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Gulf of California Electrical Hot-Spot Hypothesis:

Climate and Wildfire Teleconnections

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Introduction: The prevailing view that radioactive decay is the major thermal source for the interior of the planet may create limitations in geophysical modeling efforts. New theoretical insights (Gregori 2002) provide for an electrical source from the core-mantle-boundary (CMB) by a tide-driven (TD) geodynamo which is enhanced by various solar induction processes. Joule heating at density boundaries within the upper mantle and base of the lithosphere from CMB electrical emanations may provide some of the hotspot energy for upper mantle melts and associated magmatism driving seafloor spreading and lithospheric rupture. Estimates of the total budget of the endogenous energy of the Earth supporting the electrical hot-spot hypothesis are as follows (Gregori, 2002).

1) The general scenario is that the TD geodynamo has a very low performance in terms of magnetic energy output (<<1%), while almost its entire energy output supplies (via Joule's heating) the endogenous energy budget. Indeed it can be sufficient for justifying the entire observed energy budget of the Earth, while other sources, such as radioactivity, are just optional.

2) A different consideration is due to chemical and phase transformation processes, occurring within deep Earth. Observations are evident that the Earth operates like a car battery, being recharged and discharged at different times. This occurs by storing energy within the deep Earth interior. Within a car battery, such storage occurs via a reversible chemical reaction. In the case of the Earth, such storage occurs via a conspicuous change of liquid *vs.* solid phase. It should be stressed that such inference is a matter of observational evidence, and of strict implications. It is NOT a result of any kind of speculation.

3) The timing of such recharging and discharging is manifested, as the most evident effect, in terms of the Earth's electrocardiogram, displaying one heartbeat every ~27.4 Ma (with an error bar of, say, < ±0,05 Ma). Every heartbeat elapses a few Ma, and during it some large igneous province (LIP) is generated. At present, we are close to the peak of one such heartbeat, and a present LIP is Iceland.

4) The manifestation of such huge endogenous energy budget, at least according to the observational evidence referring to the last few million years, occurs in terms of a ~ 60% release as a gentle geothermal heat flow, while the entire remaining 40% includes all other forms of energy, such as volcanism, seismicity, continental drift or sea floor spreading, geodynamics, and tidal phenomena. Therefore, the planetary-integrated role of heat flow cannot be neglected (such as it is being generally assumed when dealing with climate models). Tectonic theorist might consider electrical stimulation from the interior of the planet as a plausible driving mechanism of surge channel activity and plate motions. This driver has remained elusive in modern theoretical constructs.

Two recent lines of observational evidence linked to electrical stimulation within a geologic hotspot exemplify the importance of understanding this tectonic driving mechanism and testing the validity of our hypothesis. The Guaymas Basin Rift, (Fig. 1, and Fig. 2 – Area 2) a geologic hotspot within the Gulf of California is considered a geothermal power source for the region. In the first scenario gentle geothermal heat flow from TD joule heating within the hotspot is invigorated during bursts of regional seismic activity. Solar induced and electrically stimulated seismic activity provides additional thermal energy at the base of the lithosphere. This heat may take up to 6 - 7 months for transmigration and escape at the surface. This timing is consistent with the observational data and rationally explains the local sea surface thermal signatures over the Guaymas Rift coincident with El Nino climate teleconnections (Fig. 2 – Area 3 and 4). In the second scenario Coronal Mass Ejections (CME) induce powerful surges of electrical activity from the deep interior of the planet. These powerful surges overcome resistance in the lithosphere by traveling along more conductive zones generally associated with basaltic fault intrusions and their signature geomagnetic anomaly trends. Ionized gases may be forced through the fracture systems and wildfires may be sparked by electrical arcing (lightning) or direct combustion from intense joule heating near the surface. The unprecedented wildfire storm in October 2003 occurred simultaneously with a powerful CME. Geospatial wildfire patterns suggests these wildfires followed fault and geomagnetic anomaly trends associated with the extension of the East Pacific Rise into the North American continent and Pacific fracture zones traversing the west coast of California. Details of each scenario are discussed below.

