Appendix 2B
Fault Stability Assessment

Tech Limit
Solutions with magnitude

River Parish Geomechanical Fault Seal Potential

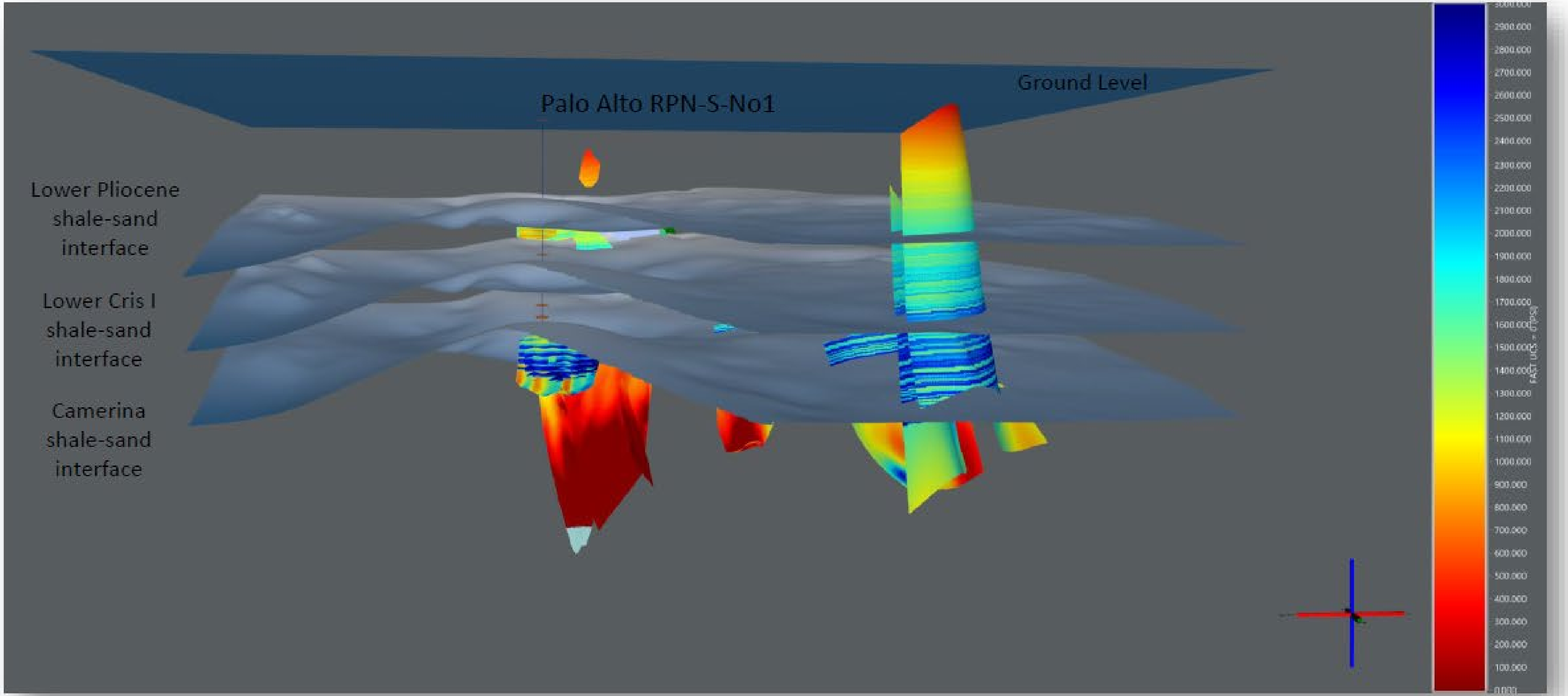
Project Number: 272401

Author: Scott Mildren

Date: April 2024

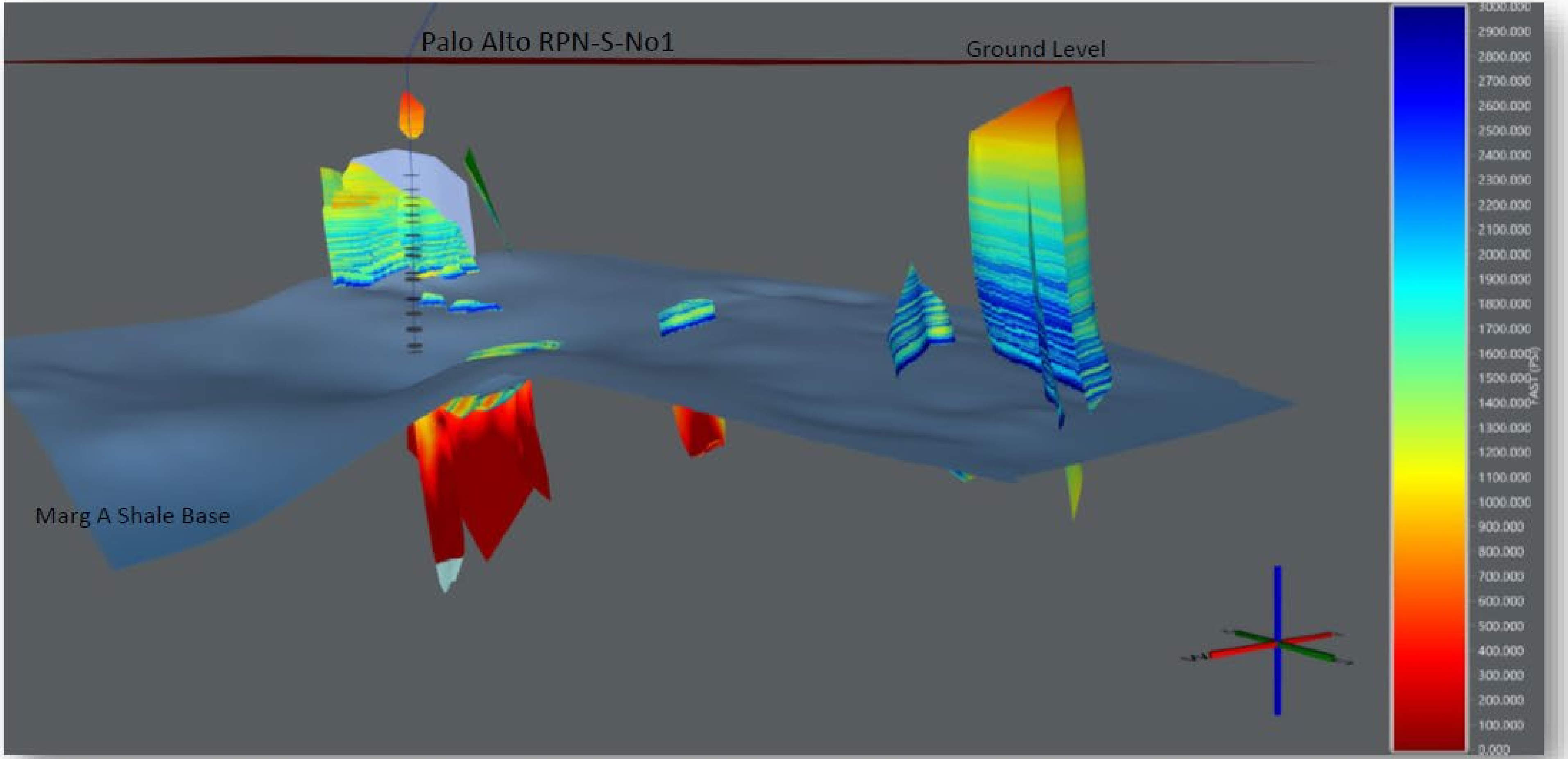
Full Model Reactivation Risk

- Overview of fault reactivation risk.
- Fault risk is represented as pressure change to activate fault surface (DeltaP) in psi.
- Shale–sand interface for shallow, mid and deep models shown for reference.



