	535	-114.534329	29.888468	-114.539326	29.863484	2.81
Jaraguay	536	-114.545037	29.874192	-114.545393	29.855632	2.06
Jaraguay	537	-114.548606	29.834930	-114.537541	29.835287	1.07
Jaraguay	538	-114.543609	29.849921	-114.539326	29.823509	2.96
Jaraguay	539	-114.551461	29.871693	-114.554673	29.853133	2.08
Jaraguay	540	-114.580015	29.902031	-114.566095	29.872050	3.59
Jaraguay	541	-114.585725	29.895607	-114.583584	29.886684	1.01
Jaraguay	542	-114.577873	29.872764	-114.574661	29.863484	1.08
Jaraguay	543	-114.602144	29.888825	-114.592150	29.850278	4.39
Jaraguay	544	-114.609282	29.888468	-114.603571	29.859201	3.30
Jaraguay	545	-114.566809	29.838143	-114.568593	29.831361	0.77
Jaraguay	546	-114.527548	29.833146	-114.507203	29.771399	7.31
Jaraguay	547	-114.545393	29.814586	-114.498994	29.742845	9.41
Jaraguay	548	-114.524692	29.759264	-114.507917	29.746058	2.18
Jaraguay	549	-114.517911	29.771756	-114.507917	29.737491	3.93
Jaraguay	550	-114.516840	29.744630	-114.513985	29.736421	0.95
Jaraguay	551	-114.553246	29.762833	-114.532901	29.746771	2.65
Jaraguay	552	-114.557529	29.813515	-114.531474	29.780679	4.46
Jaraguay	553	-114.573233	29.817798	-114.550747	29.791386	3.65
Jaraguay	554	-114.553246	29.791029	-114.532901	29.761762	3.84
Jaraguay	555	-114.567879	29.807091	-114.553960	29.778894	3.41
Jaraguay	556	-114.611424	29.771756	-114.597861	29.762119	1.69
Jaraguay	557	-114.592507	29.765688	-114.515055	29.705726	10.11
Jaraguay	558	-114.542895	29.723929	-114.427253	29.551180	22.55
Jaraguay	559	-114.452238	29.678600	-114.436533	29.658255	2.72
Jaraguay	560	-114.379783	29.663609	-114.347303	29.652188	3.38
Jaraguay	561	-114.355156	29.624705	-114.338380	29.620065	1.72
Jaraguay	562	-114.374072	29.656828	-114.356583	29.648976	1.90
Jaraguay	563	-114.367648	29.648262	-114.375143	29.642908	0.94
Jaraguay	564	-114.377641	29.650403	-114.361937	29.637911	2.06
Jaraguay	565	-114.369075	29.648619	-114.359082	29.643622	1.11
Jaraguay	566	-114.470084	29.682883	-114.402269	29.602219	11.11
Jaraguay	567	-114.508988	29.731067	-114.390491	29.575093	20.88
Jaraguay	568	-114.357297	29.552250	-114.344805	29.535118	2.26
Jaraguay	569	-114.363722	29.551537	-114.357297	29.541186	1.31
Jaraguay	570	-114.364435	29.584730	-114.304116	29.537260	7.86
Jaraguay	571	-114.446527	29.525482	-114.421543	29.503709	3.42
Jaraguay	572	-114.417260	29.584730	-114.221311	29.403058	27.91
Jaraguay	573	-114.223452	29.403415	-114.223809	29.382714	2.31
Jaraguay	574	-114.327673	29.542257	-114.293409	29.490860	6.61

Appendix B (Continued)

Field Name	ID #	Start X	Start Y	End X	End Y	Length (km)
Jaraguay	575	-114.235231	29.490503	-114.232375	29.477297	1.50
Jaraguay	576	-114.205250	29.501568	-114.198111	29.484079	2.07
Jaraguay	577	-114.206677	29.485507	-114.192044	29.475156	1.82
Jaraguay	578	-114.274849	29.577592	-114.224880	29.445532	15.83
Jaraguay	579	-114.379426	29.601148	-114.248794	29.476227	19.18
Jaraguay	580	-114.329814	29.550466	-114.223809	29.408769	18.98
Jaraguay	581	-114.235945	29.384855	-114.234517	29.353446	3.51
Jaraguay	582	-114.254504	29.386283	-114.243440	29.348093	4.39
Jaraguay	583	-114.280916	29.385212	-114.250935	29.317755	8.10
Jaraguay	584	-114.279846	29.373791	-114.277704	29.361656	1.37
Jaraguay	585	-114.277704	29.354874	-114.266640	29.308118	5.33
Jaraguay	586	-114.263427	29.322038	-114.253791	29.301336	2.49
Jaraguay	587	-114.319821	29.305976	-114.269495	29.290272	5.16
Jaraguay	588	-114.213459	29.398418	-114.083897	29.353803	13.47
Jaraguay	589	-114.144216	29.400560	-114.162776	29.358800	4.99
Jaraguay	590	-114.072833	29.340954	-114.104955	29.312401	4.44
Jaraguay	591	-114.091392	29.344523	-114.074617	29.308832	4.30
Jaraguay	592	-114.101029	29.320253	-114.092820	29.303478	2.03
Jaraguay	593	-114.079257	29.340954	-114.074974	29.328462	1.46
Jaraguay	594	-114.070691	29.341668	-114.063910	29.318825	2.63
Jaraguay	595	-114.072833	29.302407	-114.063196	29.293841	1.33
Jaraguay	596	-114.079614	29.300266	-114.043922	29.275638	4.41
Jaraguay	597	-114.153853	29.251725	-114.173484	29.502996	28.11
Jaraguay	598	-114.456878	29.337028	-114.288412	29.288487	17.32
Jaraguay	599	-114.430109	29.338099	-114.404054	29.317398	3.49
Jaraguay	600	-114.262357	29.287060	-114.186690	29.241731	8.90
Jaraguay	601	-114.295907	29.284204	-114.237372	29.267786	6.01
Jaraguay	602	-114.248794	29.295626	-114.168487	29.252795	9.48
Jaraguay	603	-114.270209	29.274567	-114.089965	29.166778	21.23
Jaraguay	604	-114.167773	29.295269	-114.123515	29.248869	6.72
Jaraguay	605	-114.017510	29.282063	-113.972181	29.263860	4.82
Jaraguay	606	-114.022150	29.278137	-113.993240	29.263146	3.25
Jaraguay	607	-114.041424	29.278493	-114.007159	29.249226	4.65
Jaraguay	608	-114.028218	29.247441	-113.999307	29.233165	3.33
Jaraguay	609	-113.992169	29.227811	-113.981104	29.222457	1.22
Jaraguay	610	-114.010372	29.220673	-113.986101	29.212463	2.54
Jaraguay	611	-114.015725	29.210679	-114.009301	29.207467	0.72
Jaraguay	612	-114.123515	29.137153	-114.121017	29.121449	1.77
Jaraguay	613	-114.107097	29.128587	-114.106026	29.116452	1.36
Jaraguay	614	-114.110309	29.101105	-114.106740	29.062557	4.32
Jaraguay	615	-114.122801	29.093609	-114.114235	29.040071	6.05
Jaraguay	616	-114.130297	29.086114	-114.121374	29.032933	6.01
Jaraguay	617	-114.106740	29.032933	-114.102100	28.995100	4.26
Jaraguay	618	-114.112451	28.968688	-114.090678	28.853403	13.16
Jaraguay	619	-114.244154	28.986177	-114.226308	28.904799	9.38
Jaraguay	620	-114.349802	29.043641	-114.242012	28.893021	20.04
Jaraguay	621	-114.281987	28.920147	-114.269852	28.891593	3.45

Appendix B (Continued)

Field Name	ID #	Start X	Start Y	End X	End Y	Length (km)
Jaraguay	622	-114.263427	28.898731	-114.245581	28.870178	3.71
Jaraguay	623	-114.417260	28.892664	-114.350873	28.850904	7.96
Jaraguay	624	-114.300190	29.093252	-114.324104	29.063985	4.06
Jaraguay	625	-114.442244	29.141080	-114.371931	29.116095	7.53
Jaraguay	626	-114.446884	29.303478	-114.465444	29.297767	1.90
Jaraguay	627	-114.551461	29.290629	-114.447241	29.295982	10.08
Jaraguay	628	-114.651755	29.317398	-114.593221	29.275995	7.30
Jaraguay	629	-114.625700	29.237805	-114.593934	29.223528	3.45
Jaraguay	630	-114.614636	29.177842	-114.594648	29.151787	3.58
Jaraguay	631	-114.619633	29.161781	-114.582513	29.127874	5.35
Jaraguay	632	-113.961117	29.229952	-113.959689	29.223885	0.69
Jaraguay	633	-113.950052	29.247085	-113.953265	29.228882	2.06
Jaraguay	634	-113.943271	29.238519	-113.945769	29.226026	1.42
Jaraguay	635	-114.613653	29.078497	-114.567551	29.052025	5.34
Jaraguay	636	-115.090220	29.575563	-115.057479	29.573469	3.17
Jaraguay	637	-115.106210	29.543964	-115.059192	29.534446	4.66
San Borja	638	-114.140746	28.974194	-114.032821	28.687935	34.16
San Borja	639	-114.172488	28.749111	-114.010313	28.640033	19.94
San Borja	640	-114.083032	28.674084	-114.085341	28.648113	2.92
San Borja	641	-113.782922	28.590399	-113.748294	28.547692	5.92
San Borja	642	-113.767340	28.559234	-113.750603	28.545383	2.24
San Borja	643	-113.835441	28.601365	-113.784077	28.570777	6.03
San Borja	644	-113.927206	28.529223	-113.833133	28.544806	9.24
San Borja	645	-113.975685	28.507292	-113.850447	28.532686	12.43
San Borja	646	-113.990113	28.443230	-113.881035	28.377437	13.13
San Borja	647	-113.906429	28.381477	-113.871801	28.360123	4.12
San Borja	648	-113.753134	28.992018	-113.683178	28.950615	8.19
San Borja	649	-113.701738	28.959657	-113.674136	28.920158	5.16
San Borja	650	-113.671757	28.889225	-113.656528	28.881611	1.70
San Borja	651	-113.738382	28.804992	-113.644631	28.838304	9.81
San Borja	652	-113.624168	28.885894	-113.614174	28.822124	7.22
San Borja	653	-113.743616	28.774535	-113.655101	28.792619	8.79
San Borja	654	-113.591331	28.883514	-113.595138	28.809275	8.33
San Borja	655	-113.583241	28.892080	-113.586096	28.854961	4.27
San Borja	656	-113.578958	28.859244	-113.582289	28.832118	3.14
San Borja	657	-113.569440	28.836401	-113.578482	28.824979	1.55
San Borja	658	-113.586572	28.797378	-113.544694	28.954898	18.30
San Borja	659	-113.594662	28.942049	-113.528989	28.854485	11.75
San Borja	660	-113.559922	28.807371	-113.549452	28.793571	1.85
San Borja	661	-113.568488	28.803088	-113.554687	28.790239	1.96
San Borja	662	-113.571819	28.794522	-113.561826	28.783101	1.60
San Borja	663	-113.582289	28.795474	-113.595138	28.767396	3.39
San Borja	664	-113.463792	28.770252	-113.481400	28.748361	2.99
San Borja	665	-113.551832	28.783577	-113.500911	28.627484	18.37
San Borja	666	-113.544218	28.725518	-113.542314	28.716476	1.03
San Borja	667	-113.531369	28.705055	-113.529465	28.685067	2.25
San Borja	668	-113.524706	28.683164	-113.519947	28.654134	3.29

Appendix B (Continued)

Field Name	ID #	Start X	Start Y	End X	End Y	Length (km)
San Borja	669	-113.551356	28.719331	-113.535176	28.655086	7.46
San Borja	670	-113.594662	28.726946	-113.544218	28.670314	8.13
San Borja	671	-113.551832	28.711717	-113.393360	28.452356	35.18
San Borja	672	-113.517568	28.633671	-113.558494	28.597979	5.63
San Borja	673	-113.502815	28.534685	-113.455226	28.471392	8.50
San Borja	674	-113.504243	28.524691	-113.499484	28.415712	12.34
San Borja	675	-113.488062	28.437603	-113.489966	28.410953	3.00
San Borja	676	-113.518044	28.502325	-113.514236	28.460446	4.75
San Borja	677	-113.359571	28.547534	-113.357668	28.534685	1.46
San Borja	678	-113.354813	28.568474	-113.348626	28.538016	3.48
San Borja	679	-113.331018	28.517553	-113.321500	28.501849	1.99
San Borja	680	-113.337680	28.558956	-113.293898	28.504704	7.64
San Borja	681	-113.342439	28.567998	-113.273435	28.546107	7.15
San Borja	682	-113.311030	28.545631	-113.255827	28.479482	9.21
San Borja	683	-113.301989	28.553245	-113.246309	28.483765	9.48
San Borja	684	-113.308175	28.584654	-113.231556	28.507559	11.41
San Borja	685	-113.133523	28.581323	-113.145420	28.538492	4.95
San Borja	686	-113.190630	28.615111	-113.169215	28.585606	3.91
San Borja	687	-113.255827	28.643665	-113.234412	28.613683	4.32
San Borja	688	-113.254399	28.611780	-113.213948	28.587985	4.73
San Borja	689	-113.306272	28.696489	-113.301513	28.659369	4.25
San Borja	690	-113.320548	28.717904	-113.316741	28.702675	1.75
San Borja	691	-113.290567	28.729325	-113.294850	28.704579	2.86
San Borja	692	-113.239171	28.688398	-113.243454	28.672694	1.81
San Borja	693	-113.230605	28.696964	-113.232032	28.682212	1.66
San Borja	694	-113.254399	28.713621	-113.213948	28.718380	3.96
San Borja	695	-113.203479	28.737891	-113.210617	28.715048	2.65
San Borja	696	-113.193009	28.741222	-113.198720	28.706958	3.88
San Borja	697	-113.193961	28.682212	-113.196340	28.666031	1.83
San Borja	698	-113.206810	28.709814	-113.199196	28.668887	4.71
San Borja	699	-113.211093	28.700772	-113.208714	28.630340	8.11
San Borja	700	-113.218707	28.699820	-113.222039	28.689826	1.17
San Borja	701	-113.225846	28.714097	-113.232032	28.668411	5.28
San Borja	702	-113.236791	28.760258	-113.220135	28.719807	4.87
San Borja	703	-113.203955	28.765017	-113.197768	28.749313	1.86
San Borja	704	-113.260110	28.758830	-113.262965	28.746457	1.42
San Borja	705	-113.326259	28.709814	-113.327687	28.677929	3.63
San Borja	706	-113.328639	28.744078	-113.345295	28.631767	12.77
San Borja	707	-113.359571	28.676025	-113.358620	28.658417	1.99
San Borja	708	-113.361951	28.659369	-113.367186	28.639381	2.37
San Borja	709	-113.363379	28.668887	-113.366234	28.661273	0.90
San Borja	710	-113.377180	28.670790	-113.376704	28.658893	1.34
San Borja	711	-113.389553	28.675073	-113.390504	28.663652	1.29
San Borja	712	-113.384318	28.710765	-113.359571	28.694109	3.03
San Borja	713	-113.349578	28.755023	-113.358620	28.645568	12.64
San Borja	714	-113.391456	28.722663	-113.358144	28.699820	4.11
San Borja	715	-113.413823	28.733608	-113.392884	28.719807	2.55