I. El Nino Climate Teleconnection: Sea Surface Temperature (SST) anomalies over the Gulf of California/Baja (Fig. 2 - Area 2) are teleconnected to the peak El Nino SST anomaly patterns also seen in Fig. 2. Note the spurious SST anomaly over the Cocos Ridge associated with El Nino (Fig. 2 – Area 3). Earthquakes beginning in November 1996 at the beginning of a solar sunspot cycle (Hale Cycle) signal the beginning of an increased period of seismic activity associated with heat inputs driving the 1997/98 El Nino (Fig. 3). Blot (1976, 2003) indicates thermal transmigration rates of approximately 0.15 km/day accounting for the approximately 7month delay of sea surface thermal signatures after high impact earthquake bursts which even triggered a small tsunami in Hawaii (Walker, Per. Comn.). Seismic precursors to El Nino by 6-7 months have also been documented (Walker 1988, 1995, 1999) over the last 7 recent El Nino events. The resulting clustered seismic activity is hypothesized to be electrical in nature and is associated with joule heating at density boundaries near the base of the lithosphere (Gregori, 2000, 2002). Electrical stimulus of these earthquakes is highly suspect, especially below the lithosphere. This scenario provides a geophysical mechanism for explaining the SST anomaly teleconnections. These SST anomaly patterns overlying earthquake events are hypothesized to be the result of increased heat emission from seafloor volcanic extrusions and/or associated hydrothermal venting. The volcanism is triggered by electrical bursts from the core-mantle-boundary induced by solar coupling to the internal geodynamo. The larger implication is that El Nino may be solar-tectonically modulated (Leybourne 1997, Leybourne and Adams 2001).