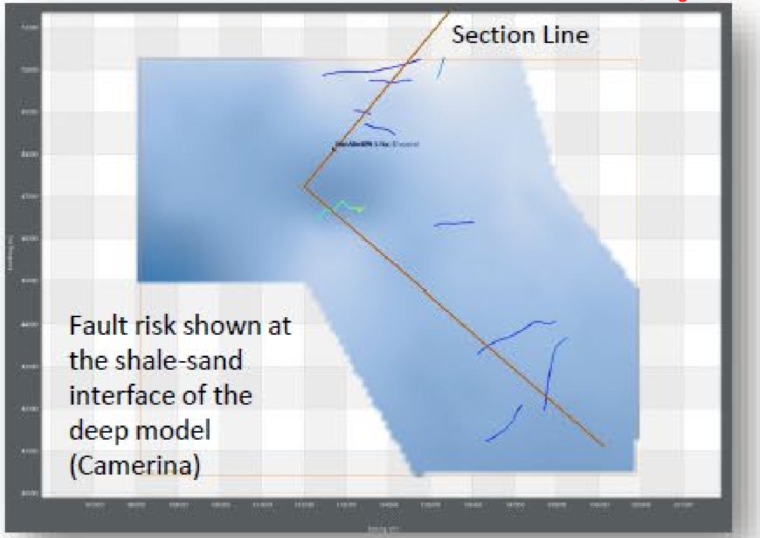
Full Model Reactivation Risk

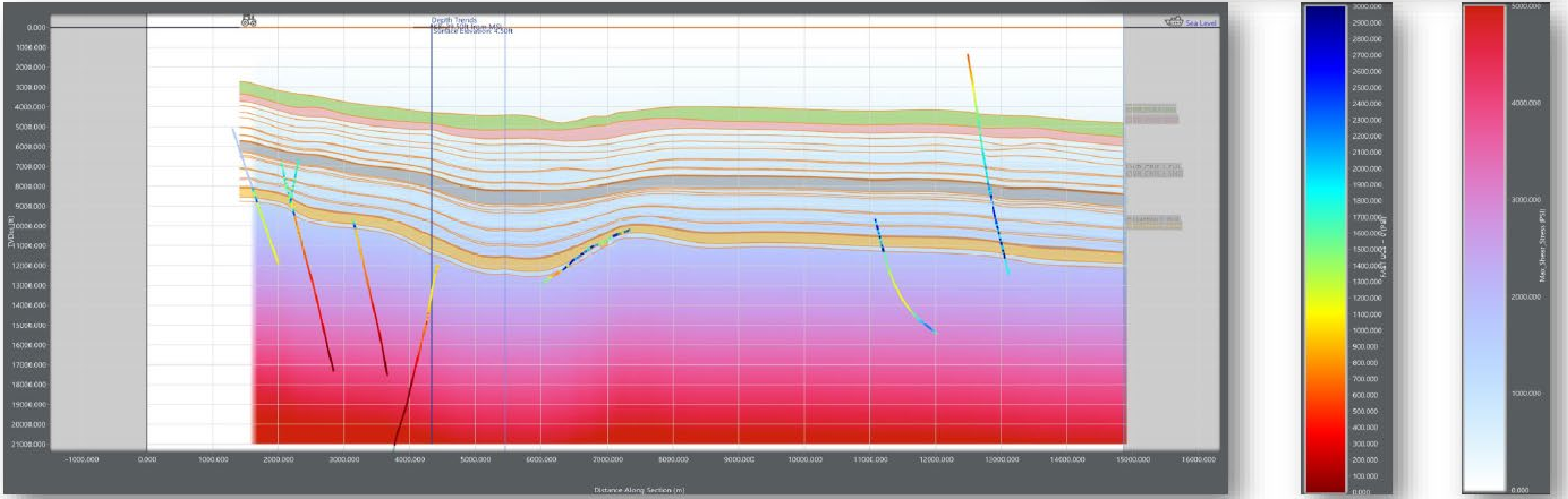
- Alternative 3D view of River Parish faults coloured with respect to pressure change required to reactivate fault segment.
- Surface horizon (red) and Marg A Shale Base (grey) surfaces included for reference.



Section Line Reactivation Risk

- Section and plan view illustrating reactivation risk Faults coloured by DeltaP (pressure change required to activate fault) superimposed on maximum shear stress.
- Above Marga Shale Base and below 1st Miocene Shale, faults indicate a pressure change in excess of 1500 psi for activation.
- Note: data trends used above 1st Miocene Shale and below Marga Shale Base.





Tech Limit
Solutions with magnitude

Shallow Case
Lower Pliocene

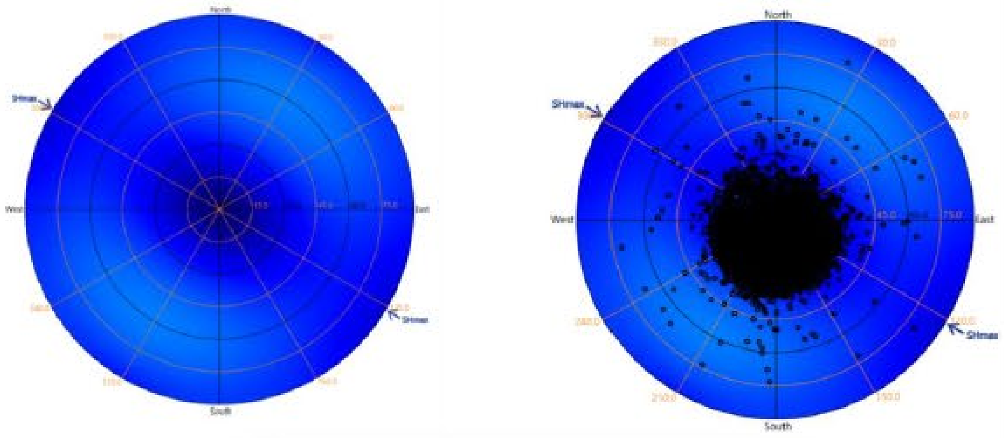
Shale: 4600 ft
Sand: 5025 ft

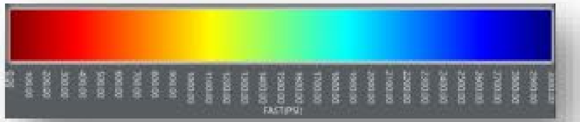
Risk is presented as the pressure change required to induce failure.