Appendix B (Continued)

Field Name	ID #	Start X	Start Y	End X	End Y	Length (km)
San Borja	716	-113.413823	28.718855	-113.409064	28.714572	0.66
San Borja	717	-113.412396	28.710765	-113.413347	28.691254	2.19
San Borja	718	-113.435238	28.719331	-113.430955	28.695061	2.87
San Borja	719	-113.436666	28.702199	-113.409540	28.697916	2.66
San Borja	720	-113.367662	28.730277	-113.359096	28.720283	1.39
San Borja	721	-113.327211	28.796902	-113.156841	28.504228	37.55
San Borja	722	-113.262489	28.793571	-113.279146	28.663176	14.78
San Borja	723	-113.279146	28.787384	-113.327211	28.635574	17.72
San Borja	724	-113.283905	28.809751	-113.276766	28.783577	3.02
San Borja	725	-113.350530	28.781673	-113.360047	28.735988	5.43
San Borja	726	-113.361475	28.746457	-113.361475	28.739795	0.75
San Borja	727	-113.364806	28.747409	-113.365758	28.735512	1.34
San Borja	728	-113.367662	28.747885	-113.376228	28.743126	0.98
San Borja	729	-113.388125	28.751216	-113.395739	28.737415	1.71
San Borja	730	-113.422389	28.760258	-113.392408	28.731229	4.42
San Borja	731	-113.419534	28.746933	-113.409064	28.733132	1.85
San Borja	732	-113.425721	28.747885	-113.417630	28.736463	1.50
San Borja	733	-113.410492	28.768824	-113.419058	28.683164	9.80
San Borja	734	-113.390029	28.777390	-113.387173	28.755975	2.42
San Borja	735	-113.453798	28.916351	-113.420010	28.917778	3.26
San Borja	736	-113.425245	28.916351	-113.395739	28.900170	3.37
San Borja	737	-113.380035	28.901598	-113.353385	28.863527	5.02
San Borja	738	-113.389077	28.879707	-113.384794	28.771680	13.27
San Borja	739	-113.387649	28.785004	-113.420486	28.711241	8.86
San Borja	740	-113.404781	28.793095	-113.424293	28.765969	3.73
San Borja	741	-113.425245	28.837829	-113.411444	28.815937	2.79
San Borja	742	-113.265563	28.407523	-113.203102	28.406333	6.05
San Borja	743	-113.220353	28.389082	-113.207266	28.373616	2.15
San Borja	744	-113.203102	28.374805	-113.185256	28.362908	2.18
San Borja	745	-113.179902	28.377780	-113.159082	28.360528	2.79
San Borja	746	-113.107924	28.389677	-113.088888	28.375995	2.40
San Borja	747	-113.086509	28.376590	-113.072232	28.361123	2.22
San Borja	748	-113.091862	28.371831	-113.078775	28.359934	1.84
San Borja	749	-113.080560	28.379564	-113.000253	28.280817	13.84
San Borja	750	-113.072827	28.392651	-113.060929	28.380754	1.76
San Borja	751	-113.072827	28.404549	-113.017504	28.351011	8.18
San Borja	752	-113.031781	28.356959	-113.026427	28.347441	1.19
San Borja	753	-113.046058	28.360528	-113.032376	28.349226	1.83
San Borja	754	-113.066878	28.374210	-113.058550	28.363503	1.45
San Borja	755	-112.983002	28.297473	-112.989545	28.222520	8.67
San Borja	756	-113.090078	28.311155	-113.065688	28.276058	4.60
San Borja	757	-113.069852	28.319483	-113.240579	28.408118	19.62
San Borja	758	-113.332188	28.310560	-113.302445	28.273678	5.05
San Borja	759	-113.411305	28.300447	-113.256045	28.183853	21.10
San Borja	760	-113.432125	28.265350	-113.342895	28.239176	9.24
San Borja	761	-113.451161	28.247504	-113.358957	28.211812	9.97
San Borja	762	-113.340516	28.221925	-113.379777	28.200510	4.49

Appendix B (Continued)

Field Name	ID #	Start X	Start Y	End X	End Y	Length (km)
San Borja	763	-113.235225	28.234417	-113.230466	28.228468	0.81
San Borja	764	-113.237009	28.229063	-113.231061	28.218356	1.34
San Borja	765	-113.243553	28.265350	-113.217974	28.230848	4.61
San Borja	766	-113.191800	28.232632	-113.178118	28.177310	6.39
San Borja	767	-113.260804	28.213002	-113.228681	28.201699	3.35
San Borja	768	-113.247122	28.200510	-113.141831	28.190992	10.27
San Borja	769	-113.240579	28.180879	-113.185256	28.160059	6.02
San Borja	770	-113.176928	28.155895	-113.140046	28.151136	3.62
San Borja	771	-113.168005	28.152921	-113.093052	28.143998	7.40
San Borja	772	-113.184661	28.280222	-113.154323	28.240366	5.36
San Borja	773	-113.232845	28.396815	-113.044868	28.130316	35.50
San Borja	774	-113.177523	28.336734	-113.149564	28.284386	6.48
San Borja	775	-113.154918	28.315914	-113.126364	28.284386	4.59
San Borja	776	-113.112683	28.306991	-113.092457	28.265945	5.02
San Borja	777	-113.084129	28.268324	-113.073421	28.239176	3.44
San Borja	778	-113.100785	28.268919	-113.075801	28.255237	2.86
San Borja	779	-113.062714	28.247504	-113.069257	28.244530	0.71
San Borja	780	-113.121606	28.273083	-113.115657	28.270109	0.66
San Borja	781	-113.121011	28.264755	-113.108519	28.254048	1.71
San Borja	782	-113.105544	28.254048	-113.097811	28.249289	0.92
San Borja	783	-113.128149	28.261781	-113.121606	28.257617	0.79
San Borja	784	-113.134693	28.258212	-113.116847	28.244530	2.31
San Borja	785	-112.940172	28.318293	-112.887229	28.210028	13.39
San Borja	786	-112.892582	28.230253	-112.860460	28.221330	3.26
San Borja	787	-112.888418	28.273083	-112.875926	28.249884	2.88
San Borja	788	-112.878306	28.271894	-112.872952	28.253453	2.14
San Borja	789	-112.869383	28.256427	-112.869978	28.242745	1.54
San Borja	790	-112.886634	28.252858	-112.796214	28.179689	12.29
San Borja	791	-112.978243	28.317103	-112.968725	28.246314	8.09
San Borja	792	-113.069852	28.320673	-112.853321	28.097598	33.48
San Borja	793	-112.889013	28.153515	-112.872357	28.131505	3.17
San Borja	794	-112.988951	28.125557	-112.979433	28.101167	2.90
San Borja	795	-112.969915	28.141023	-112.966346	28.130910	1.19
San Borja	796	-112.960992	28.143998	-112.958612	28.127341	1.89
San Borja	797	-112.933033	28.155895	-112.932438	28.141618	1.61
San Borja	798	-112.893772	28.117823	-112.900911	28.057147	6.88
San Borja	799	-112.896746	28.089270	-112.894962	28.048819	4.70
San Borja	800	-112.883065	28.033353	-112.887824	28.011937	2.46
San Borja	801	-112.874142	28.035137	-112.875926	28.019076	1.82
Michoacan-Guanauato	802	-101.572921	20.803352	-101.616369	20.769779	5.80
Michoacan-Guanauato	803	-101.626902	20.761221	-101.616369	20.746738	2.01
Michoacan-Guanauato	804	-101.651917	20.745422	-101.668374	20.730281	2.41
Michoacan-Guanauato	805	-101.653233	20.715140	-101.667058	20.697366	2.51
Michoacan-Guanauato	806	-101.584112	20.771095	-101.578188	20.775045	0.74
Michoacan-Guanauato	807	-101.574238	20.773728	-101.554489	20.791502	2.85
Michoacan-Guanauato	808	-101.559097	20.759246	-101.585429	20.747397	2.91
Michoacan-Guanauato	809	-101.588720	20.725673	-101.578188	20.715140	1.62
Michoacan-Guanauato	810	-101.577529	20.712507	-101.592670	20.706582	1.62

Appendix B (Continued)

Field Name	ID #	Start X	Start Y	End X	End Y	Length (km)
Michoacan-Guanauato	811	-101.597937	20.713165	-101.584771	20.699999	2.02
Michoacan-Guanauato	812	-101.580163	20.696708	-101.576213	20.692758	0.61
Michoacan-Guanauato	813	-101.574238	20.693416	-101.564364	20.682225	1.64
Michoacan-Guanauato	814	-101.499192	20.730281	-101.527499	20.714482	3.32
Michoacan-Guanauato	815	-101.513017	20.711849	-101.506434	20.700658	1.48
Michoacan-Guanauato	816	-101.494584	20.699999	-101.509067	20.692758	1.64
Michoacan-Guanauato	817	-101.485368	20.686833	-101.497217	20.682225	1.27
Michoacan-Guanauato	818	-101.521574	20.693416	-101.569630	20.673668	5.20
Michoacan-Guanauato	819	-101.558439	20.678276	-101.538690	20.649311	3.95
Michoacan-Guanauato	820	-101.538032	20.674326	-101.549881	20.667743	1.39
Michoacan-Guanauato	821	-101.511042	20.682225	-101.505775	20.662477	2.42
Michoacan-Guanauato	822	-101.501826	20.664451	-101.518283	20.657210	1.81
Michoacan-Guanauato	823	-101.451137	20.678276	-101.482077	20.652602	4.28
Michoacan-Guanauato	824	-101.401106	20.707241	-101.416247	20.694075	2.15
Michoacan-Guanauato	825	-101.384649	20.705266	-101.412297	20.683542	3.72
Michoacan-Guanauato	826	-101.668374	20.560441	-101.640726	20.505144	7.13
Michoacan-Guanauato	827	-101.667058	20.539375	-101.659158	20.543325	0.90
Michoacan-Guanauato	828	-101.666399	20.512385	-101.651258	20.521601	1.83
Michoacan-Guanauato	829	-101.549223	20.422199	-101.501167	20.441948	5.20
Michoacan-Guanauato	830	-101.530791	20.427465	-101.532765	20.393892	4.03
Michoacan-Guanauato	831	-101.548564	20.411008	-101.524208	20.383360	4.06
Michoacan-Guanauato	832	-101.516308	20.416274	-101.516966	20.388626	3.31
Michoacan-Guanauato	833	-101.549881	20.393234	-101.524208	20.370194	3.71
Michoacan-Guanauato	834	-101.521574	20.365586	-101.493268	20.383360	3.46
Michoacan-Guanauato	835	-101.668374	20.279349	-101.646650	20.289882	2.45
Michoacan-Guanauato	836	-101.668374	20.270791	-101.652575	20.278691	1.79
Michoacan-Guanauato	837	-101.669032	20.264208	-101.644675	20.272766	2.56
Michoacan-Guanauato	838	-101.613077	20.251042	-101.605836	20.239193	1.58
Michoacan-Guanauato	839	-101.611102	20.235902	-101.571605	20.254992	4.45
Michoacan-Guanauato	840	-101.357001	20.246434	-101.344493	20.233927	1.92
Michoacan-Guanauato	841	-101.325403	20.245118	-101.355026	20.209570	5.19
Michoacan-Guanauato	842	-101.355026	20.221419	-101.346468	20.226027	0.99
Michoacan-Guanauato	843	-101.334619	20.229977	-101.316845	20.241168	2.18
Michoacan-Guanauato	844	-101.340543	20.226685	-101.335935	20.214178	1.56
Michoacan-Guanauato	845	-101.312237	20.226685	-101.337252	20.206937	3.38
Michoacan-Guanauato	846	-101.330011	20.207595	-101.323428	20.201670	0.95
Michoacan-Guanauato	847	-101.284588	20.152956	-101.284588	20.136499	1.97
Michoacan-Guanauato	848	-101.496559	20.160856	-101.510383	20.152956	1.64
Michoacan-Guanauato	849	-101.491951	20.154931	-101.504459	20.147690	1.49
Michoacan-Guanauato	850	-101.529474	20.134524	-101.550539	20.125308	2.31
Michoacan-Guanauato	851	-101.580163	20.112800	-101.569630	20.109509	1.09
Michoacan-Guanauato	852	-101.582796	20.098318	-101.568972	20.110167	1.95
Michoacan-Guanauato	853	-101.501826	20.085810	-101.482077	20.088444	1.93
Michoacan-Guanauato	854	-101.313553	20.117409	-101.324744	20.106876	1.66
Michoacan-Guanauato	855	-101.322769	20.098976	-101.306312	20.118067	2.79
Michoacan-Guanauato	856	-101.301046	20.106876	-101.310262	20.098318	1.36
Michoacan-Guanauato	857	-101.297754	20.096343	-101.348443	20.099635	4.91
Michoacan-Guanauato	858	-101.355026	20.099635	-101.341202	20.090418	1.73

Appendix B (Continued)