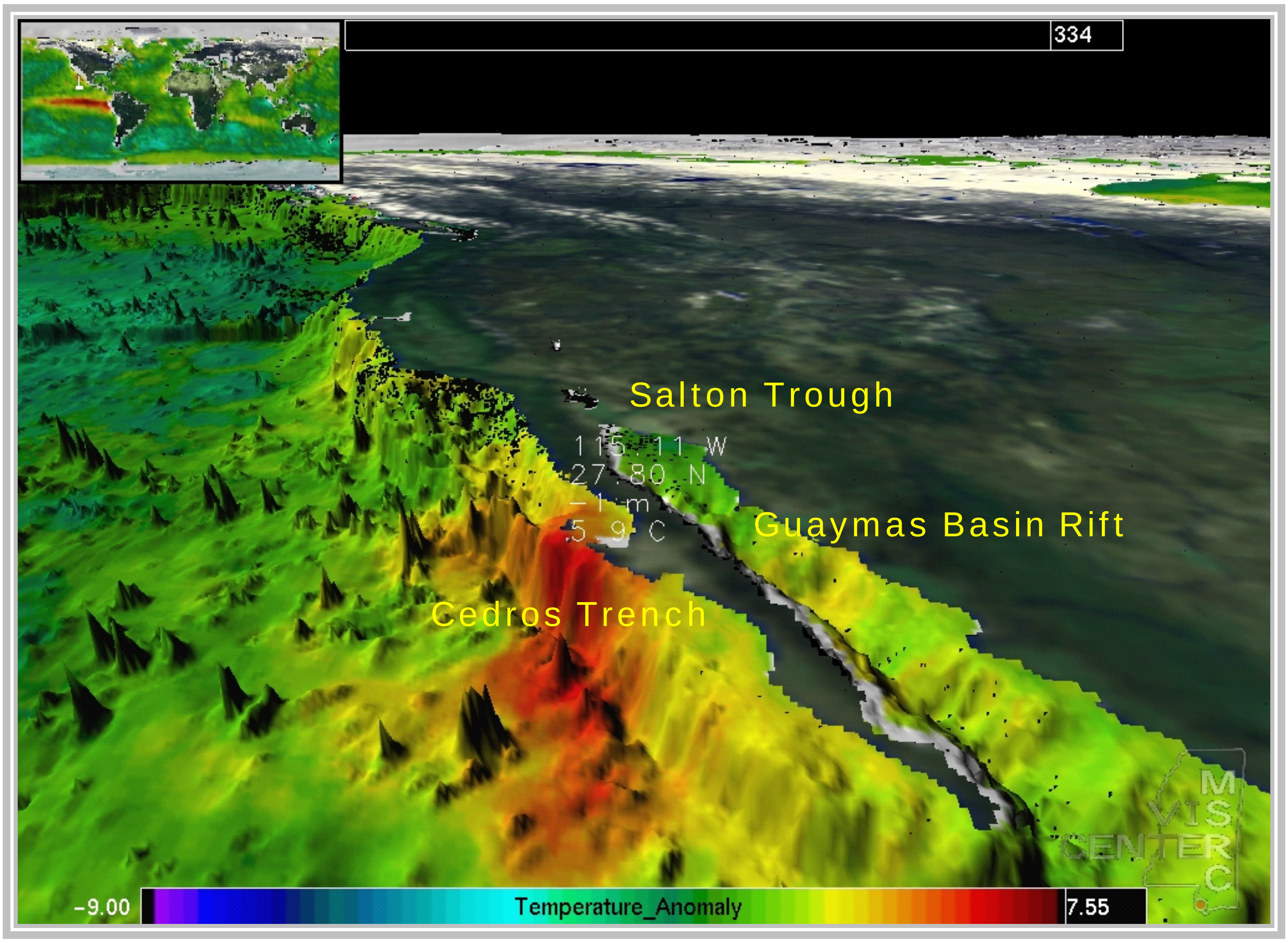

Fig. 1. SST Drape Over Bathymetry in the Gulf of California Salton Trough Region Exhibits Thermal Anomalies Coincident with the Adjacent Cedros Trench. Thermal Signatures in this area are often Teleconnected to El Nino SST Anomalies off the Coast of South America. The Guaymas Basin Rift is the Likely Energy Source for this Local Thermal Signature and is a Known Geologic Hot-spot Supplying Southern California with Geothermal Power (Image by Haas 2002, NAVOCEANO-MSRC).