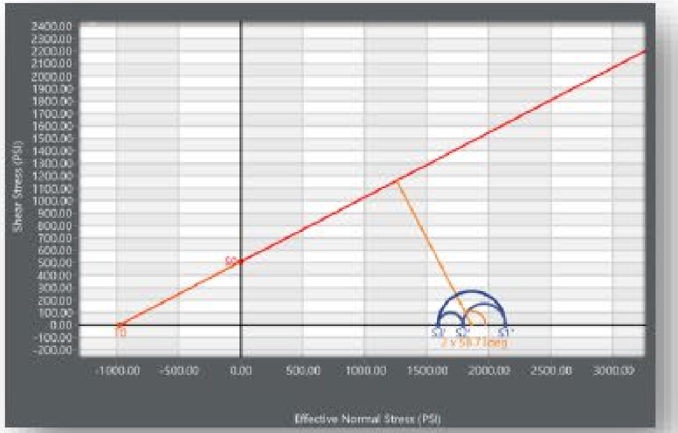
Intact rock strength used to risk creation of new faults and fractures at critical orientations

Shallow Case Intact Rock

Lower Plio Shale (4600 ft)





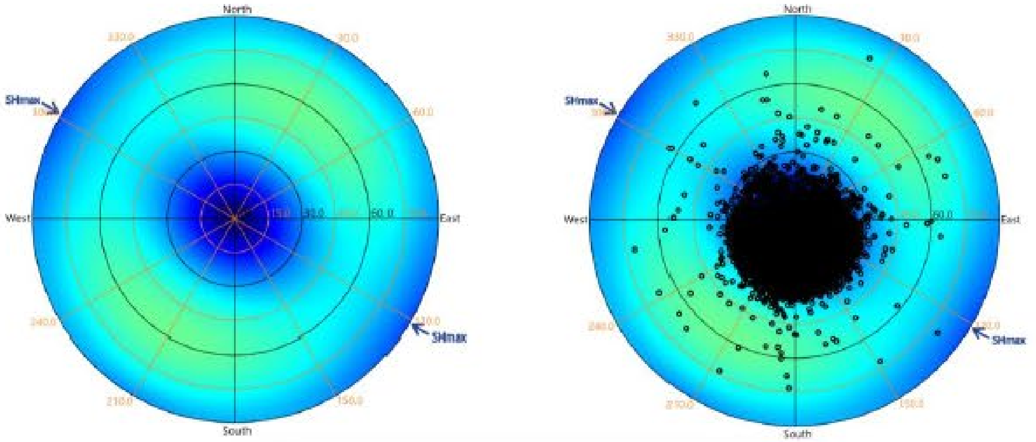


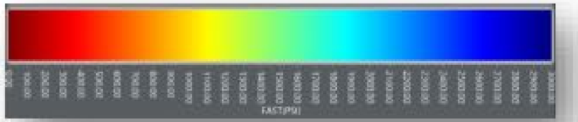
Stereonets plot poles to planes (northern hemisphere projection) Coloured by reactivation risk **calculated at Palo Alto RPN-S-No1**

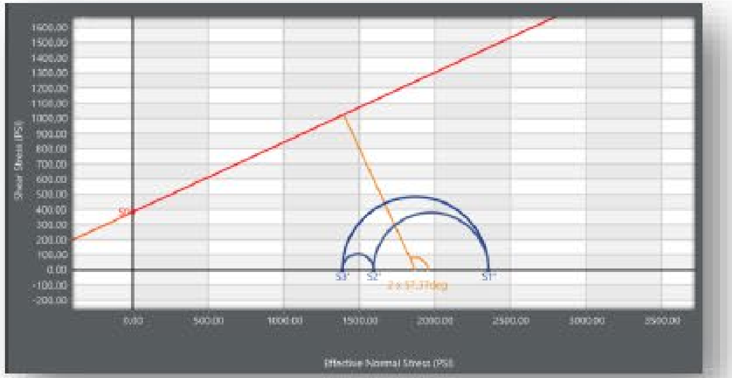
Image log derived surfaces (full population) are superimposed as poles to planes

Mohr diagrams plot the corresponding pore pressure & stress conditions

Lower Plio Sand (5025 ft)

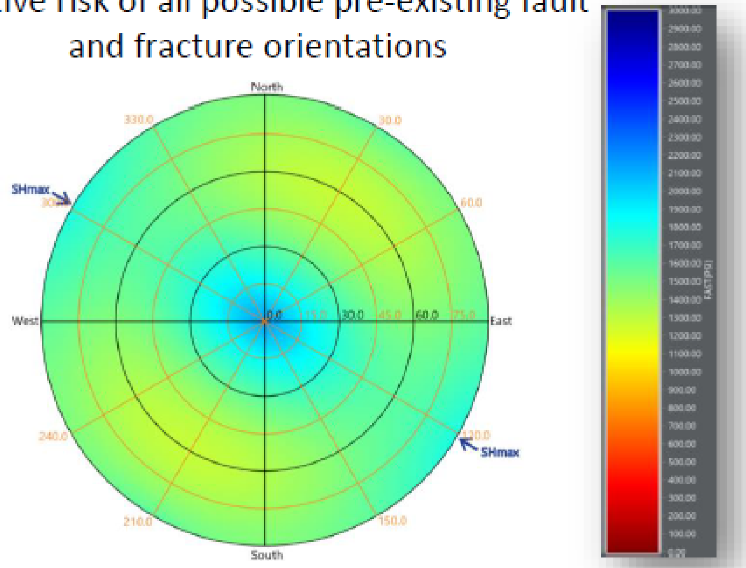




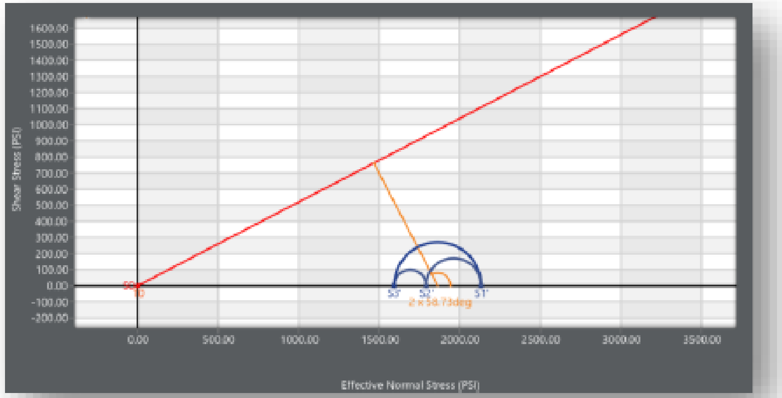


Shallow Case React LWR Plio Shale

Relative risk of all possible pre-existing fault and fracture orientations



Mohr diagram illustrates the corresponding pore pressure, stress and strength conditions

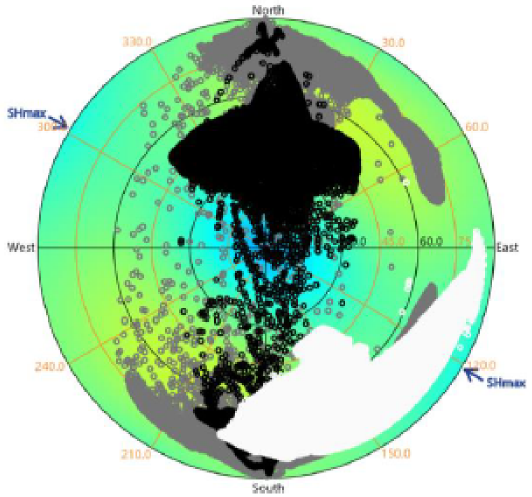


All figures are specific for stress and strength conditions at 4600 ft at Palo Alto RPN-S-No1

Risk is presented as the pressure change required to induce failure.