Field Name	ID #	Start X	Start Y	End X	End Y	Length (km)
Michoacan-Guanauato	859	-101.358317	20.093052	-101.348443	20.089760	1.03
Michoacan-Guanauato	860	-101.367533	20.093710	-101.355026	20.085152	1.58
Michoacan-Guanauato	861	-101.364900	20.089102	-101.393865	20.079886	3.01
Michoacan-Guanauato	862	-101.424147	20.077911	-101.464303	20.060137	4.42
Michoacan-Guanauato	863	-101.475494	20.060795	-101.487343	20.063428	1.19
Michoacan-Guanauato	864	-101.301704	20.081861	-101.320136	20.075936	1.92
Michoacan-Guanauato	865	-101.301704	20.095685	-101.349759	20.076594	5.17
Michoacan-Guanauato	866	-101.352393	20.063428	-101.330669	20.072645	2.37
Michoacan-Guanauato	867	-101.336594	20.060795	-101.312895	20.063428	2.31
Michoacan-Guanauato	868	-101.274056	20.083177	-101.253648	20.087127	2.03
Michoacan-Guanauato	869	-101.274056	20.071328	-101.258257	20.075278	1.60
Michoacan-Guanauato	870	-101.551856	20.063428	-101.586746	20.046971	4.13
Michoacan-Guanauato	871	-101.557781	20.050262	-101.545273	20.058820	1.58
Michoacan-Guanauato	872	-101.526182	20.064745	-101.504459	20.050921	2.67
Michoacan-Guanauato	873	-101.466278	20.042363	-101.393865	20.074619	8.26
Michoacan-Guanauato	874	-101.395182	20.079227	-101.362925	20.049604	4.73
Michoacan-Guanauato	875	-101.216126	20.064745	-101.268131	20.048288	5.45
Michoacan-Guanauato	876	-101.264839	20.050262	-101.272739	20.034463	2.04
Michoacan-Guanauato	877	-101.317503	20.025906	-101.260890	20.036438	5.62
Michoacan-Guanauato	878	-101.345151	20.039730	-101.376091	20.023931	3.69
Michoacan-Guanauato	879	-101.368192	20.052896	-101.398473	20.030514	3.97
Michoacan-Guanauato	880	-101.403740	20.043680	-101.417564	20.035780	1.64
Michoacan-Guanauato	881	-101.461670	20.035780	-101.444554	20.035122	1.65
Michoacan-Guanauato	882	-101.454428	20.026564	-101.439288	20.033147	1.66
Michoacan-Guanauato	883	-101.497217	20.036438	-101.467594	20.053554	3.52
Michoacan-Guanauato	884	-101.508408	20.041705	-101.459036	20.012081	5.94
Michoacan-Guanauato	885	-101.446529	20.016689	-101.482735	19.998257	4.17
Michoacan-Guanauato	886	-101.396498	20.033147	-101.462328	19.996282	8.12
Michoacan-Guanauato	887	-101.407031	20.023931	-101.387941	20.002207	3.19
Michoacan-Guanauato	888	-101.395840	20.006815	-101.422830	19.998257	2.80
Michoacan-Guanauato	889	-101.347785	20.029855	-101.359634	20.021298	1.54
Michoacan-Guanauato	890	-101.344493	20.025906	-101.368192	20.014056	2.69
Michoacan-Guanauato	891	-101.338568	20.023272	-101.303021	20.000232	4.41
Michoacan-Guanauato	892	-101.318820	20.016689	-101.287221	20.010765	3.13
Michoacan-Guanauato	893	-101.297096	20.011423	-101.302362	19.992333	2.35
Michoacan-Guanauato	894	-101.275372	20.011423	-101.283930	19.991674	2.51
Michoacan-Guanauato	895	-101.254307	20.015373	-101.197693	20.035780	6.09
Michoacan-Guanauato	896	-101.191110	20.018006	-101.218759	20.012740	2.74
Michoacan-Guanauato	897	-101.203618	20.004182	-101.181236	20.010107	2.27
Michoacan-Guanauato	898	-101.191769	19.996941	-101.201643	19.994307	1.00
Michoacan-Guanauato	899	-101.270764	19.996282	-101.210859	19.994966	6.08
Michoacan-Guanauato	900	-101.249699	19.989041	-101.194402	19.987066	5.35
Michoacan-Guanauato	901	-101.194402	19.987066	-101.247724	19.977192	5.54
Michoacan-Guanauato	902	-101.231925	19.972584	-101.202301	19.980483	3.01
Michoacan-Guanauato	903	-101.220075	19.971925	-101.179261	19.964026	4.16
Michoacan-Guanauato	904	-101.311578	20.004182	-101.366217	19.994307	5.50
Michoacan-Guanauato	905	-101.360292	20.000232	-101.336594	20.000890	2.29
Michoacan-Guanauato	906	-101.345151	19.991674	-101.308945	19.985091	3.58

Appendix B (Continued)

Field Name	ID #	Start X	Start Y	End X	End Y	Length (km)
Michoacan-Guanauato	907	-101.324086	20.005498	-101.596620	19.942960	28.20
Michoacan-Guanauato	908	-101.534082	19.971925	-101.565022	19.958101	3.46
Michoacan-Guanauato	909	-101.551856	19.985750	-101.584771	19.967976	3.83
Michoacan-Guanauato	910	-101.536057	20.026564	-101.549881	20.013398	2.07
Michoacan-Guanauato	911	-101.582796	20.008790	-101.571605	19.994966	1.98
Michoacan-Guanauato	912	-101.545931	20.002865	-101.524866	20.003524	2.03
Michoacan-Guanauato	913	-101.520258	20.023272	-101.520258	20.010765	1.50
Michoacan-Guanauato	914	-101.509067	20.019323	-101.518941	20.008132	1.65
Michoacan-Guanauato	915	-101.499851	20.010765	-101.479444	20.008132	1.99
Michoacan-Guanauato	916	-101.590037	19.981800	-101.620319	19.963368	3.67
Michoacan-Guanauato	917	-101.709847	19.978508	-101.698656	19.985091	1.34
Michoacan-Guanauato	918	-101.750003	19.937036	-101.726304	19.948227	2.65
Michoacan-Guanauato	919	-101.745395	19.925845	-101.718404	19.942960	3.32
Michoacan-Guanauato	920	-101.743420	19.921895	-101.655208	19.940986	9.61
Michoacan-Guanauato	921	-101.685490	19.931769	-101.660475	19.944935	2.89
Michoacan-Guanauato	922	-101.719063	19.927820	-101.697997	19.948227	3.18
Michoacan-Guanauato	923	-101.697997	19.944935	-101.706555	19.925845	2.44
Michoacan-Guanauato	924	-101.688123	19.952177	-101.639409	19.984433	6.16
Michoacan-Guanauato	925	-101.630193	19.983116	-101.648625	19.950860	4.26
Michoacan-Guanauato	926	-101.661791	19.958101	-101.688123	19.948227	2.80
Michoacan-Guanauato	927	-101.663108	19.986408	-101.689440	19.973242	2.99
Michoacan-Guanauato	928	-101.642042	19.934403	-101.620319	19.944935	2.45
Michoacan-Guanauato	929	-101.642042	19.911362	-101.622952	19.921895	2.25
Michoacan-Guanauato	930	-101.584771	19.935719	-101.556464	19.946910	3.04
Michoacan-Guanauato	931	-101.582137	19.925186	-101.545273	19.939669	3.96
Michoacan-Guanauato	932	-101.544615	19.939669	-101.520258	19.932428	2.51
Michoacan-Guanauato	933	-101.526841	19.937036	-101.405715	19.970609	13.48
Michoacan-Guanauato	934	-101.636776	19.833684	-101.602545	19.844875	3.57
Michoacan-Guanauato	935	-101.664424	19.815251	-101.605836	19.824467	5.80
Michoacan-Guanauato	936	-101.585429	19.824467	-101.566338	19.826442	1.86
Michoacan-Guanauato	937	-101.622293	19.819201	-101.661791	19.796161	4.71
Michoacan-Guanauato	938	-101.633484	19.802744	-101.612419	19.803402	2.03
Michoacan-Guanauato	939	-101.570288	19.879764	-101.489976	19.917287	9.09
Michoacan-Guanauato	940	-101.491951	19.915970	-101.511042	19.894905	3.13
Michoacan-Guanauato	941	-101.403081	19.952177	-101.478785	19.923870	8.23
Michoacan-Guanauato	942	-101.402423	19.939011	-101.422830	19.932428	2.12
Michoacan-Guanauato	943	-101.370825	19.930453	-101.400448	19.921237	3.22
Michoacan-Guanauato	944	-101.450479	19.917287	-101.385966	19.889639	7.06
Michoacan-Guanauato	945	-101.484710	19.895563	-101.459695	19.914654	3.33
Michoacan-Guanauato	946	-101.474177	19.892272	-101.443237	19.902804	3.24
Michoacan-Guanauato	947	-101.524866	19.861990	-101.486026	19.877789	4.20
Michoacan-Guanauato	948	-101.570288	19.840266	-101.529474	19.854091	4.27
Michoacan-Guanauato	949	-101.561730	19.832367	-101.546590	19.842900	1.93
Michoacan-Guanauato	950	-101.536715	19.837633	-101.514333	19.848824	2.54
Michoacan-Guanauato	951	-101.517625	19.852116	-101.488660	19.860015	2.95
Michoacan-Guanauato	952	-101.473519	19.857382	-101.466278	19.860674	0.80
Michoacan-Guanauato	953	-101.509067	19.839608	-101.447845	19.858699	6.43
Michoacan-Guanauato	954	-101.492609	19.829734	-101.482077	19.831050	1.03

Appendix B (Continued)

Field Name	ID #	Start X	Start Y	End X	End Y	Length (km)
Michoacan-Guanauato	955	-101.470227	19.833684	-101.460353	19.836975	1.03
Michoacan-Guanauato	956	-101.492609	19.815251	-101.482077	19.817226	1.04
Michoacan-Guanauato	957	-101.561072	19.796819	-101.505117	19.817226	5.93
Michoacan-Guanauato	958	-101.605836	19.777070	-101.527499	19.792211	7.84
Michoacan-Guanauato	959	-101.474177	19.792869	-101.466278	19.795502	0.83
Michoacan-Guanauato	960	-101.466936	19.817226	-101.347785	19.873840	13.43
Michoacan-Guanauato	961	-101.419539	19.827759	-101.411639	19.840266	1.69
Michoacan-Guanauato	962	-101.445870	19.803402	-101.426780	19.811960	2.11
Michoacan-Guanauato	963	-101.417564	19.815251	-101.397157	19.817884	1.99
Michoacan-Guanauato	964	-101.430071	19.795502	-101.416247	19.804060	1.68
Michoacan-Guanauato	965	-101.367533	19.857382	-101.289196	19.891613	8.85
Michoacan-Guanauato	966	-101.280639	19.896222	-101.171362	19.843558	12.38
Michoacan-Guanauato	967	-101.245091	19.856724	-101.232583	19.860674	1.30
Michoacan-Guanauato	968	-101.337910	19.865940	-101.290513	19.877131	4.86
Michoacan-Guanauato	969	-101.299729	19.865940	-101.291171	19.870548	0.99
Michoacan-Guanauato	970	-101.358317	19.843558	-101.345810	19.850799	1.49
Michoacan-Guanauato	971	-101.343177	19.834342	-101.380699	19.813276	4.58
Michoacan-Guanauato	972	-101.337910	19.842900	-101.295121	19.858699	4.54
Michoacan-Guanauato	973	-101.278005	19.853432	-101.344493	19.824467	7.52
Michoacan-Guanauato	974	-101.279322	19.850141	-101.255623	19.860015	2.58
Michoacan-Guanauato	975	-101.253648	19.838292	-101.227317	19.816568	3.64
Michoacan-Guanauato	976	-101.231925	19.849483	-101.200327	19.813935	5.25
Michoacan-Guanauato	977	-101.237191	19.808010	-101.255623	19.787603	12.14
Michoacan-Guanauato	978	-101.274714	19.840266	-101.258257	19.810643	3.90
Michoacan-Guanauato	979	-101.279322	19.823151	-101.286563	19.805377	2.25
Michoacan-Guanauato	980	-101.286563	19.841583	-101.308287	19.820518	3.29
Michoacan-Guanauato	981	-101.321453	19.801427	-101.370167	19.765221	6.44
Michoacan-Guanauato	982	-101.317503	19.791553	-101.336594	19.765879	3.59
Michoacan-Guanauato	983	-101.275372	19.744814	-101.246407	19.755346	3.07
Michoacan-Guanauato	984	-101.236533	19.750080	-101.170703	19.763246	6.66
Michoacan-Guanauato	985	-101.927742	19.952177	-101.916551	19.954151	1.11
Michoacan-Guanauato	986	-101.910627	19.957443	-101.898777	19.985091	3.51
Michoacan-Guanauato	987	-101.904044	19.956126	-101.879687	19.960076	2.40
Michoacan-Guanauato	988	-101.881662	19.946910	-101.853355	19.950202	2.76
Michoacan-Guanauato	989	-101.799375	19.980483	-101.769093	19.986408	3.01
Michoacan-Guanauato	990	-101.799375	19.898196	-101.778309	19.900171	2.06
Michoacan-Guanauato	991	-101.640067	19.617763	-101.611102	19.634879	3.72
Michoacan-Guanauato	992	-101.599253	19.625662	-101.636118	19.605255	4.44
Michoacan-Guanauato	993	-101.626902	19.519019	-101.726304	19.476230	11.42
Michoacan-Guanauato	994	-101.470227	19.565758	-101.483393	19.553908	1.91
Michoacan-Guanauato	995	-101.482077	19.539426	-101.489318	19.524943	1.88
Michoacan-Guanauato	996	-101.385307	19.655286	-101.402423	19.647386	1.91
Michoacan-Guanauato	997	-101.359634	19.633562	-101.394524	19.599989	5.34
Michoacan-Guanauato	998	-101.372800	19.599331	-101.383332	19.567074	4.01
Michoacan-Guanauato	999	-101.405056	19.561150	-101.410981	19.535476	3.14
Michoacan-Guanauato	1000	-101.421514	19.534818	-101.427438	19.520994	1.76
Michoacan-Guanauato	1001	-101.368850	19.496637	-101.354368	19.506511	1.91
Michoacan-Guanauato	1002	-101.462328	19.447265	-101.436654	19.428174	3.38

Appendix B (Continued)