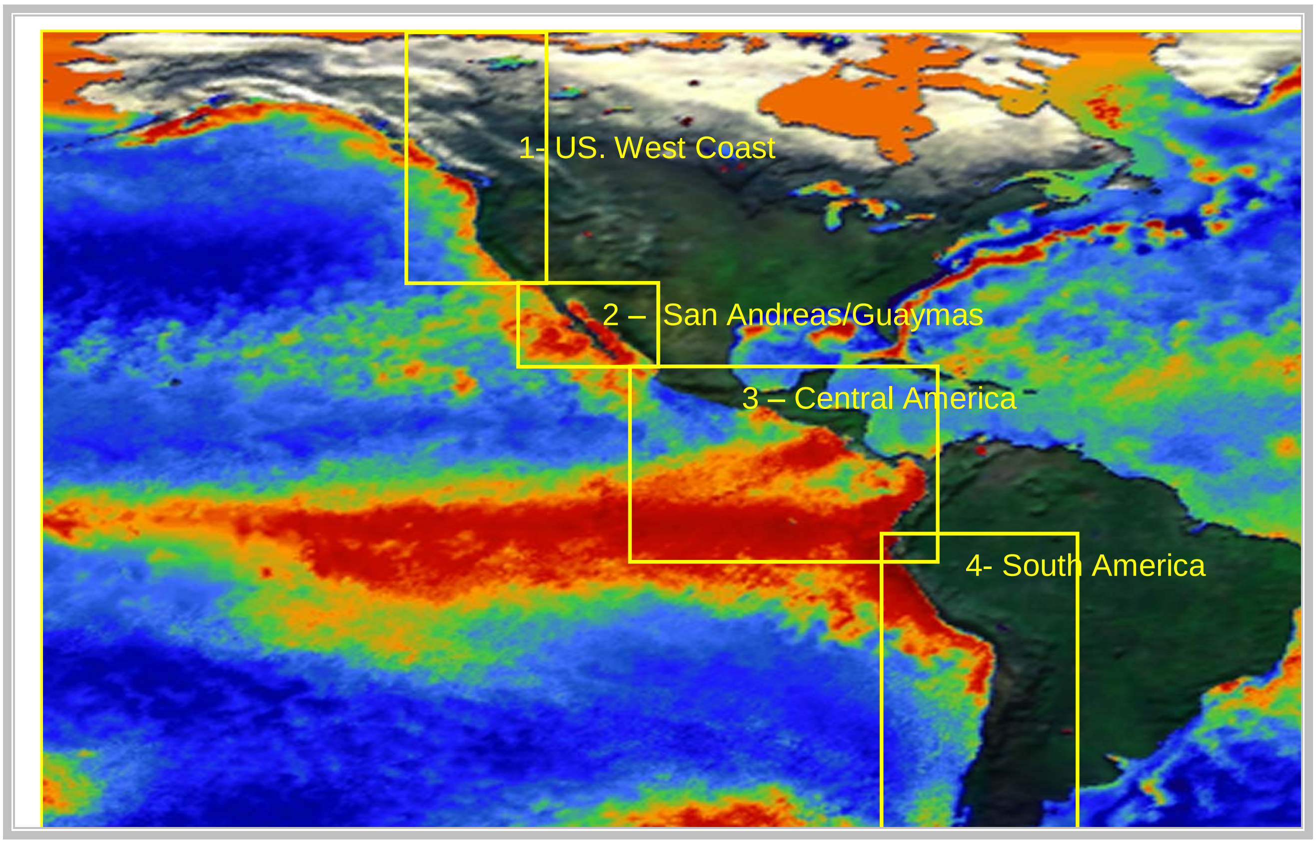

Fig. 2. Eastern Pacific SST anomalies peak in January of 1998 during 97/98 El Nino event in area 2 - San Andreas/Guaymas. This corresponds to the viewing angle in Fig. 1 Exhibiting Teleconnection SST anomalies over Guaymas Rift and Cedros Trench. Area 3 Central American Exhibits the main intertropical convergence SST anomaly coincident with spurious teleconnection pattern over the Cocos Ridge trend (NAVOCEANO-MSRC).