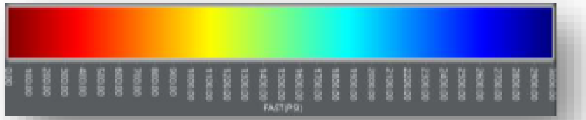
Cohesive strength is reduced to 0 to risk activation of existing faults and fractures

Stereonets plot poles to planes (northern hemisphere projection) Coloured by reactivation risk **calculated at Palo Alto RPN-S-No1**



Fault populations superimposed as poles to planes over reactivation risk

- Northern
- Central
- Southern



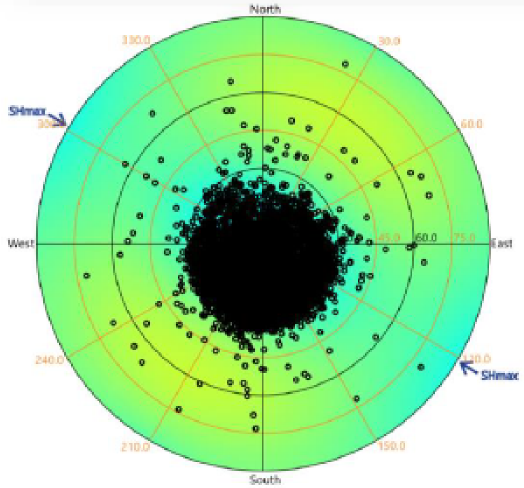
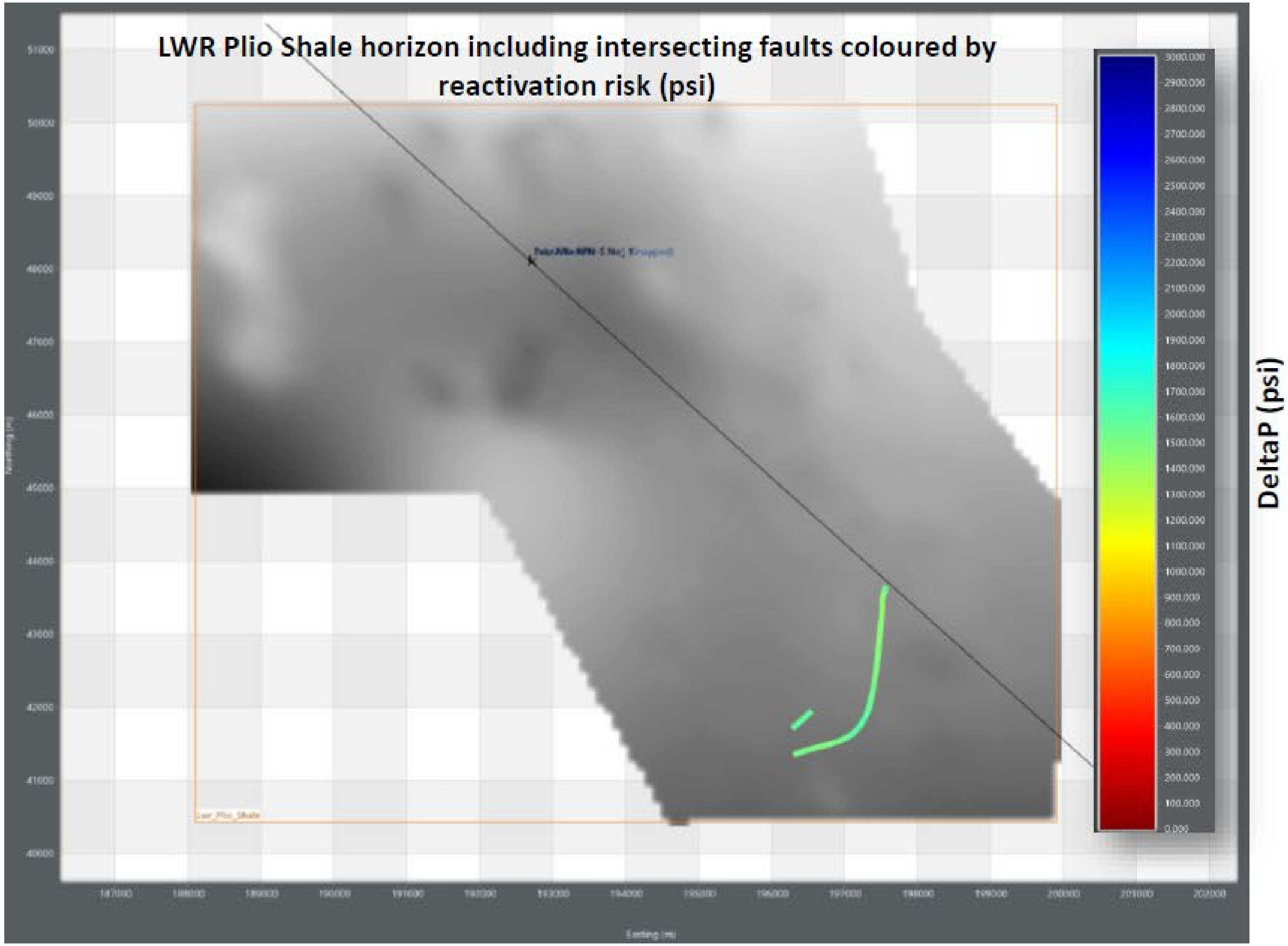