Field Name	ID #	Start X	Start Y	End X	End Y	Length (km)
Michoacan-Guanauato	1003	-101.365559	19.615130	-101.231266	19.631587	13.32
Michoacan-Guanauato	1004	-101.259573	19.606572	-101.237191	19.603939	2.18
Michoacan-Guanauato	1005	-101.274056	19.598672	-101.334619	19.575632	6.47
Michoacan-Guanauato	1006	-101.245091	19.571682	-101.302362	19.546009	6.89
Michoacan-Guanauato	1007	-101.257598	19.563124	-101.245749	19.553250	1.65
Michoacan-Guanauato	1008	-101.278005	19.540742	-101.315528	19.492029	6.93
Michoacan-Guanauato	1009	-101.206910	19.665160	-101.270106	19.635537	7.61
Michoacan-Guanauato	1010	-101.156221	19.563783	-101.183211	19.536793	4.16
Michoacan-Guanauato	1011	-101.254307	19.561808	-101.242457	19.553250	1.54
Michoacan-Guanauato	1012	-101.445870	19.039122	-101.410323	19.020690	4.09
Michoacan-Guanauato	1013	-101.408348	19.045047	-101.445212	19.010157	5.51
Michoacan-Guanauato	1014	-101.297096	19.159590	-101.273397	19.138524	3.42
Michoacan-Guanauato	1015	-101.260890	19.178680	-101.230608	19.151032	4.43
Michoacan-Guanauato	1016	-101.227975	19.188555	-101.245091	19.165514	3.23
Michoacan-Guanauato	1017	-101.242457	19.127992	-101.217442	19.106268	3.56
Michoacan-Guanauato	1018	-101.129889	19.093760	-101.068668	19.107584	6.14
Michoacan-Guanauato	1019	-101.058793	19.208962	-101.084467	19.187238	3.61
Michoacan-Guanauato	1020	-101.065376	19.237927	-101.014029	19.218178	5.50
Michoacan-Guanauato	1021	-101.110140	19.266892	-101.072617	19.243851	4.56
Michoacan-Guanauato	1022	-101.108824	19.193163	-101.185844	19.173414	7.80
Michoacan-Guanauato	1023	-101.135155	19.252409	-101.187819	19.239243	5.32
Michoacan-Guanauato	1024	-101.186502	19.288616	-101.155563	19.250434	5.53
Michoacan-Guanauato	1025	-101.007446	19.208962	-100.983089	19.184605	3.76
Michoacan-Guanauato	1026	-100.998230	19.188555	-100.984406	19.177364	1.90
Michoacan-Guanauato	1027	-100.993622	19.069403	-101.009421	19.055579	2.26
Michoacan-Guanauato	1028	-101.006130	19.085202	-100.981773	19.064795	3.41
Michoacan-Guanauato	1029	-100.988356	19.055579	-101.010738	19.044388	2.55
Michoacan-Guanauato	1030	-101.010079	19.179339	-100.978481	19.155640	4.18
Michoacan-Guanauato	1031	-100.944250	19.175389	-100.960707	19.145107	3.98
Michoacan-Guanauato	1032	-100.922526	19.122725	-100.935034	19.082569	5.00
Michoacan-Guanauato	1033	-100.960707	19.087177	-100.981114	19.073353	2.58
Michoacan-Guanauato	1034	-100.979140	19.065454	-100.963340	19.076645	2.04
Michoacan-Guanauato	1035	-100.973873	19.039122	-101.015346	19.011473	5.21
Michoacan-Guanauato	1036	-100.952149	19.023981	-100.928451	18.999624	3.73
Michoacan-Guanauato	1037	-100.916602	19.022664	-100.900144	19.006207	2.54
Michoacan-Guanauato	1038	-100.856697	19.031881	-100.862621	19.016740	1.92
Michoacan-Guanauato	1039	-100.833656	19.066770	-100.851430	19.027273	5.07
Michoacan-Guanauato	1040	-100.846822	19.027273	-100.855380	19.010815	2.15
Michoacan-Guanauato	1041	-100.902777	19.057554	-100.876446	19.029906	4.20
Michoacan-Guanauato	1042	-101.015346	19.135233	-100.873154	19.010157	20.53
Michoacan-Guanauato	1043	-100.894878	19.069403	-100.875129	19.050313	2.99
Michoacan-Guanauato	1044	-100.909360	19.102318	-100.875787	19.068087	5.25
Michoacan-Guanauato	1045	-100.835631	19.158931	-100.856038	19.120092	5.08
Michoacan-Guanauato	1046	-100.752028	19.169464	-100.718455	19.022006	18.11
Michoacan-Guanauato	1047	-100.703972	19.075986	-100.722405	19.068087	2.02
Michoacan-Guanauato	1048	-100.734912	19.064137	-100.752686	19.056896	1.92
Michoacan-Guanauato	1049	-100.701997	19.044388	-100.719113	19.041097	1.70
Michoacan-Guanauato	1050	-100.667766	19.054921	-100.625635	19.016082	6.23

Appendix B (Continued)

Field Name	ID #	Start X	Start Y	End X	End Y	Length (km)
Michoacan-Guanauato	1051	-100.588771	19.105610	-100.603912	19.039122	8.16
Michoacan-Guanauato	1052	-100.567705	19.191188	-100.632877	19.120092	10.64
Michoacan-Guanauato	1053	-100.549931	19.236610	-100.585479	19.205012	5.13
Michoacan-Guanauato	1054	-100.565730	19.218178	-100.543348	19.189871	4.04
Michoacan-Guanauato	1055	-100.530183	19.241218	-100.547298	19.229369	2.18
Michoacan-Guanauato	1056	-100.562439	19.268208	-100.598645	19.245168	4.46
Michoacan-Guanauato	1057	-100.617077	19.307048	-100.578238	19.265575	6.25
Michoacan-Guanauato	1058	-100.646701	19.310339	-100.621027	19.281374	4.28
Michoacan-Guanauato	1059	-100.677641	19.345887	-100.639459	19.320214	4.81
Michoacan-Guanauato	1060	-100.646701	19.380118	-100.670399	19.359053	3.42
Michoacan-Guanauato	1061	-100.668424	19.359711	-100.632218	19.335354	4.56
Michoacan-Guanauato	1062	-100.618394	19.368927	-100.569680	19.334038	6.31
Michoacan-Guanauato	1063	-100.530183	19.357078	-100.571655	19.312972	6.65
Michoacan-Guanauato	1064	-100.555198	19.408425	-100.533474	19.410400	2.11
Michoacan-Guanauato	1065	-100.644068	19.407767	-100.605228	19.403159	3.79
Michoacan-Guanauato	1066	-100.752686	19.274791	-100.710555	19.252409	4.88
Michoacan-Guanauato	1067	-100.809300	19.318897	-100.759927	19.288616	6.00
Michoacan-Guanauato	1068	-100.753344	19.382093	-100.751370	19.310339	8.65
Michoacan-Guanauato	1069	-100.818516	19.366294	-100.769802	19.332721	6.20
Michoacan-Guanauato	1070	-100.871838	19.251093	-100.848797	19.229369	3.44
Michoacan-Guanauato	1071	-100.986381	19.297832	-100.931084	19.266892	6.53
Michoacan-Guanauato	1072	-100.979798	19.316264	-100.959391	19.301781	2.63
Michoacan-Guanauato	1073	-100.996914	19.369586	-100.958074	19.339304	5.23
Michoacan-Guanauato	1074	-101.200327	19.382093	-101.191110	19.340621	5.08
Michoacan-Guanauato	1075	-101.162804	19.395918	-101.146346	19.409742	2.30
Michoacan-Guanauato	1076	-101.140422	19.418958	-101.118698	19.435415	2.89
Michoacan-Guanauato	1077	-101.097633	19.434757	-101.069326	19.424883	2.98
Michoacan-Guanauato	1078	-101.002180	19.432782	-100.965315	19.416325	4.07
Michoacan-Guanauato	1079	-101.239166	19.441340	-101.267473	19.417641	3.95
Michoacan-Guanauato	1080	-101.206910	19.478204	-101.225342	19.461747	2.66
Michoacan-Guanauato	1081	-101.173336	19.461089	-101.154904	19.445290	2.60
Michoacan-Guanauato	1082	-101.168070	19.494662	-101.187819	19.476888	2.87
Michoacan-Guanauato	1083	-101.187819	19.499928	-101.157537	19.526260	4.31
Michoacan-Guanauato	1084	-101.161487	19.495978	-101.146346	19.476230	2.79
Michoacan-Guanauato	1085	-101.152929	19.512436	-101.160829	19.484787	3.42
Michoacan-Guanauato	1086	-101.131206	19.478863	-101.112115	19.492687	2.48
Michoacan-Guanauato	1087	-101.164120	19.476888	-101.112115	19.482812	6.18
Michoacan-Guanauato	1088	-101.130547	19.515727	-101.148321	19.498612	2.68
Michoacan-Guanauato	1089	-101.118698	19.520335	-101.076567	19.497295	4.92
Michoacan-Guanauato	1090	-101.093683	19.497953	-101.109482	19.460430	4.77
Michoacan-Guanauato	1091	-101.078542	19.490712	-101.069984	19.461089	7.68
Michoacan-Guanauato	1092	-101.094341	19.455164	-101.073276	19.447265	2.24
Michoacan-Guanauato	1093	-101.071959	19.499928	-101.026537	19.467013	5.91
Michoacan-Guanauato	1094	-101.098949	19.532185	-101.079859	19.517044	2.59
Michoacan-Guanauato	1095	-101.074592	19.519677	-101.044311	19.527577	3.07
Michoacan-Guanauato	1096	-101.093683	19.545350	-101.121331	19.531526	3.14
Michoacan-Guanauato	1097	-101.134497	19.533501	-101.147663	19.519019	2.16
Michoacan-Guanauato	1098	-101.143713	19.533501	-101.120015	19.565099	4.44

Appendix B (Continued)

Field Name	ID #	Start X	Start Y	End X	End Y	Length (km)
Michoacan-Guanauato	1099	-101.121990	19.570366	-101.114748	19.574974	0.89
Michoacan-Guanauato	1100	-101.115407	19.582215	-101.099607	19.571682	1.98
Michoacan-Guanauato	1101	-101.116723	19.582215	-101.131864	19.566416	2.40
Michoacan-Guanauato	1102	-101.125281	19.582873	-101.101582	19.603280	3.36
Michoacan-Guanauato	1103	-101.110798	19.590115	-101.105532	19.592089	0.56
Michoacan-Guanauato	1104	-101.108165	19.606572	-101.136472	19.580898	4.12
Michoacan-Guanauato	1105	-101.137130	19.634220	-101.106190	19.615130	3.77
Michoacan-Guanauato	1106	-101.164779	19.671085	-101.155563	19.661869	1.42
Michoacan-Guanauato	1107	-101.237191	19.669110	-101.094341	19.674376	13.81
Michoacan-Guanauato	1108	-101.092366	19.670426	-101.021929	19.661869	6.87
Michoacan-Guanauato	1109	-101.042336	19.661869	-101.048919	19.648044	1.78
Michoacan-Guanauato	1110	-101.062085	19.666477	-101.073276	19.655286	1.73
Michoacan-Guanauato	1111	-101.097633	19.667793	-101.110798	19.659894	1.59
Michoacan-Guanauato	1112	-101.075909	19.686884	-101.085125	19.678326	1.36
Michoacan-Guanauato	1113	-101.069984	19.700050	-101.077225	19.690175	1.38
Michoacan-Guanauato	1114	-101.048260	19.675693	-101.019296	19.680301	2.87
Michoacan-Guanauato	1115	-101.004155	19.681617	-100.953466	19.685567	4.91
Michoacan-Guanauato	1116	-101.066693	19.628954	-101.052210	19.636195	1.65
Michoacan-Guanauato	1117	-101.093025	19.615788	-101.059452	19.625662	4.21
Michoacan-Guanauato	1118	-101.048260	19.623029	-101.006130	19.597356	5.12
Michoacan-Guanauato	1119	-101.041678	19.638170	-101.023904	19.626321	2.23
Michoacan-Guanauato	1120	-101.003496	19.630929	-101.023245	19.628296	1.93
Michoacan-Guanauato	1121	-101.025220	19.627637	-101.046286	19.599989	3.90
Michoacan-Guanauato	1122	-101.011396	19.613813	-100.994280	19.603280	2.08
Michoacan-Guanauato	1123	-101.049577	19.590773	-101.031145	19.576949	2.44
Michoacan-Guanauato	1124	-101.080517	19.586823	-101.068668	19.579582	1.44
Michoacan-Guanauato	1125	-101.056160	19.571024	-101.087758	19.555225	3.59
Michoacan-Guanauato	1126	-101.095658	19.563783	-101.079859	19.557200	1.72
Michoacan-Guanauato	1127	-101.086442	19.574315	-101.071959	19.564441	1.83
Michoacan-Guanauato	1128	-101.081175	19.555883	-101.033778	19.530210	5.52
Michoacan-Guanauato	1129	-101.058135	19.557200	-101.010738	19.534159	5.35
Michoacan-Guanauato	1130	-101.007446	19.568391	-101.039703	19.553250	3.61
Michoacan-Guanauato	1131	-101.029828	19.567074	-101.004813	19.557200	2.69
Michoacan-Guanauato	1132	-100.996914	19.563783	-100.977165	19.557200	2.06
Michoacan-Guanauato	1133	-101.016662	19.593406	-100.903436	19.584848	11.15
Michoacan-Guanauato	1134	-100.927134	19.592089	-100.906069	19.592748	2.03
Michoacan-Guanauato	1135	-100.925818	19.597356	-100.908702	19.598014	1.65
Michoacan-Guanauato	1136	-100.939642	19.577607	-100.960049	19.576949	1.97
Michoacan-Guanauato	1137	-101.002180	19.540742	-100.979140	19.532185	2.45
Michoacan-Guanauato	1138	-100.946225	19.536134	-100.931742	19.529551	1.61
Michoacan-Guanauato	1139	-100.950833	19.524943	-100.928451	19.519677	2.25
Michoacan-Guanauato	1140	-100.998230	19.516385	-100.974531	19.522968	2.42
Michoacan-Guanauato	1141	-100.987039	19.507169	-100.967949	19.515069	2.07
Michoacan-Guanauato	1142	-100.980456	19.501903	-100.933059	19.488737	4.86
Michoacan-Guanauato	1143	-100.962024	19.492029	-100.983089	19.478204	2.63
Michoacan-Guanauato	1144	-100.914627	19.526918	-100.896194	19.536134	2.10
Michoacan-Guanauato	1145	-100.892245	19.512436	-100.876446	19.524285	2.09
Michoacan-Guanauato	1146	-100.927793	19.466355	-100.856697	19.499928	8.04

Appendix B (Continued)