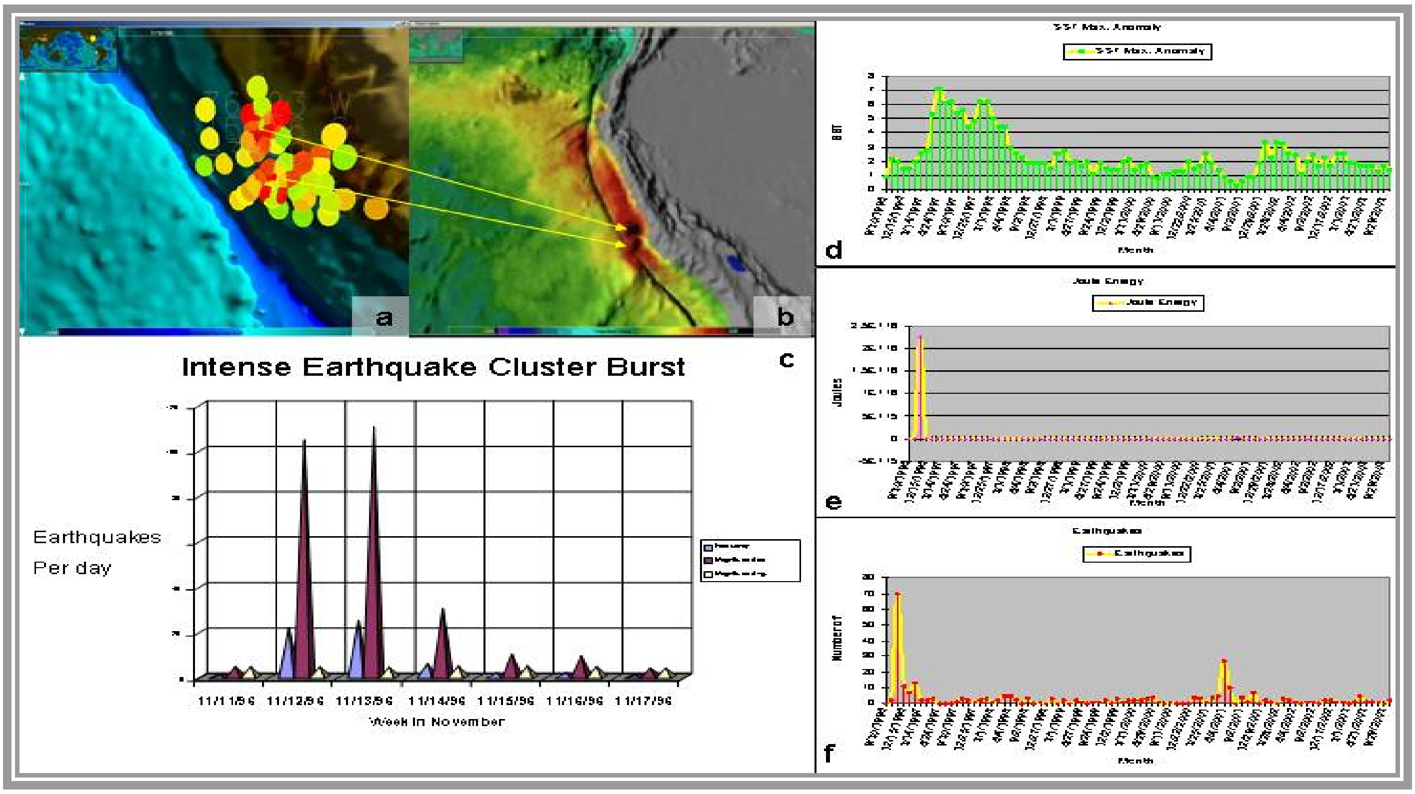

Fig. 3(a). Two distinct clusters of earthquakes off the Coast of South America in Nov. 96 are apparent, (b). SST's seem to emanate in a similar pattern to the earthquake paired clusters. The northern SST anomaly is on the continental shelf as is the northern earthquake cluster, while the southern SST anomaly is further offshore over the continental slope as is the southern earthquake cluster. These SST anomalies appeared (June 1997) just north of earthquake positions possibly due to prevailing long shore currents, about 7 months after the paired earthquake clusters. (c). Chart indicates earthquakes/day (Frequency), magnitudes are added for simple power indicator (Magnitude Add), along with an average (Magnitude Avg). A spike in earthquake activity begins Nov. 12th and tapers off Nov. 14th revealing the intense episodic nature of these events. (d). SST Max. Anomaly/month indicating anomalies > 7° C by June 97 followed by a year of elevated SST anomalies associated with the 97/98 El Nino. (e). Joule energy released during (f). Earthquake events Nov. 96.

II. Wildfire Teleconnection: Wildfire outbreaks during a period of geomagnetic storms in October 2003 may be linked to electrical emanations from within the earth (Leybourne et. al. 2004). In late October 2003, a powerful Coronal Mass Ejection (CME) directed straight at Earth erupted on the Sun's surface, when wildfires simultaneously broke out along an arc shaped pattern of geomagnetic anomaly trends extending from Mexico to north of Los Angeles (Fig. 4). The wildfire ignitions slowed dramatically when the CME period ended. The geomagnetic anomalies are inter-splayed by fault systems connected to the Gulf of California hotspot through the San Andreas Fault complex and to the Hawaii hotspot through the Murray Fracture Zone. These orthogonal fault systems intersect in the San Gabriel Mountains where a huge wildfire out break occurred near strong geomagnetic signatures (Fig.5). Strong electrical impulses emitted from the CMB during CME may not only joule heat local geologic hotspots, but unconverted superfluous electrical energy and ionic plasmas could be transmitted further along conductive igneous complexes (generally associated with geomagnetic signatures) and fault systems through the lithospheric fractions of the earth, arcing to power lines and igniting tree lighter or underbrush. In 1859 during the strongest CME on record, telegraph wires in western United States and Europe caught fire and were destroyed. Potential voltage differences between hotspot locations may create electrical ground shorts at geomagnetic intersection areas (Fig. 6), starting fires near power line circuits or from discharges directly to the ionosphere. An electrical hot-spot hypothesis based on Gregori's theoretical construct is understood in terms of deep earth electromagnetic induction coupled to solar perturbations. The induction process creates anomalous electric currents from the internal-geodynamo.