Image log derived surfaces (full population) are superimposed as poles to planes

Shallow Case: LWR Plio Shale

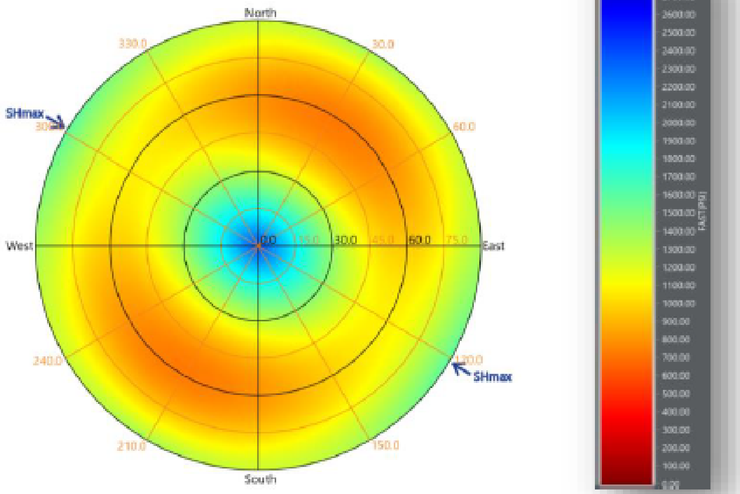
Note: Maps consider 3-dimensionality of the problem, stereonets are for a single depth at Palo Alto RPN-S-No1

- Map illustrating faults intersecting the LWR Plio **Shale** horizon coloured by reactivation risk (pressure change required to initiate failure) at this intersection.
- Effective stresses are mapped to all faults and the pressure change required to activate the specific orientation of the fault across each triangulated surface is calculated.
- Fault cohesion conservatively assumed to be 0 psi and utilising friction angle equivalent to intact rock at this depth.
- Prediction suggests faults will reactivate with a pressure change exceeding approx. 1300 psi.

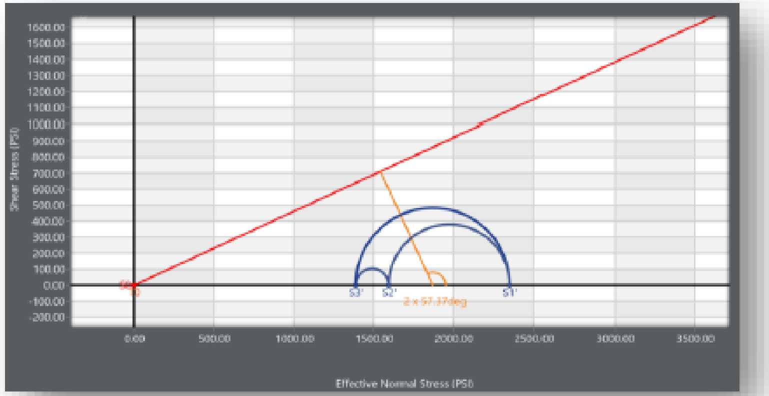


Shallow Case React LWR Plio Sand

Relative risk of all possible pre-existing fault and fracture orientations



Mohr diagram illustrates the corresponding pore pressure, stress and strength conditions

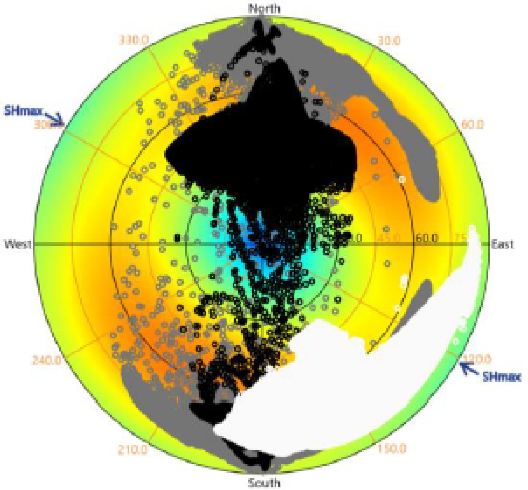


All figures are specific for stress and strength conditions at 5025 ft at Palo Alto RPN-S-No1

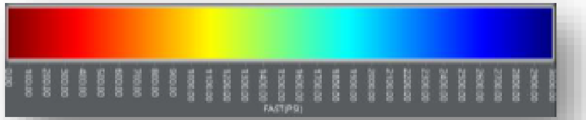
Risk is presented as the pressure change required to induce failure.

Cohesive strength is reduced to 0 to risk activation of existing faults and fractures

Stereonets plot poles to planes (northern hemisphere projection) Coloured by reactivation risk **calculated at Palo Alto RPN-S-No1**



Fault populations superimposed as poles to planes over reactivation risk



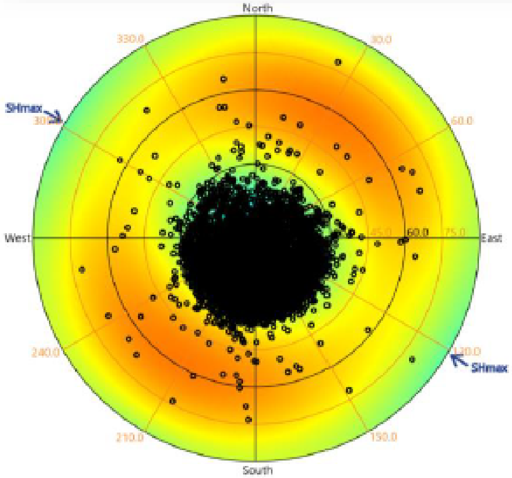
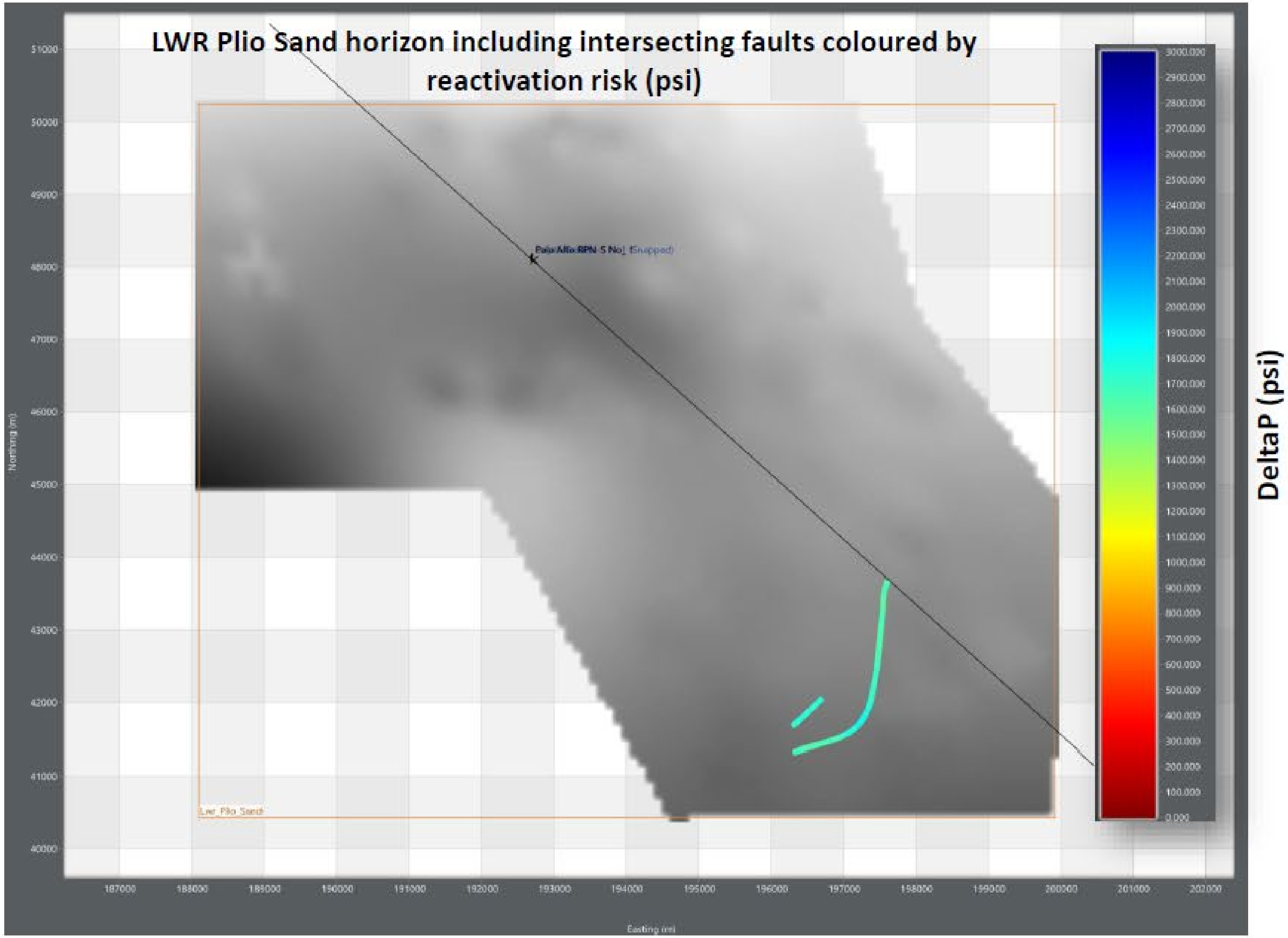