Field Name	ID #	Start X	Start Y	End X	End Y	Length (km)
Michoacan-Guanauato	1147	-100.871838	19.486104	-100.868546	19.448581	4.53
Michoacan-Guanauato	1148	-100.877104	19.477546	-100.873812	19.464380	1.62
Michoacan-Guanauato	1149	-100.813908	19.426199	-100.786918	19.387360	5.36
Michoacan-Guanauato	1150	-100.814566	19.492029	-100.760586	19.442656	7.91
Michoacan-Guanauato	1151	-100.868546	19.522310	-100.832998	19.555225	5.24
Michoacan-Guanauato	1152	-100.851430	19.554567	-100.823124	19.540742	3.23
Michoacan-Guanauato	1153	-100.859988	19.551275	-100.825099	19.526918	4.46
Michoacan-Guanauato	1154	-100.861305	19.522968	-100.821807	19.499928	4.71
Michoacan-Guanauato	1155	-100.798109	19.576949	-100.775726	19.587481	2.50
Michoacan-Guanauato	1156	-100.784943	19.607888	-100.753344	19.554567	7.11
Michoacan-Guanauato	1157	-100.906727	19.609863	-100.793500	19.559175	15.32
Michoacan-Guanauato	1158	-100.793500	19.607888	-100.825099	19.599989	3.19
Michoacan-Guanauato	1159	-100.898169	19.619738	-100.883029	19.604597	2.34
Michoacan-Guanauato	1160	-100.879737	19.613155	-100.855380	19.616446	2.38
Michoacan-Guanauato	1161	-100.957416	19.655944	-100.970582	19.628954	3.49
Michoacan-Guanauato	1162	-100.962024	19.642778	-100.922526	19.654627	4.07
Michoacan-Guanauato	1163	-100.938325	19.661210	-100.925818	19.619738	5.13
Michoacan-Guanauato	1164	-100.925818	19.640803	-100.900144	19.647386	2.60
Michoacan-Guanauato	1165	-100.911993	19.628954	-100.886320	19.633562	2.54
Michoacan-Guanauato	1166	-100.873154	19.653311	-100.830365	19.603280	7.30
Michoacan-Guanauato	1167	-100.832998	19.613155	-100.800742	19.626979	3.53
Michoacan-Guanauato	1168	-100.836948	19.652652	-100.857355	19.652652	1.97
Michoacan-Guanauato	1169	-100.805350	19.637512	-100.848139	19.627637	4.34
Michoacan-Guanauato	1170	-100.852747	19.640145	-100.817857	19.646728	3.46
Michoacan-Guanauato	1171	-100.769802	19.663844	-100.751370	19.667135	1.82
Michoacan-Guanauato	1172	-100.759927	19.695442	-100.776385	19.680959	2.36
Michoacan-Guanauato	1173	-100.782309	19.711241	-100.802058	19.704658	2.06
Michoacan-Guanauato	1174	-101.038386	19.653311	-101.021929	19.637512	2.48
Michoacan-Guanauato	1175	-100.990989	19.655286	-100.973873	19.648703	1.83
Michoacan-Guanauato	1176	-101.000205	19.670426	-100.968607	19.655944	3.51
Michoacan-Guanauato	1177	-100.923843	19.678984	-100.896853	19.686226	2.75
Michoacan-Guanauato	1178	-100.886978	19.694783	-100.935034	19.688859	4.70
Michoacan-Guanauato	1179	-100.935034	19.700050	-100.873154	19.708608	6.06
Michoacan-Guanauato	1180	-100.861305	19.730990	-100.841556	19.716507	2.58
Michoacan-Guanauato	1181	-100.967290	19.725723	-100.948858	19.730990	1.89
Michoacan-Guanauato	1182	-101.013371	19.712557	-100.956099	19.717824	5.56
Michoacan-Guanauato	1183	-100.994280	19.702683	-100.945567	19.709266	4.77
Michoacan-Guanauato	1184	-101.052210	19.725065	-101.043652	19.725065	0.83
Michoacan-Guanauato	1185	-101.187161	19.752055	-101.026537	19.802744	16.94
Michoacan-Guanauato	1186	-101.016662	19.760613	-100.998230	19.769171	2.05
Michoacan-Guanauato	1187	-101.014029	19.735598	-100.976506	19.742181	3.71
Michoacan-Guanauato	1188	-100.983748	19.732964	-101.057477	19.711241	7.58
Michoacan-Guanauato	1189	-101.069984	19.717165	-101.107507	19.705974	3.86
Michoacan-Guanauato	1190	-101.133839	19.701366	-101.149638	19.692808	1.84
Michoacan-Guanauato	1191	-101.129231	19.696758	-101.141738	19.688200	1.59
Michoacan-Guanauato	1192	-101.147005	19.702025	-101.132522	19.686884	2.30
Michoacan-Guanauato	1193	-100.955441	19.747447	-100.890270	19.760613	6.48
Michoacan-Guanauato	1194	-100.849456	19.758638	-100.831023	19.763904	1.89

Appendix B (Continued)

Field Name	ID #	Start X	Start Y	End X	End Y	Length (km)
Michoacan-Guanauato	1195	-100.831023	19.798794	-100.821149	19.803402	1.10
Michoacan-Guanauato	1196	-100.865913	19.791553	-100.849456	19.794844	1.64
Michoacan-Guanauato	1197	-100.744128	19.829734	-100.946883	19.788919	22.44
Michoacan-Guanauato	1198	-100.759269	19.827101	-100.756636	19.806693	2.47
Michoacan-Guanauato	1199	-100.756636	19.852774	-100.756636	19.839608	1.58
Michoacan-Guanauato	1200	-100.758611	19.845533	-100.771777	19.838292	1.54
Michoacan-Guanauato	1201	-100.812591	19.872523	-100.874471	19.866598	6.09
Michoacan-Guanauato	1202	-100.860647	19.876473	-100.875787	19.871206	1.59
Michoacan-Guanauato	1203	-100.888295	19.887005	-100.886320	19.873840	1.59
Michoacan-Guanauato	1204	-101.050894	19.819859	-101.071959	19.805377	2.68
Michoacan-Guanauato	1205	-100.973873	19.867257	-100.836290	19.888322	14.98
Michoacan-Guanauato	1206	-100.751370	19.910046	-100.779018	19.900830	2.89
Michoacan-Guanauato	1207	-100.790867	19.903463	-100.821149	19.904121	2.92
Michoacan-Guanauato	1208	-100.836290	19.896880	-100.806008	19.894247	2.94
Michoacan-Guanauato	1209	-101.032461	19.861332	-101.061426	19.854091	3.34
Michoacan-Guanauato	1210	-101.121331	19.818543	-101.094999	19.821176	2.61
Michoacan-Guanauato	1211	-101.170703	19.841583	-101.150954	19.839608	1.92
Michoacan-Guanauato	1212	-101.234558	19.856066	-101.137130	19.893588	10.43
Michoacan-Guanauato	1213	-101.164120	19.890955	-101.141080	19.900171	2.48
Michoacan-Guanauato	1214	-101.192427	19.865940	-101.161487	19.877789	3.31
Michoacan-Guanauato	1215	-101.146346	19.862649	-101.122648	19.869890	2.45
Michoacan-Guanauato	1216	-101.131206	19.854749	-101.100266	19.863307	3.16
Michoacan-Guanauato	1217	-101.072617	19.873181	-101.044311	19.883714	3.01
Michoacan-Guanauato	1218	-101.056160	19.891613	-101.102899	19.882397	4.94
Michoacan-Guanauato	1219	-101.138447	19.956126	-101.116723	19.966001	2.41
Michoacan-Guanauato	1220	-101.125939	19.952835	-101.105532	19.962051	2.26
Michoacan-Guanauato	1221	-101.098949	19.960076	-101.091708	19.962709	0.77
Michoacan-Guanauato	1222	-100.981773	19.929136	-100.972557	19.933086	1.02
Michoacan-Guanauato	1223	-100.994939	19.913995	-100.980456	19.915970	1.42
Michoacan-Guanauato	1224	-100.992305	19.948885	-100.982431	19.952177	1.03
Michoacan-Guanauato	1225	-100.987697	19.978508	-101.006130	19.968634	2.14
Michoacan-Guanauato	1226	-101.012054	19.951518	-100.987039	19.965342	2.93
Michoacan-Guanauato	1227	-101.004813	19.949543	-100.985723	19.958760	2.15
Michoacan-Guanauato	1228	-101.002180	19.968634	-100.983748	19.975217	1.95
Michoacan-Guanauato	1229	-100.982431	19.978508	-100.892245	19.986408	8.94
Michoacan-Guanauato	1230	-100.916602	19.973900	-100.927793	19.967976	1.29
Michoacan-Guanauato	1231	-100.937009	19.958760	-100.950833	19.953493	1.48
Michoacan-Guanauato	1232	-100.918576	19.961393	-100.906069	19.964684	1.27
Michoacan-Guanauato	1233	-100.906069	19.971925	-100.896194	19.974559	1.00
Michoacan-Guanauato	1234	-100.906069	19.965342	-100.896853	19.971267	1.14
Michoacan-Guanauato	1235	-100.904094	19.998257	-100.871838	20.005498	3.23
Michoacan-Guanauato	1236	-100.867888	20.018006	-100.838923	20.018006	2.97
Michoacan-Guanauato	1237	-100.810616	20.012081	-100.881054	19.994307	7.25
Michoacan-Guanauato	1238	-100.854722	19.990358	-100.840898	19.994966	1.44
Michoacan-Guanauato	1239	-100.829048	19.995624	-100.821149	19.998916	0.86
Michoacan-Guanauato	1240	-100.803375	20.002865	-100.787576	20.009448	1.72
Michoacan-Guanauato	1241	-100.807325	19.992991	-100.796134	19.994966	1.11
Michoacan-Guanauato	1242	-100.810616	19.986408	-100.784943	19.977192	2.71

Appendix B (Continued)

Field Name	ID #	Start X	Start Y	End X	End Y	Length (km)
Michoacan-Guanauato	1243	-100.810616	19.977850	-100.836948	19.975875	2.57
Michoacan-Guanauato	1244	-100.836948	19.975875	-100.802717	19.975217	3.58
Michoacan-Guanauato	1245	-100.827732	19.985750	-100.874471	19.983775	4.55
Michoacan-Guanauato	1246	-100.851430	19.979167	-100.834315	19.985091	1.80
Michoacan-Guanauato	1247	-100.870521	19.951518	-100.796134	19.948227	7.31
Michoacan-Guanauato	1248	-100.814566	19.925845	-100.798767	19.931111	1.65
Michoacan-Guanauato	1249	-100.768485	19.941644	-100.752686	19.946252	1.62
Michoacan-Guanauato	1250	-100.892245	20.272766	-100.827073	20.301731	7.23
Michoacan-Guanauato	1251	-101.118040	20.278691	-101.096316	20.287907	2.37
Michoacan-Guanauato	1252	-101.135814	20.108851	-101.012713	20.142424	12.72
Michoacan-Guanauato	1253	-100.989014	20.135183	-100.959391	20.138474	2.89
Michoacan-Guanauato	1254	-100.956099	20.135841	-100.925159	20.152298	3.58
Michoacan-Guanauato	1255	-100.954124	20.128600	-100.915943	20.132549	3.71
Michoacan-Guanauato	1256	-100.925818	20.122675	-100.899486	20.126625	2.58
Michoacan-Guanauato	1257	-100.990989	20.125966	-100.956758	20.125308	3.30
Michoacan-Guanauato	1258	-101.064718	20.128600	-101.015346	20.133208	4.80
Michoacan-Guanauato	1259	-101.064718	20.117409	-101.036411	20.120042	2.76
Michoacan-Guanauato	1260	-101.061426	20.110167	-101.039703	20.113459	2.22
Michoacan-Guanauato	1261	-101.012054	20.122017	-100.984406	20.121358	2.67
Michoacan-Guanauato	1262	-101.100266	20.110826	-101.079859	20.115434	2.05
Michoacan-Guanauato	1263	-101.137130	20.096343	-101.119356	20.100293	1.78
Michoacan-Guanauato	1264	-101.133181	20.093052	-101.120015	20.093052	1.27
Michoacan-Guanauato	1265	-101.117381	20.087127	-101.093025	20.094368	2.51
Michoacan-Guanauato	1266	-101.081834	20.099635	-101.006788	20.114775	7.47
Michoacan-Guanauato	1267	-101.058793	20.091077	-101.040361	20.093052	1.79
Michoacan-Guanauato	1268	-101.035095	20.088444	-100.986381	20.087785	4.70
Michoacan-Guanauato	1269	-101.131206	20.080544	-101.114748	20.081202	1.59
Michoacan-Guanauato	1270	-101.125281	20.075936	-101.089075	20.086469	3.72
Michoacan-Guanauato	1271	-101.106849	20.069353	-101.060110	20.077253	4.61
Michoacan-Guanauato	1272	-101.050894	20.070670	-101.000863	20.077911	4.93
Michoacan-Guanauato	1273	-101.084467	20.068036	-101.046944	20.060137	3.74
Michoacan-Guanauato	1274	-100.902777	20.090418	-100.863938	20.094368	3.97
Michoacan-Guanauato	1275	-101.009421	20.110167	-100.990989	20.110167	1.78
Michoacan-Guanauato	1276	-100.834315	20.191796	-100.814566	20.181263	2.29
Michoacan-Guanauato	1277	-100.844189	20.185871	-100.825757	20.177313	2.05
Michoacan-Guanauato	1278	-100.834315	20.170730	-100.786918	20.170730	4.73
Michoacan-Guanauato	1279	-100.806008	20.158223	-100.785601	20.162173	2.10
Michoacan-Guanauato	1280	-100.851430	20.169414	-100.826415	20.157565	2.80
Michoacan-Guanauato	1281	-101.180578	20.499878	-101.145688	20.476179	4.64
Michoacan-Guanauato	1282	-101.124623	20.584798	-101.099607	20.597964	2.88
Michoacan-Guanauato	1283	-101.102241	20.632853	-101.077884	20.651286	3.22
Michoacan-Guanauato	1284	-101.085125	20.653919	-101.052210	20.646677	3.29
Michoacan-Guanauato	1285	-101.034436	20.690125	-101.017321	20.674326	2.51
Michoacan-Guanauato	1286	-101.065376	20.725015	-101.045627	20.709874	2.63
Michoacan-Guanauato	1287	-101.085125	20.725673	-101.106190	20.710532	2.72
Michoacan-Guanauato	1288	-101.123964	20.736206	-101.111457	20.708557	3.52
Michoacan-Guanauato	1289	-101.154904	20.725673	-101.133839	20.694733	4.22
Michoacan-Guanauato	1290	-101.150296	20.678934	-101.200327	20.659185	5.37

Appendix B (Continued)