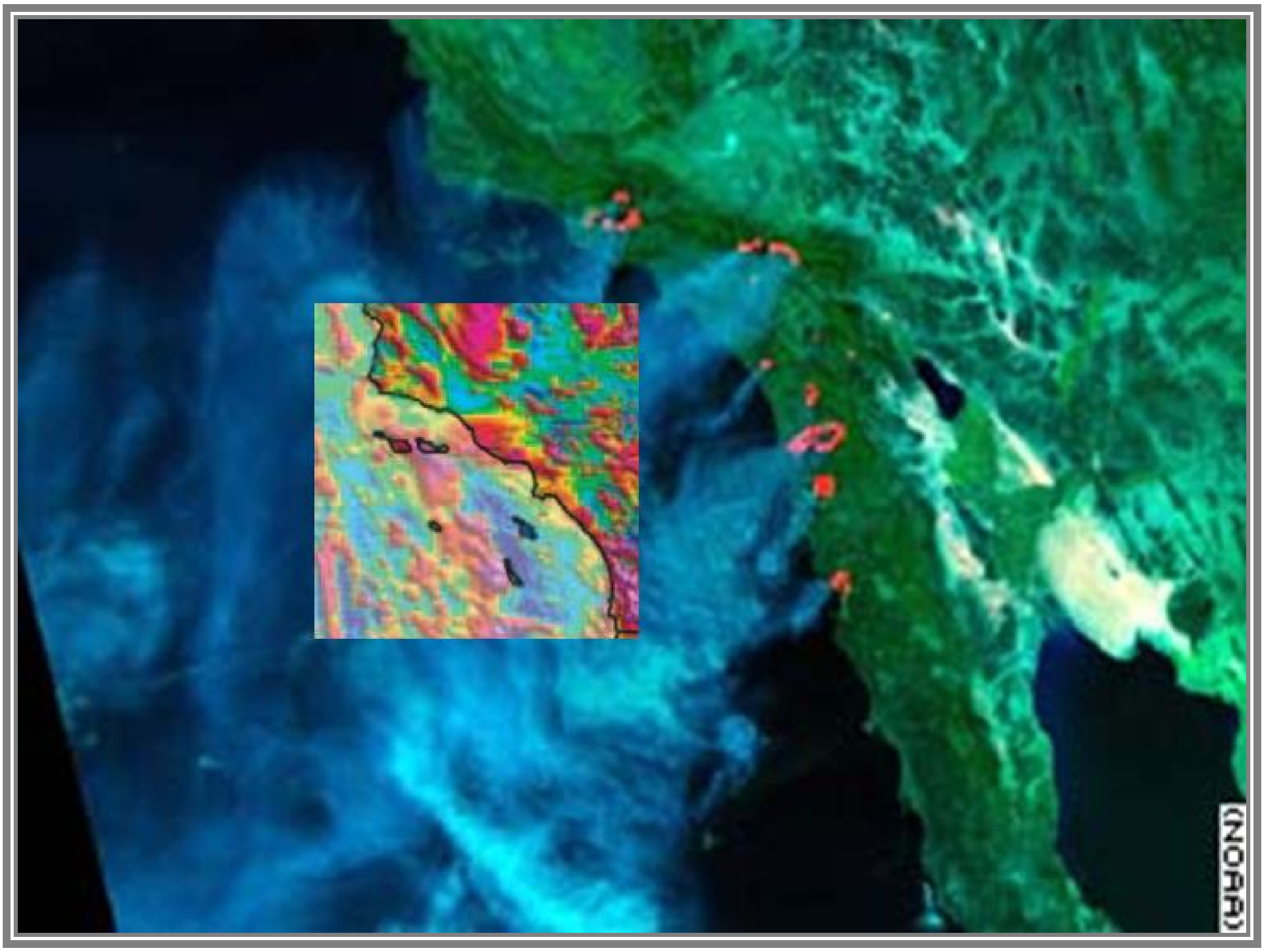

Fig. 4. Arc-shaped fire pattern appears linked to geomagnetic anomaly trends (insert).
http://activefiremaps.fs.fed.us/fire_imagery.php?firePick=southern_california; http://pubs.usgs.gov/sm/mag_map/ mag_s.pdf