Image log derived surfaces (full population) are superimposed as poles to planes

Shallow Case : LWR Plio Sand

Note: Maps consider 3-dimensionality of the problem, stereonets are for a single depth at Palo Alto RPN-S-No1

- Map illustrating faults intersecting the LWR Plio **Sand** horizon coloured by reactivation risk (pressure change required to initiate failure) at this intersection.
- Effective stresses are mapped to all faults and the pressure change required to activate the specific orientation of the fault across each triangulated surface is calculated.
- Fault cohesion conservatively assumed to be 0 psi and utilising friction angle equivalent to intact rock at this depth.
- Prediction suggests steep faults in the southeast will reactivate with a pressure change exceeding approx. 1400 psi.
- Faults are not critically oriented at this horizon under these conditions.



Tech Limit
Solutions with magnitude

Mid Case
Lower Cris I

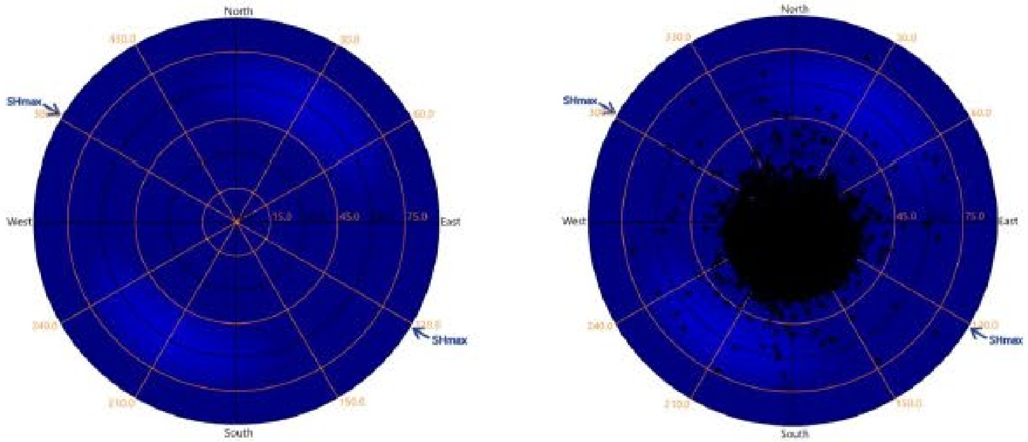
Shale: 7475 ft
Sand: 7600 ft

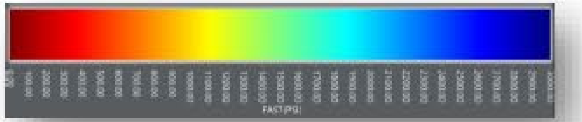
Mid Case Intact Rock

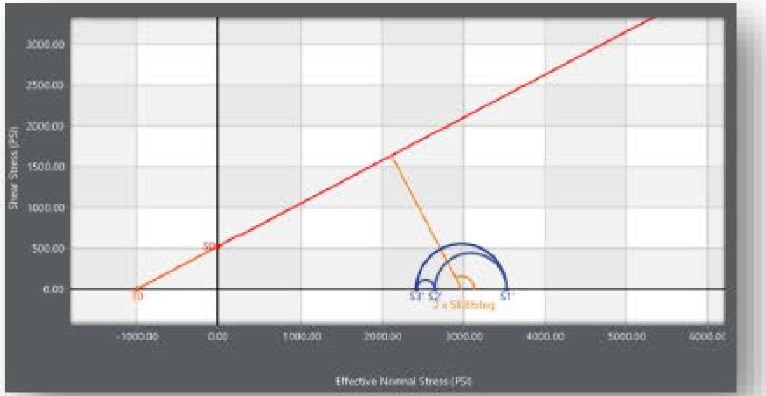
Risk is presented as the pressure change required to induce failure.

Intact rock strength used to risk creation of new faults and fractures at critical orientations

Lower Cris I Shale (7475 ft)





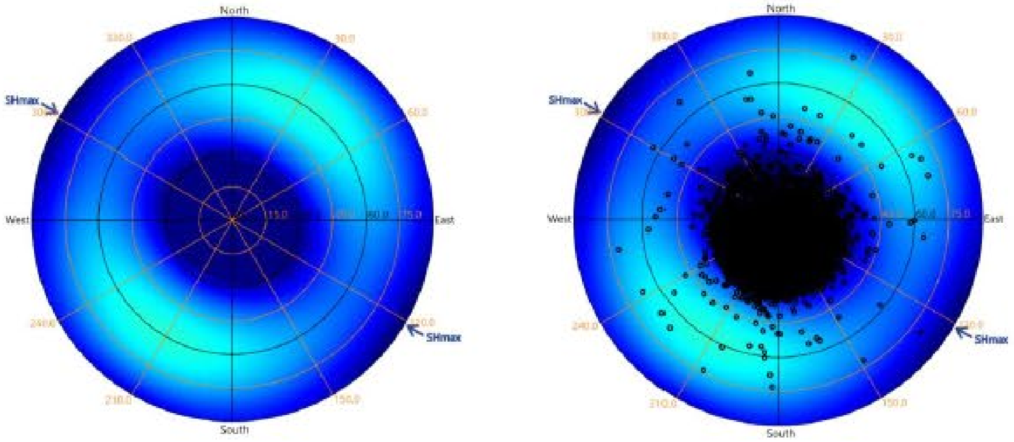


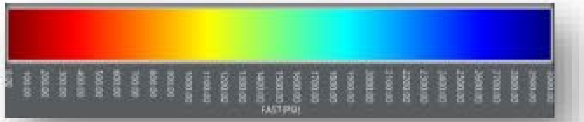
Stereonets plot poles to planes (northern hemisphere projection) Coloured by reactivation risk **calculated at Palo Alto RPN-S-No1**