Field Name	ID #	Start X	Start Y	End X	End Y	Length (km)
Michoacan-Guanauato	1291	-101.200985	20.722381	-101.178603	20.691442	4.28
Michoacan-Guanauato	1292	-101.227975	20.717773	-101.199668	20.703949	3.19
Michoacan-Guanauato	1293	-101.219417	20.704607	-101.202301	20.694075	2.08
Michoacan-Guanauato	1294	-101.195060	20.698024	-101.224683	20.678934	3.66
Michoacan-Guanauato	1295	-101.094999	20.770437	-101.104874	20.751346	2.47
Michoacan-Guanauato	1296	-101.099607	20.749371	-101.075251	20.742130	2.50
Michoacan-Guanauato	1297	-101.074592	20.767804	-101.091708	20.755954	2.18
Michoacan-Guanauato	1298	-101.052210	20.756613	-101.068668	20.743447	2.24
Michoacan-Guanauato	1299	-101.065376	20.723040	-101.045627	20.706582	2.74
Michoacan-Guanauato	1300	-101.052869	20.813226	-101.068009	20.798085	2.32
Michoacan-Guanauato	1301	-101.150954	20.845482	-101.108165	20.819151	5.19
Michoacan-Guanauato	1302	-101.121990	20.840216	-101.096316	20.826392	2.98
Michoacan-Guanauato	1303	-100.993622	20.829683	-100.969265	20.815859	2.87
Michoacan-Guanauato	1304	-101.002180	20.816518	-100.985064	20.805326	2.12
Michoacan-Guanauato	1305	-100.930426	20.713165	-100.938325	20.673009	4.88
Michoacan-Guanauato	1306	-100.917918	20.692100	-100.938984	20.673009	3.06
Michoacan-Guanauato	1307	-100.929767	20.666426	-100.898828	20.684200	3.73
Michoacan-Guanauato	1308	-100.935692	20.644703	-100.937667	20.633512	1.35
Michoacan-Guanauato	1309	-100.906069	20.663793	-100.880395	20.638778	3.88
Michoacan-Guanauato	1310	-100.877104	20.646677	-100.863280	20.637461	1.73
Michoacan-Guanauato	1311	-100.847481	20.631537	-100.812591	20.661818	4.94
Michoacan-Guanauato	1312	-100.836290	20.659843	-100.814566	20.629562	4.21
Michoacan-Guanauato	1313	-100.856038	20.665110	-100.863938	20.649969	1.96
Michoacan-Guanauato	1314	-100.863280	20.683542	-100.867229	20.671693	1.47
Michoacan-Guanauato	1315	-100.879079	20.688808	-100.885003	20.671693	2.12
Michoacan-Guanauato	1316	-100.925159	20.818492	-100.953466	20.812568	2.82
Michoacan-Guanauato	1317	-100.936350	20.855357	-100.968607	20.842849	3.45
Michoacan-Guanauato	1318	-100.937667	20.859307	-100.921210	20.851407	1.85
Michoacan-Guanauato	1319	-100.910677	20.853382	-100.883029	20.832975	3.61
Michoacan-Guanauato	1320	-100.885003	20.844166	-100.896853	20.811251	4.09
Michoacan-Guanauato	1321	-100.918576	20.827050	-100.904094	20.816518	1.88
Michoacan-Guanauato	1322	-100.929109	20.852065	-100.939642	20.824417	3.45
Michoacan-Guanauato	1323	-100.919235	20.816518	-100.927134	20.792819	2.93
Michoacan-Guanauato	1324	-100.902777	20.810593	-100.908044	20.796769	1.73
Michoacan-Guanauato	1325	-100.906727	20.805326	-100.878420	20.780311	4.05
Michoacan-Guanauato	1326	-100.789551	20.856015	-100.799425	20.824417	3.89
Michoacan-Guanauato	1327	-101.316845	20.985699	-101.335277	20.973192	2.32
Michoacan-Guanauato	1328	-101.239166	20.963976	-101.261548	20.954101	2.46
Michoacan-Guanauato	1329	-101.229950	20.975825	-101.203618	20.933694	5.63
Michoacan-Guanauato	1330	-101.217442	20.959367	-101.244432	20.950151	2.83
Michoacan-Guanauato	1331	-101.225342	20.950810	-101.219417	20.943568	1.04
Michoacan-Guanauato	1332	-101.240483	20.941593	-101.214809	20.921186	3.47
Michoacan-Guanauato	1333	-101.247724	20.929744	-101.232583	20.920528	1.83
Michoacan-Guanauato	1334	-101.197035	20.977141	-101.215467	20.965950	2.22
Michoacan-Guanauato	1335	-101.189136	20.982408	-101.150296	20.946860	5.66
Michoacan-Guanauato	1336	-101.172020	20.942910	-101.156879	20.932377	1.93
Michoacan-Guanauato	1337	-101.172678	20.923161	-101.191110	20.908679	2.48
Michoacan-Guanauato	1338	-101.164779	20.910654	-101.181236	20.899463	2.08

Appendix B (Continued)

Field Name	ID #	Start X	Start Y	End X	End Y	Length (km)
Michoacan-Guanauato	1339	-101.137789	20.940935	-101.129889	20.928428	1.68
Michoacan-Guanauato	1340	-101.141738	20.962659	-101.106849	20.941593	4.20
Michoacan-Guanauato	1341	-101.172678	20.841533	-101.083150	20.875106	9.53
Michoacan-Guanauato	1342	-100.980456	20.904071	-100.999547	20.883664	3.05
Michoacan-Guanauato	1343	-100.985723	20.857332	-100.974531	20.863256	1.29
Michoacan-Guanauato	1344	-100.955441	20.876422	-100.966632	20.845482	3.85
Michoacan-Guanauato	1345	-100.933717	20.866548	-100.917918	20.856015	1.98
Michoacan-Guanauato	1346	-100.742812	20.983724	-100.752028	20.852065	16.00
Michoacan-Guanauato	1347	-100.740837	20.838900	-100.727013	20.816518	2.99
Michoacan-Guanauato	1348	-100.727013	20.829025	-100.690806	20.841533	3.80
Michoacan-Guanauato	1349	-100.774410	20.838241	-100.748736	20.811909	4.00
Michoacan-Guanauato	1350	-100.741495	20.805985	-100.755319	20.792819	2.08
Michoacan-Guanauato	1351	-100.767827	20.812568	-100.784284	20.808618	1.66
Michoacan-Guanauato	1352	-100.758611	20.786894	-100.790867	20.775703	3.39
Michoacan-Guanauato	1353	-100.766510	20.768462	-100.745445	20.779653	2.43
Michoacan-Guanauato	1354	-100.725696	20.806643	-100.713189	20.794794	1.88
Michoacan-Guanauato	1355	-100.710555	20.806643	-100.677641	20.821784	3.65
Michoacan-Guanauato	1356	-100.716480	20.784919	-100.727671	20.775703	1.64
Michoacan-Guanauato	1357	-100.697389	20.777678	-100.671716	20.758588	3.37
Michoacan-Guanauato	1358	-100.662500	20.754638	-100.646042	20.739497	2.41
Michoacan-Guanauato	1359	-100.634193	20.728306	-100.611811	20.713165	2.82
Michoacan-Guanauato	1360	-100.665791	20.737522	-100.642093	20.723040	2.87
Michoacan-Guanauato	1361	-100.604570	20.831000	-100.630243	20.816518	3.02
Michoacan-Guanauato	1362	-100.609836	20.807301	-100.584163	20.789527	3.26
Michoacan-Guanauato	1363	-100.532157	20.829025	-100.616419	20.780311	10.05
Michoacan-Guanauato	1364	-100.580871	20.796769	-100.584163	20.781628	1.86
Michoacan-Guanauato	1365	-100.572313	20.802693	-100.557831	20.798744	1.54
Michoacan-Guanauato	1366	-100.552565	20.791502	-100.564414	20.769779	3.29
Michoacan-Guanauato	1367	-100.563097	20.778336	-100.599962	20.756613	4.40
Michoacan-Guanauato	1368	-100.520966	20.806643	-100.551248	20.787553	3.71
Michoacan-Guanauato	1369	-100.552565	20.779653	-100.529524	20.764512	2.87
Michoacan-Guanauato	1370	-100.715822	20.708557	-100.702656	20.681567	3.47
Michoacan-Guanauato	1371	-100.713847	20.702633	-100.736887	20.690125	2.68
Michoacan-Guanauato	1372	-100.734912	20.675642	-100.705289	20.684859	3.06
Michoacan-Guanauato	1373	-100.723721	20.667743	-100.674349	20.684200	5.15
Michoacan-Guanauato	1374	-100.698706	20.670376	-100.692123	20.657868	1.62
Michoacan-Guanauato	1375	-100.666450	20.636145	-100.658550	20.615738	2.56
Michoacan-Guanauato	1376	-100.628268	20.661160	-100.618394	20.638778	2.84
Michoacan-Guanauato	1377	-100.604570	20.661160	-100.595354	20.642069	2.45
Michoacan-Guanauato	1378	-100.603253	20.638120	-100.626952	20.613763	3.70
Michoacan-Guanauato	1379	-100.639459	20.606521	-100.645384	20.601255	0.85
Michoacan-Guanauato	1380	-100.639459	20.596647	-100.600620	20.611788	4.34
Michoacan-Guanauato	1381	-100.613128	20.592697	-100.631560	20.580848	2.27
Michoacan-Guanauato	1382	-100.600620	20.619687	-100.570339	20.555833	8.33
Michoacan-Guanauato	1383	-100.561122	20.649969	-100.600620	20.628245	4.68
Michoacan-Guanauato	1384	-100.555198	20.644703	-100.549273	20.635486	1.24
Michoacan-Guanauato	1385	-100.544007	20.626270	-100.532157	20.607838	2.48
Michoacan-Guanauato	1386	-100.551248	20.688150	-100.506484	20.582823	13.98

Appendix B (Continued)

Field Name	ID #	Start X	Start Y	End X	End Y	Length (km)
Michoacan-Guanauato	1387	-100.547957	20.735547	-100.528208	20.696050	5.10
Michoacan-Guanauato	1388	-100.524258	20.700658	-100.513067	20.659185	5.08
Michoacan-Guanauato	1389	-100.522941	20.736864	-100.503851	20.696050	5.21
Michoacan-Guanauato	1390	-100.493976	20.732914	-100.482127	20.720406	1.88
Michoacan-Guanauato	1391	-100.497926	20.743447	-100.467645	20.718432	4.44
Michoacan-Guanauato	1392	-100.450529	20.737522	-100.446579	20.667743	8.39
Michoacan-Guanauato	1393	-100.403790	20.819809	-100.362317	20.784919	5.78
Michoacan-Guanauato	1394	-100.413664	20.716457	-100.408398	20.674326	5.06
Michoacan-Guanauato	1395	-100.419589	20.701316	-100.389966	20.680251	3.81
Michoacan-Guanauato	1396	-100.422881	20.688808	-100.391282	20.660502	4.56
Michoacan-Guanauato	1397	-100.441971	20.637461	-100.432097	20.602572	4.28
Michoacan-Guanauato	1398	-100.406423	20.645361	-100.387991	20.586114	7.76
Michoacan-Guanauato	1399	-100.375483	20.600597	-100.397207	20.595989	2.17
Michoacan-Guanauato	1400	-100.376800	20.617054	-100.404448	20.606521	2.95
Michoacan-Guanauato	1401	-100.499243	20.570974	-100.480810	20.516993	6.70
Michoacan-Guanauato	1402	-100.568364	20.541350	-100.557173	20.404425	16.52
Michoacan-Guanauato	1403	-100.379433	20.578215	-100.353760	20.499219	9.93
Michoacan-Guanauato	1404	-100.353760	20.495270	-100.347177	20.482762	1.63
Michoacan-Guanauato	1405	-100.361001	20.496586	-100.378117	20.491320	1.77
Michoacan-Guanauato	1406	-100.375483	20.497903	-100.399182	20.495270	2.31
Michoacan-Guanauato	1407	-100.393916	20.521601	-100.434072	20.504486	4.39
Michoacan-Guanauato	1408	-100.462378	20.507119	-100.437363	20.482762	3.78
Michoacan-Guanauato	1409	-100.460403	20.497903	-100.499243	20.480787	4.27
Michoacan-Guanauato	1410	-100.492660	20.467621	-100.470936	20.472888	2.19
Michoacan-Guanauato	1411	-100.542032	20.451164	-100.525575	20.453797	1.62
Michoacan-Guanauato	1412	-100.539399	20.441948	-100.509775	20.448531	2.96
Michoacan-Guanauato	1413	-100.507801	20.442606	-100.480810	20.444581	2.61
Michoacan-Guanauato	1414	-100.434730	20.468938	-100.425514	20.449189	2.53
Michoacan-Guanauato	1415	-100.428147	20.466963	-100.425514	20.446556	2.46
Michoacan-Guanauato	1416	-100.435388	20.445898	-100.421564	20.449189	1.39
Michoacan-Guanauato	1417	-100.419589	20.447872	-100.399182	20.387968	7.44
Michoacan-Guanauato	1418	-100.411031	20.504486	-100.377458	20.423516	10.61
Michoacan-Guanauato	1419	-100.369559	20.428124	-100.351126	20.434707	1.95
Michoacan-Guanauato	1420	-100.420906	20.472229	-100.408398	20.437340	4.35
Michoacan-Guanauato	1421	-100.404448	20.370194	-100.351785	20.385334	5.40
Michoacan-Guanauato	1422	-100.513725	20.298440	-100.455137	20.318847	6.16
Michoacan-Guanauato	1423	-100.486735	20.244459	-100.436046	20.265525	5.50
Michoacan-Guanauato	1424	-100.447237	20.244459	-100.401157	20.267500	5.23
Michoacan-Guanauato	1425	-100.386674	20.289882	-100.347177	20.307656	4.37
Michoacan-Guanauato	1426	-100.369559	20.215494	-100.361001	20.188504	3.34
Michoacan-Guanauato	1427	-100.409056	20.201012	-100.361659	20.187846	4.84
Michoacan-Guanauato	1428	-100.584163	20.199037	-100.550590	20.195746	3.26
Michoacan-Guanauato	1429	-100.580871	20.178630	-100.552565	20.185213	2.84
Michoacan-Guanauato	1430	-100.602595	20.177972	-100.580213	20.168097	2.46
Michoacan-Guanauato	1431	-100.567047	20.165464	-100.530183	20.152956	3.86
Michoacan-Guanauato	1432	-100.542690	20.149007	-100.532157	20.145057	1.12
Michoacan-Guanauato	1433	-100.540715	20.143082	-100.533474	20.139132	0.84
Michoacan-Guanauato	1434	-100.567705	20.159539	-100.560464	20.147690	1.58

Appendix B (Continued)