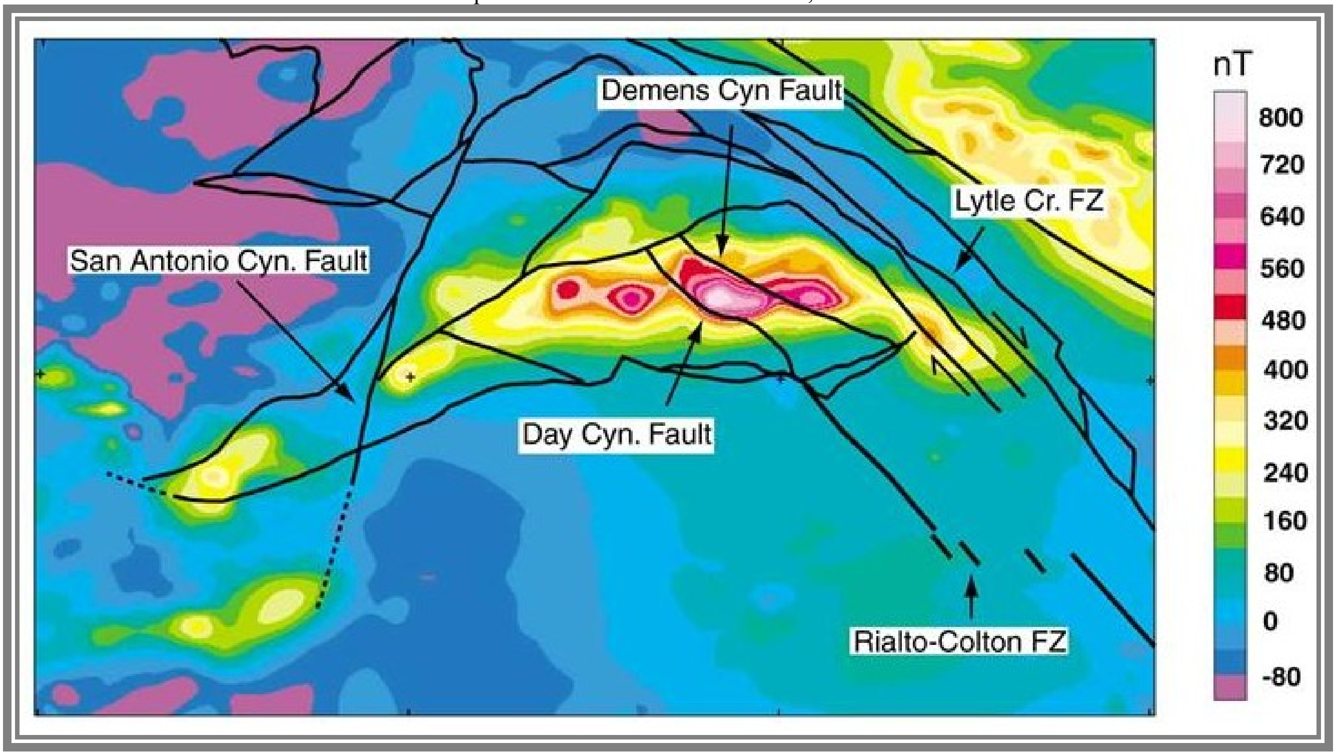

Fig. 5. [3]Geomagnetic anomalies in San Gabriel Mountains along intersecting faults and mylonite units.
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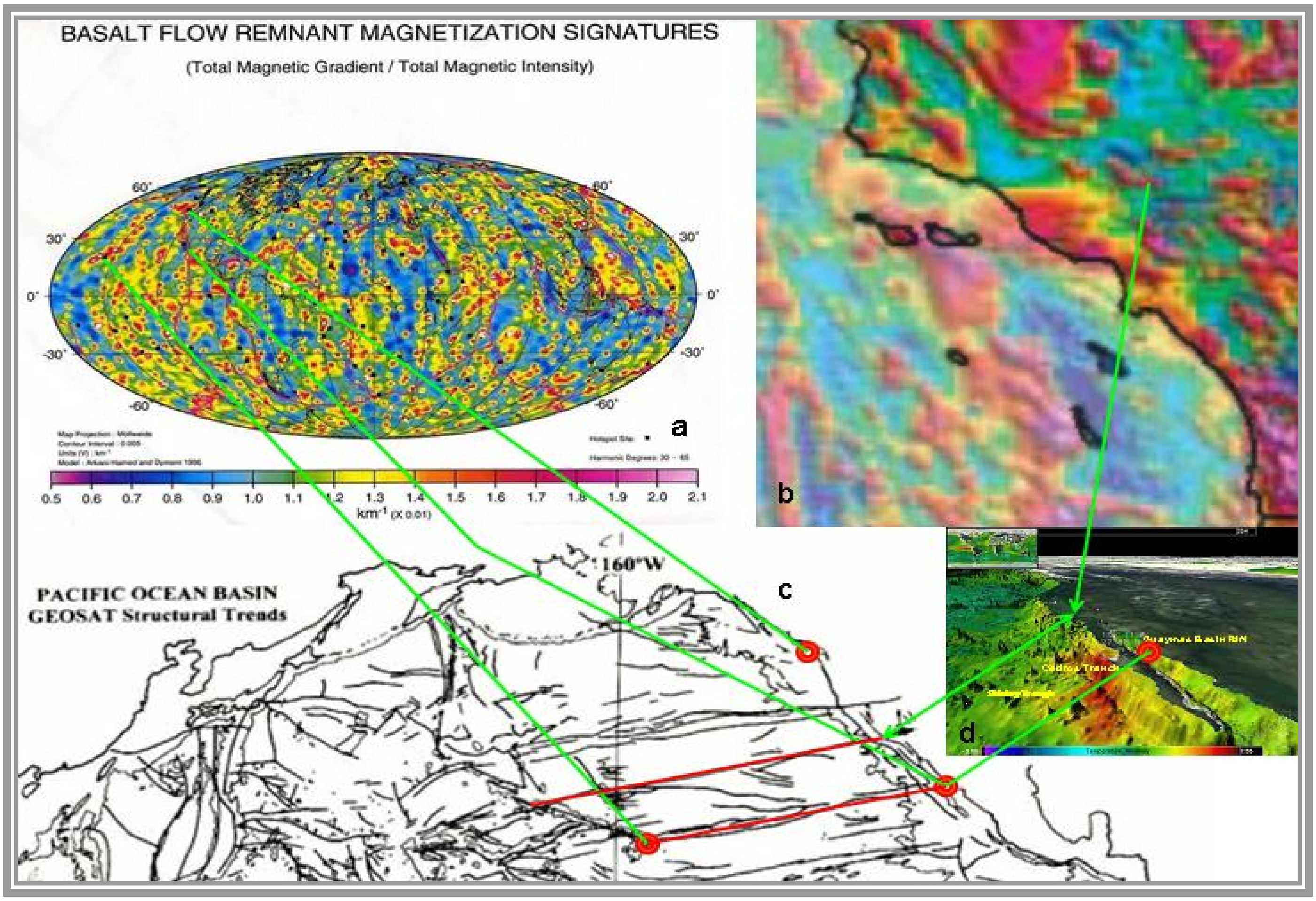

Fig. 6. Geophysical Composite Map: a.) Basalt Flow Remnant Magnetization Signatures Indicating Global Hotspot Locations and Indicated Pacific Links (Quinn 1997). b.) Southern California Geomagnetic Crustal Anomalies have Coincident Links to the San Andreas Orthogonal Fault Complex associated with an Intersection in the San Gabriel Mountains where a huge Wildfire Outbreak Occurred Near the Strong Geomagnetic Signatures During the October 2003 CME (USGS 2002). c.) Pacific Ocean Basin GEOSAT Structural Trends Indicating Possible Electrical Conduits (Red Lines) Between Murray (North) and Molokai (South) Fracture Zones which Intersections at Hawaiian, Guaymas, and Juan de Fuca Hotspots (Orange Circles), Geographical Links (Green Lines) (Smoot and Leybourne 2001). d.) Southern View in Fig. 1 with Geographical Links (Haas 2002).

Conclusions: Thus, Earth's endogenous energy may stimulate ocean basin heating associated with El Nino from episodes of increased seismic stimulation and electrical wildfire propagation during CME via geologic hotspot controls. Atmospheric pressure teleconnections are also suspected (Namias 1989) in some cases. A distinction is made between the control on the TD geodynamo exerted by the e.m. induction within very deep Earth (i.e. within the mantle, which occurs only for e.m. signals of some very low frequency, say with a period T > 22 years), and the e.m. solar induction within some much shallower structures characterized by much higher frequencies and much shorter periods. Such kinds of phenomena also include the e.m. induction effects within manmade systems, such as power lines (causing blackouts), pipelines, and communication cables (Meloni et al. 1983, Lanzerotti and Gregori 1986). Should we address these as distinct phenomena? The relationships between the different e.m. signals within such different frequency bands is not clearly defined but, these various affects at different time scales may to some degree be physically driven by electrical stimulation from the interior of the planet.

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