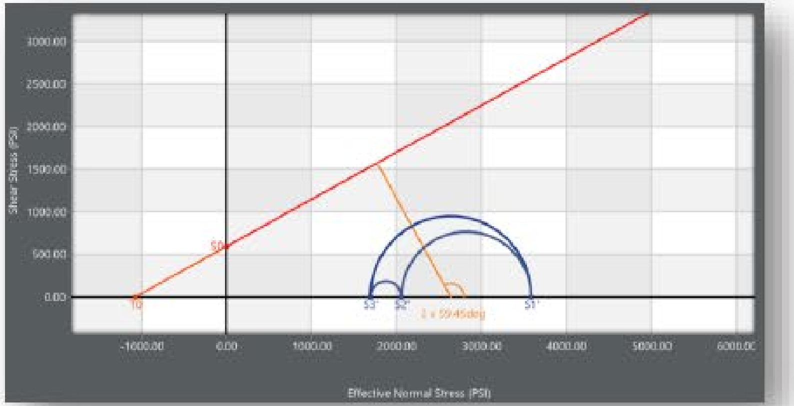
Image log derived surfaces (full population) are superimposed as poles to planes

Mohr diagrams plot the corresponding pore pressure & stress conditions

Lower Cris I Sand (7600 ft)

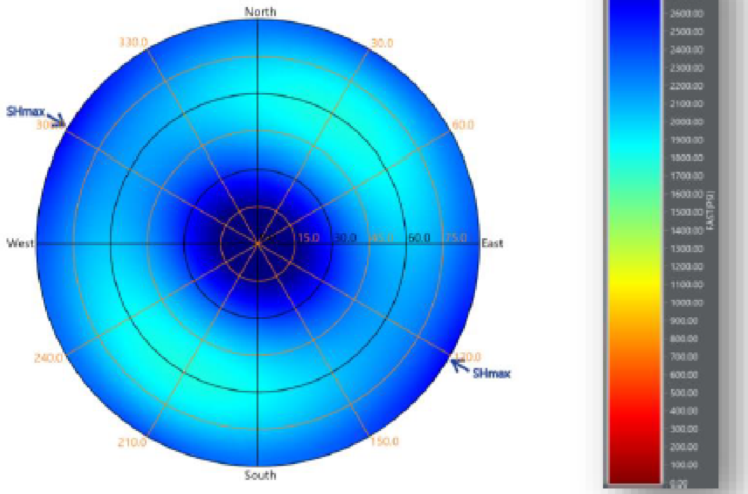




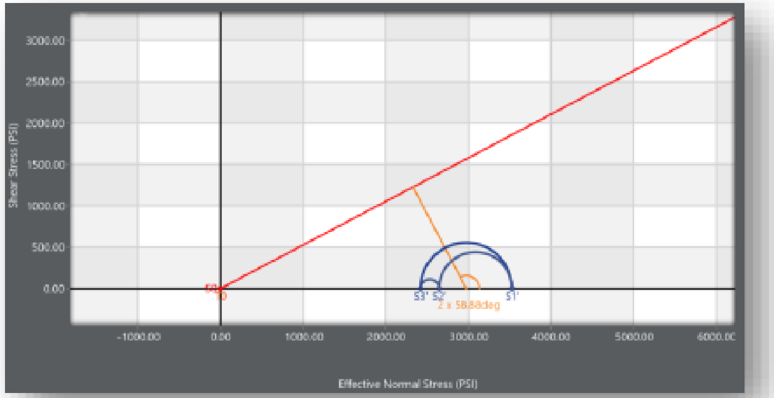


Mid Case React Lower Cris I Shale

Relative risk of all possible pre-existing fault and fracture orientations



Mohr diagram illustrates the corresponding pore pressure, stress and strength conditions

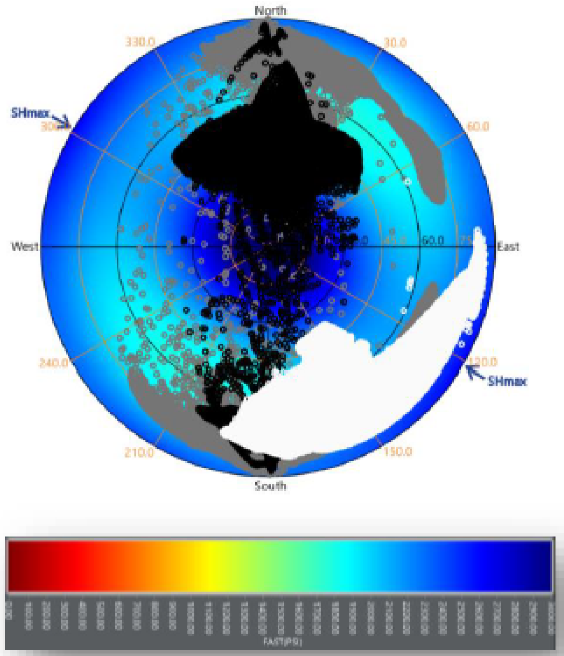


All figures are specific for stress and strength conditions at 7475 ft at Palo Alto RPN-S-No1

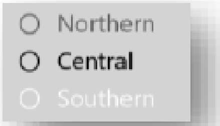
Risk is presented as the pressure change required to induce failure.

Cohesive strength is reduced to 0 to risk activation of existing faults and fractures

Stereonets plot poles to planes (northern hemisphere projection) Coloured by reactivation risk **calculated at Palo Alto RPN-S-No1**