Field Name	ID #	Start X	Start Y	End X	End Y	Length (km)
Michoacan-Guanauato	1435	-100.580871	20.149665	-100.631560	20.135183	5.19
Michoacan-Guanauato	1436	-100.626952	20.147690	-100.637485	20.139132	1.44
Michoacan-Guanauato	1437	-100.599962	20.115434	-100.628268	20.099635	3.32
Michoacan-Guanauato	1438	-100.400499	20.119383	-100.436046	20.114117	3.56
Michoacan-Guanauato	1439	-100.397207	20.110826	-100.418931	20.096343	2.72
Michoacan-Guanauato	1440	-100.387333	20.102268	-100.405765	20.088444	2.43
Michoacan-Guanauato	1441	-100.455137	20.093710	-100.407081	20.063428	5.89
Michoacan-Guanauato	1442	-100.670399	20.017348	-100.651309	20.017348	1.84
Michoacan-Guanauato	1443	-100.635510	20.019981	-100.617736	20.023931	1.78
Michoacan-Guanauato	1444	-100.673691	19.995624	-100.609836	20.005498	6.44
Michoacan-Guanauato	1445	-100.669083	19.985091	-100.738204	19.967976	7.00
Michoacan-Guanauato	1446	-100.743470	19.952177	-100.629585	19.964026	11.12
Michoacan-Guanauato	1447	-100.664475	19.985091	-100.661842	19.962709	2.70
Michoacan-Guanauato	1448	-100.694098	19.973242	-100.676324	19.942302	4.09
Michoacan-Guanauato	1449	-100.723063	19.949543	-100.703314	19.933086	2.75
Michoacan-Guanauato	1450	-100.630902	19.981142	-100.563756	19.981142	6.48
Michoacan-Guanauato	1451	-100.556514	19.973242	-100.599962	19.964684	4.52
Michoacan-Guanauato	1452	-100.548615	19.966001	-100.544665	19.966659	0.39
Michoacan-Guanauato	1453	-100.605886	19.977850	-100.633535	19.952835	4.02
Michoacan-Guanauato	1454	-100.744128	19.913995	-100.716480	19.923870	2.96
Michoacan-Guanauato	1455	-100.727671	19.924528	-100.701339	19.913337	2.87
Michoacan-Guanauato	1456	-100.707922	19.912021	-100.696073	19.915970	1.24
Michoacan-Guanauato	1457	-100.680932	19.921237	-100.669741	19.924528	1.15
Michoacan-Guanauato	1458	-100.656575	19.927820	-100.635510	19.927161	2.03
Michoacan-Guanauato	1459	-100.624319	19.925186	-100.605886	19.915970	2.09
Michoacan-Guanauato	1460	-100.608520	19.902146	-100.596012	19.908729	1.44
Michoacan-Guanauato	1461	-100.600620	19.926503	-100.572313	19.931111	2.79
Michoacan-Guanauato	1462	-100.455137	19.967976	-100.403790	19.969292	4.96
Michoacan-Guanauato	1463	-100.349152	19.971925	-100.276081	19.981800	7.27
Michoacan-Guanauato	1464	-100.277397	19.973900	-100.255015	19.983116	2.43
Michoacan-Guanauato	1465	-100.274106	19.966659	-100.245141	19.977192	3.07
Michoacan-Guanauato	1466	-100.356393	19.962051	-100.289247	19.962709	6.53
Michoacan-Guanauato	1467	-100.407081	19.954810	-100.368900	19.970609	4.14
Michoacan-Guanauato	1468	-100.414981	19.949543	-100.380750	19.953493	3.34
Michoacan-Guanauato	1469	-100.369559	19.952177	-100.332036	19.951518	3.62
Michoacan-Guanauato	1470	-100.355076	19.930453	-100.301096	19.937036	5.27
Michoacan-Guanauato	1471	-100.210910	19.952835	-100.199719	19.954151	1.09
Michoacan-Guanauato	1472	-100.422881	19.936378	-100.385358	19.939011	3.63
Michoacan-Guanauato	1473	-100.500559	19.933086	-100.439996	19.937036	5.86
Michoacan-Guanauato	1474	-100.590746	19.875156	-100.530841	19.875814	5.78
Michoacan-Guanauato	1475	-100.562439	19.871865	-100.562439	19.853432	2.21
Michoacan-Guanauato	1476	-100.631560	19.866598	-100.595354	19.866598	3.49
Michoacan-Guanauato	1477	-100.730962	19.817226	-100.681590	19.817226	4.76
Michoacan-Guanauato	1478	-100.684882	19.833025	-100.676324	19.804719	3.50
Michoacan-Guanauato	1479	-100.715163	19.809327	-100.689490	19.808010	2.48
Michoacan-Guanauato	1480	-100.694098	19.805377	-100.643409	19.800111	4.95

Appendix B (Continued)

Field Name	ID #	Start X	Start Y	End X	End Y	Length (km)
Michoacan-Guanauato	1481	-100.693440	19.798136	-100.667108	19.798136	2.54
Michoacan-Guanauato	1482	-100.698048	19.792211	-100.663816	19.789578	3.32
Michoacan-Guanauato	1483	-100.688173	19.779703	-100.658550	19.782337	2.88
Michoacan-Guanauato	1484	-100.635510	19.785628	-100.625635	19.785628	0.95
Michoacan-Guanauato	1485	-100.599304	19.810643	-100.608520	19.795502	2.03
Michoacan-Guanauato	1486	-100.602595	19.792869	-100.590087	19.795502	1.25
Michoacan-Guanauato	1487	-100.693440	19.771146	-100.708580	19.757980	2.15
Michoacan-Guanauato	1488	-100.694756	19.759955	-100.593379	19.775095	10.66
Michoacan-Guanauato	1489	-100.676324	19.769171	-100.649992	19.769829	2.54
Michoacan-Guanauato	1490	-100.673691	19.763904	-100.641434	19.756005	3.35
Michoacan-Guanauato	1491	-100.638143	19.775754	-100.630902	19.747447	3.47
Michoacan-Guanauato	1492	-100.632877	19.754688	-100.619052	19.769829	2.26
Michoacan-Guanauato	1493	-100.402473	19.651336	-100.377458	19.634879	3.12
Michoacan-Guanauato	1494	-100.197744	19.717824	-100.193136	19.700050	2.18
Michoacan-Guanauato	1495	-100.208276	19.721773	-100.200377	19.696100	3.18
Michoacan-Guanauato	1496	-100.224076	19.703341	-100.200377	19.671085	4.50
Michoacan-Guanauato	1497	-100.228025	19.615788	-100.181286	19.606572	4.64
Michoacan-Guanauato	1498	-100.165487	19.586165	-100.218809	19.572341	5.72
Michoacan-Guanauato	1499	-100.382725	19.623688	-100.356393	19.602622	3.59
Michoacan-Guanauato	1500	-100.326770	19.567732	-100.253041	19.523627	8.88
Michoacan-Guanauato	1501	-100.397207	19.536134	-100.369559	19.509803	4.14
Michoacan-Guanauato	1502	-100.336644	19.763246	-100.327428	19.755346	1.30
Michoacan-Guanauato	1503	-100.332694	19.768512	-100.317553	19.755346	2.15
Michoacan-Guanauato	1504	-100.370217	19.784311	-100.376800	19.774437	1.35
Michoacan-Guanauato	1505	-100.388649	19.777070	-100.324136	19.801427	7.27
Michoacan-Guanauato	1506	-100.306362	19.799452	-100.282664	19.807352	2.48
Michoacan-Guanauato	1507	-100.268840	19.812618	-100.242508	19.816568	2.58
Michoacan-Guanauato	1508	-100.366925	19.821834	-100.375483	19.808010	1.86
Michoacan-Guanauato	1509	-100.397865	19.861990	-100.384699	19.859357	1.31
Michoacan-Guanauato	1510	-100.338619	19.858699	-100.322820	19.850141	1.84
Michoacan-Guanauato	1511	-100.320187	19.859357	-100.389966	19.837633	7.51
Michoacan-Guanauato	1512	-100.404448	19.854749	-100.391282	19.854749	1.27
Michoacan-Guanauato	1513	-100.406423	19.854091	-100.378117	19.846191	2.92
Michoacan-Guanauato	1514	-100.355734	19.854749	-100.297805	19.829734	6.35
Michoacan-Guanauato	1515	-100.305046	19.848166	-100.312287	19.823151	3.09
Michoacan-Guanauato	1516	-100.359026	19.821834	-100.291222	19.815910	6.98
Michoacan-Guanauato	1517	-100.303729	19.846191	-100.243824	19.830392	6.55
Michoacan-Guanauato	1518	-100.239875	19.843558	-100.253699	19.836317	1.59
Michoacan-Guanauato	1519	-100.230658	19.851457	-100.195111	19.845533	3.55
Michoacan-Guanauato	1520	-100.384699	19.479521	-100.378775	19.474913	0.80
Michoacan-Guanauato	1521	-100.375483	19.470305	-100.369559	19.462405	1.11
Michoacan-Guanauato	1522	-100.396549	19.459772	-100.391282	19.445290	1.82
Michoacan-Guanauato	1523	-100.352443	19.375510	-100.376800	19.370244	2.43
Michoacan-Guanauato	1524	-100.505167	19.412375	-100.518992	19.411717	1.34
Michoacan-Guanauato	1525	-100.684882	19.491370	-100.640776	19.447265	6.81
Michoacan-Guanauato	1526	-100.706606	19.461089	-100.678957	19.445290	3.28
Michoacan-Guanauato	1527	-100.634193	19.449898	-100.616419	19.435415	2.45
Michoacan-Guanauato	1528	-100.606545	19.428832	-100.539399	19.347862	11.71

Appendix B (Continued)

Field Name	ID #	Start X	Start Y	End X	End Y	Length (km)
Michoacan-Guanauato	1529	-100.139814	19.349179	-100.126648	19.316264	4.45
Michoacan-Guanauato	1530	-100.228684	19.598014	-100.156929	19.621713	7.64
Michoacan-Guanauato	1531	-100.090442	19.782337	-100.074643	19.774437	1.80
Michoacan-Guanauato	1532	-100.106241	19.775095	-100.090442	19.770487	1.62
Michoacan-Guanauato	1533	-100.104266	19.765879	-100.085175	19.760613	1.95
Michoacan-Guanauato	1534	-100.263573	19.846191	-100.150347	19.833025	11.13
Michoacan-Guanauato	1535	-100.137839	19.827759	-100.114140	19.823151	2.35
Michoacan-Guanauato	1536	-100.102291	19.821834	-100.094391	19.820518	0.78
Michoacan-Guanauato	1537	-100.086492	19.817884	-100.066743	19.813935	1.96
Michoacan-Guanauato	1538	-100.109532	19.838950	-100.137839	19.840925	2.74
Michoacan-Guanauato	1539	-100.111507	19.844216	-100.192477	19.838950	7.98
Michoacan-Guanauato	1540	-100.110191	19.869231	-100.105583	19.849483	2.41
Michoacan-Guanauato	1541	-100.104924	19.847508	-100.066085	19.835000	4.04
Michoacan-Guanauato	1542	-100.093733	19.848824	-100.072668	19.844875	2.09
Michoacan-Guanauato	1543	-100.102949	19.872523	-100.068060	19.865940	3.46
Michoacan-Guanauato	1544	-100.203668	19.960076	-100.164171	19.960076	3.81
Michoacan-Guanauato	1545	-100.153638	19.942960	-100.122040	19.933086	3.27
Michoacan-Guanauato	1546	-100.120723	19.938352	-100.093075	19.925845	3.06
Michoacan-Guanauato	1547	-100.085834	19.919262	-100.066085	19.908729	2.29
Michoacan-Guanauato	1548	-100.073984	19.935061	-100.064110	19.929136	1.19
Michoacan-Guanauato	1549	-100.079909	19.929136	-100.065427	19.923870	1.53
Michoacan-Guanauato	1550	-100.075959	19.894905	-100.067401	19.887664	1.20
Michoacan-Guanauato	1551	-100.079251	19.889639	-100.063452	19.879764	1.93
Michoacan-Guanauato	1552	-100.410373	20.783603	-100.349152	20.778336	5.94
Michoacan-Guanauato	1553	-100.370875	20.689467	-100.349152	20.690125	2.10
Michoacan-Guanauato	1554	-100.408398	20.636145	-100.349810	20.647336	6.00

Appendix C: Additional Fault Graphs

Appendix C (Continued)

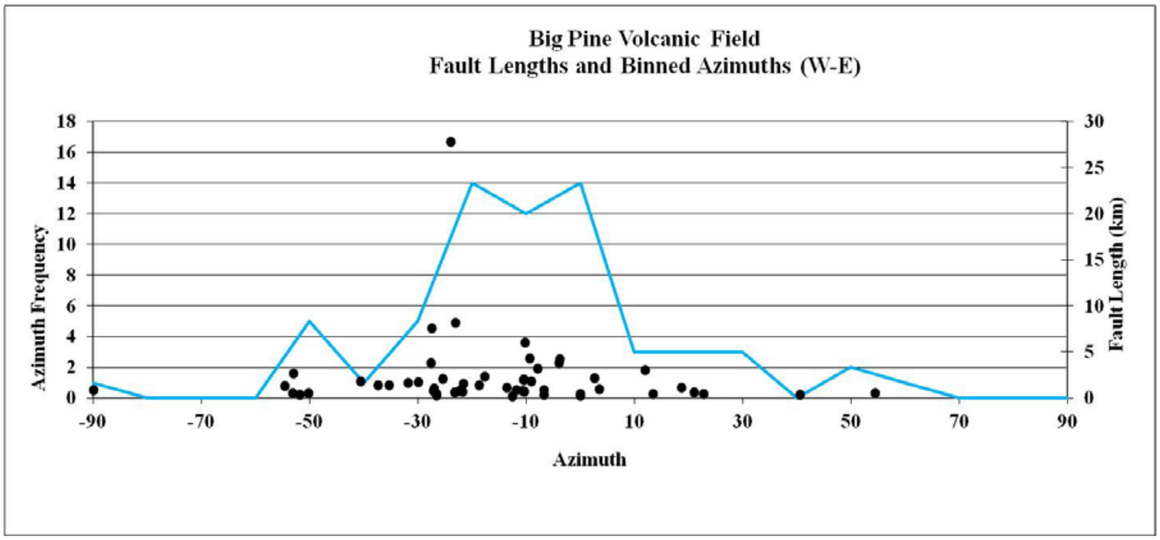

Figure C1. Fault analysis for the Big Pine Volcanic Field. The left axis shows the azimuth frequency for fault traces (blue line) and the right axis indicates the fault length vs. azimuth of fault strike. These data help to understand the basic tectonic regime of the volcanic field by way of fault geometry.

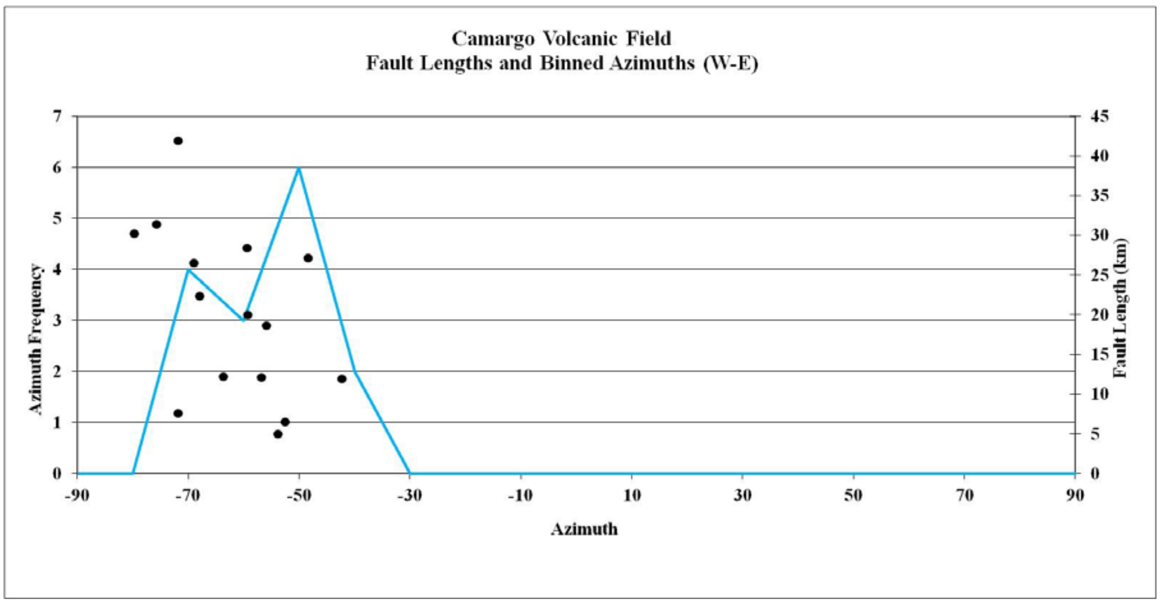

Figure C2. Fault analysis for the Camargo Volcanic Field. The left axis shows the azimuth frequency for fault traces (blue line) and the right axis indicates the fault length vs. azimuth of fault strike. These data help to understand the basic tectonic regime of the volcanic field by way of fault geometry.

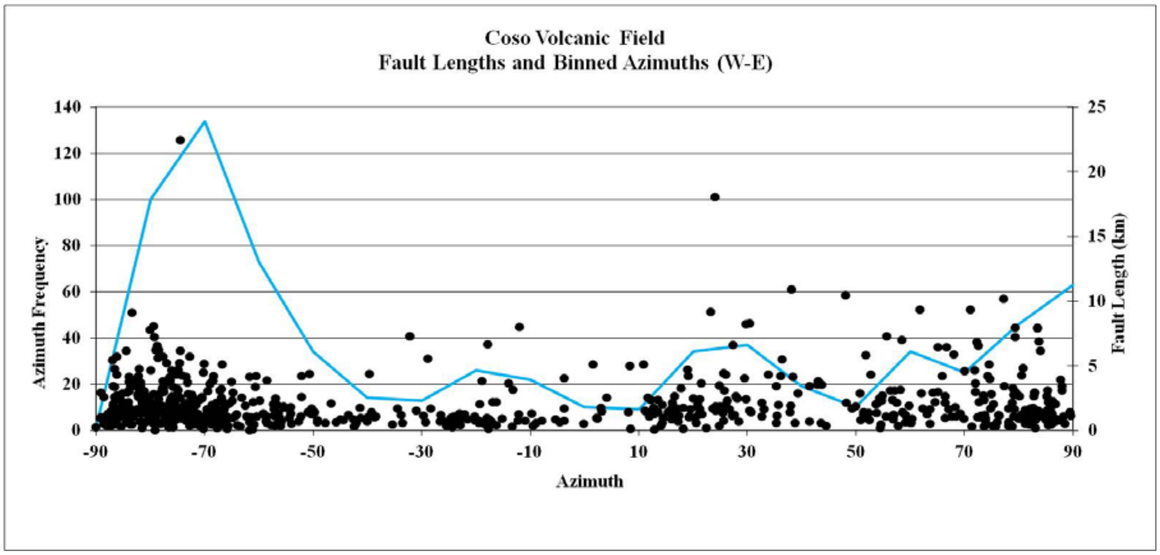

Figure C3. Fault analysis for the Coso Volcanic Field. The left axis shows the azimuth frequency for fault traces (blue line) and the right axis indicates the fault length vs. azimuth of fault strike. These data help to understand the basic tectonic regime of the volcanic field by way of fault geometry.

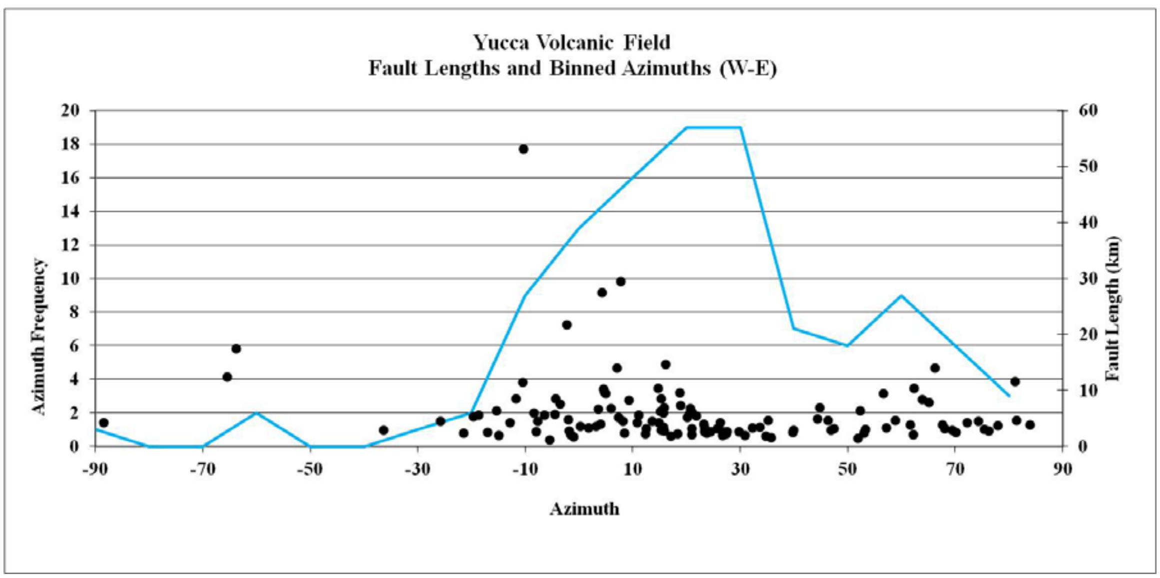

Figure C4. Fault analysis for the Yucca Volcanic Field. The left axis shows the azimuth frequency for fault traces (blue line) and the right axis indicates the fault length vs. azimuth of fault strike. These data help to understand the basic tectonic regime of the volcanic field by way of fault geometry.

Appendix C (Continued)

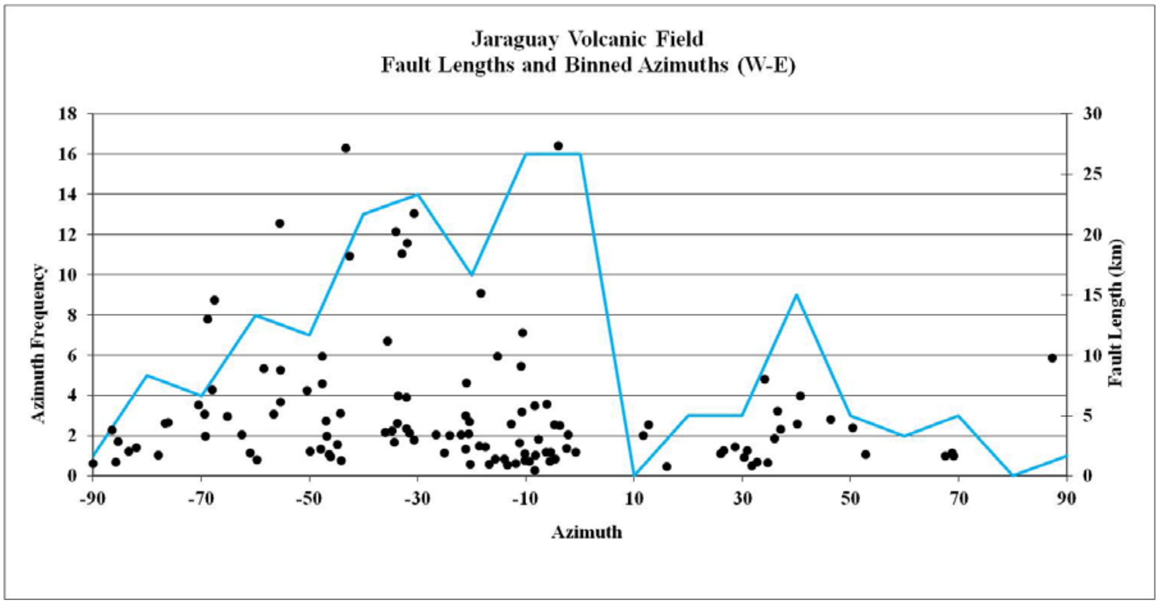

Figure C5. Fault analysis for the Jaraguay Volcanic Field. The left axis shows the azimuth frequency for fault traces (blue line) and the right axis indicates the fault length vs. azimuth of fault strike. These data help to understand the basic tectonic regime of the volcanic field by way of fault geometry.

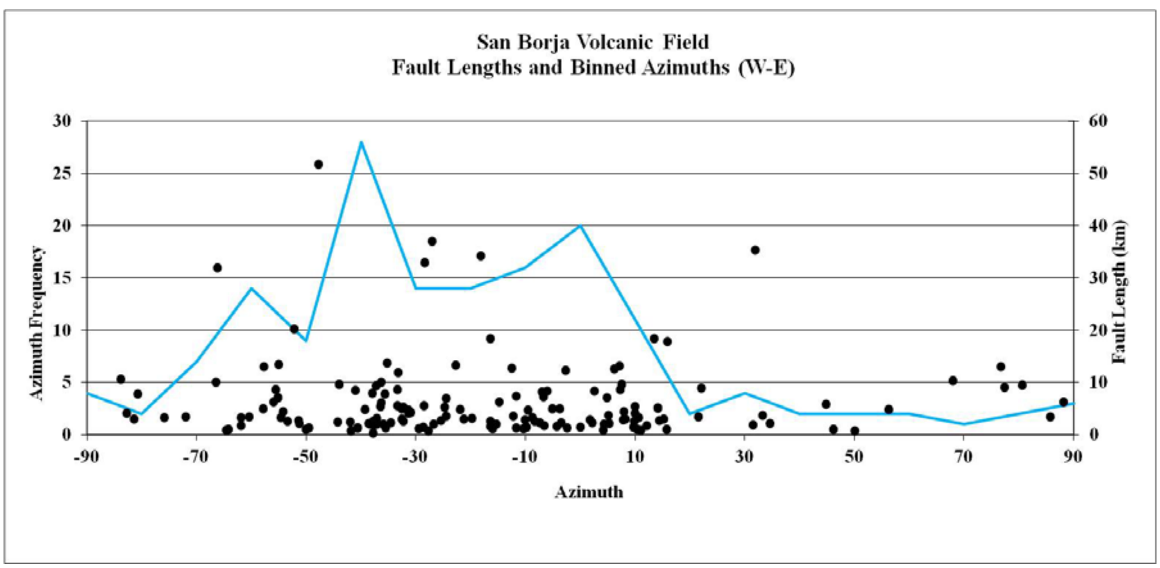

Figure C6. Fault analysis for the San Borja Volcanic Field. The left axis shows the azimuth frequency for fault traces (blue line) and the right axis indicates the fault length vs. azimuth of fault strike. These data help to understand the basic tectonic regime of the volcanic field by way of fault geometry.

Appendix C (Continued)

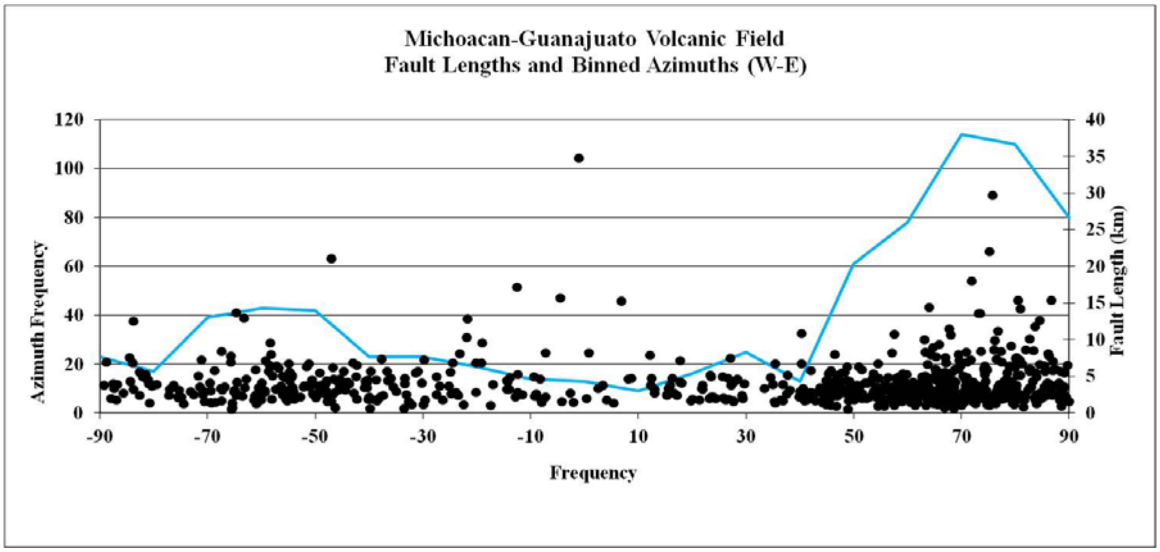

Figure C7. Fault analysis for the Michoacán-Guanajuato Volcanic Field. The left axis shows the azimuth frequency for fault traces (blue line) and the right axis indicates the fault length vs. azimuth of fault strike. These data help to understand the basic tectonic regime of the volcanic field by way of fault geometry.