Fault populations superimposed as poles to planes over reactivation risk



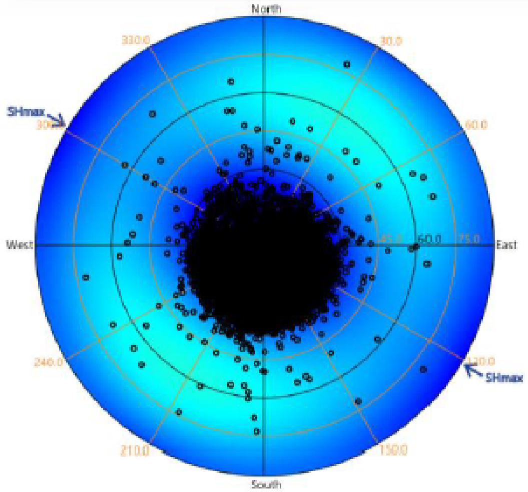
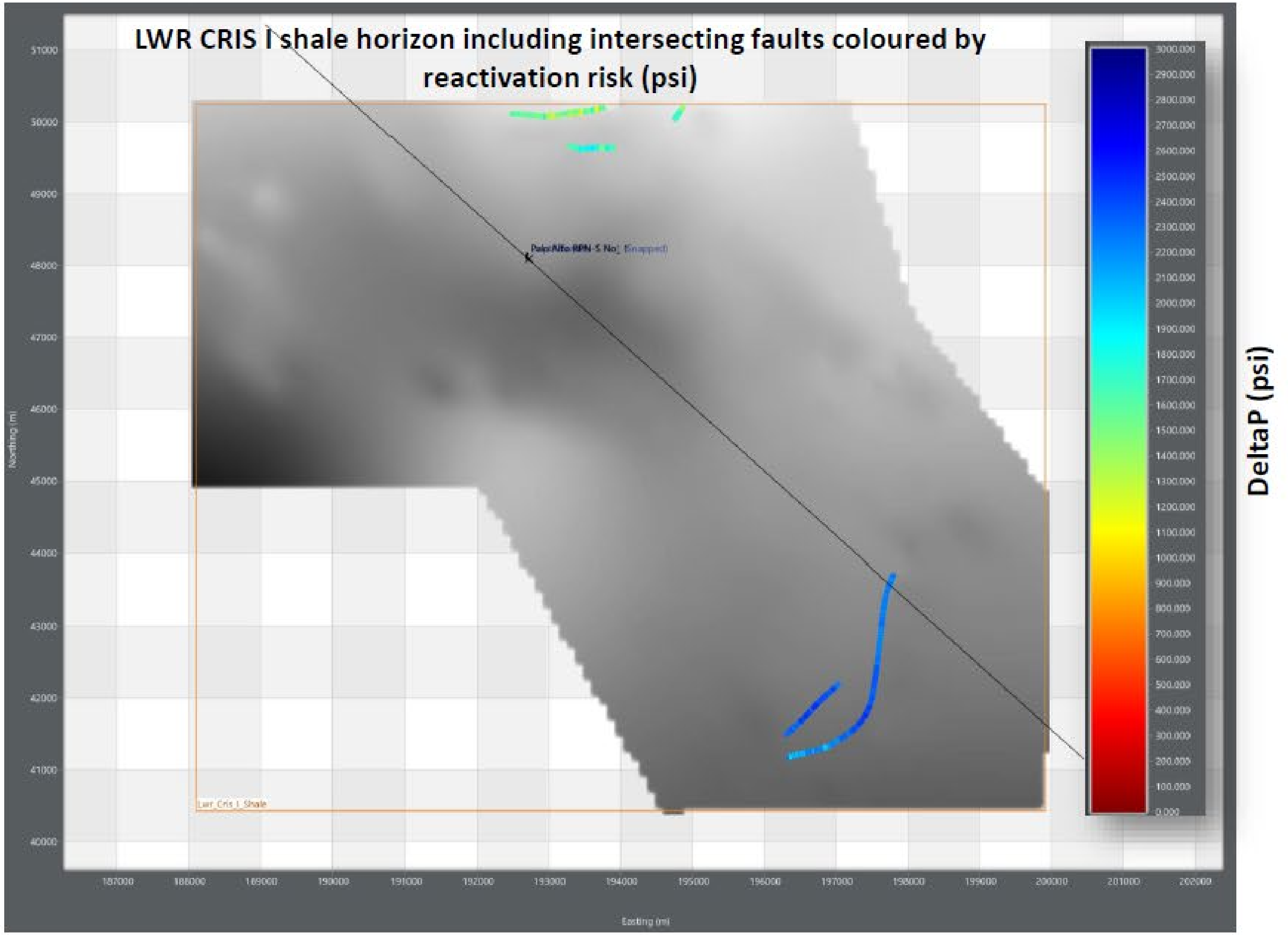


Image log derived surfaces (full population) are superimposed as poles to planes

Mid Case: LWR CRIS I Shale

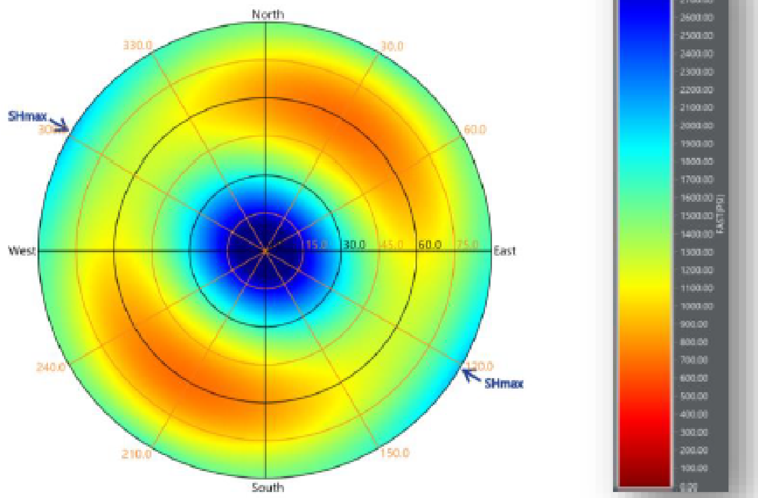
Note: Maps consider 3-dimensionality of the problem, stereonets are for a single depth at Palo Alto RPN-S-No1

- Map illustrating faults intersecting the LWR CRIS I **Shale** horizon coloured by reactivation risk (pressure change required to initiate failure) at this intersection.
- Effective stresses are mapped to all faults and the pressure change required to activate the specific orientation of the fault across each triangulated surface is calculated.
- Fault cohesion conservatively assumed to be 0 psi and utilising friction angle equivalent to intact rock at this depth.
- Prediction suggests faults will reactivate with a pressure change exceeding approx. 1900 psi in the southeast and in excess of 1100 psi in the north.

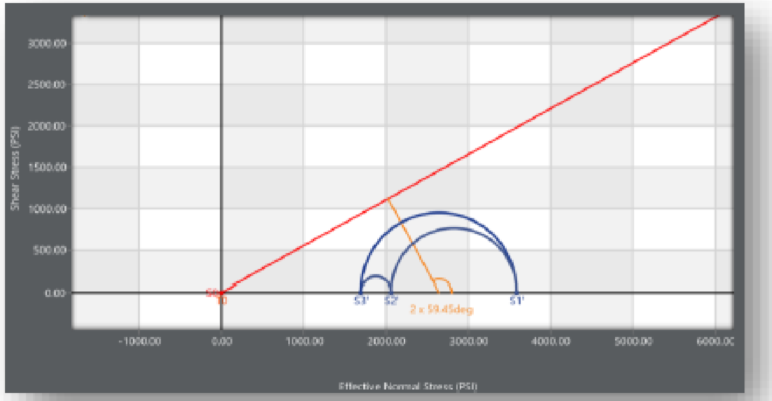


Mid Case React Lower Cris I Sand

Relative risk of all possible pre-existing fault and fracture orientations



Mohr diagram illustrates the corresponding pore pressure, stress and strength conditions

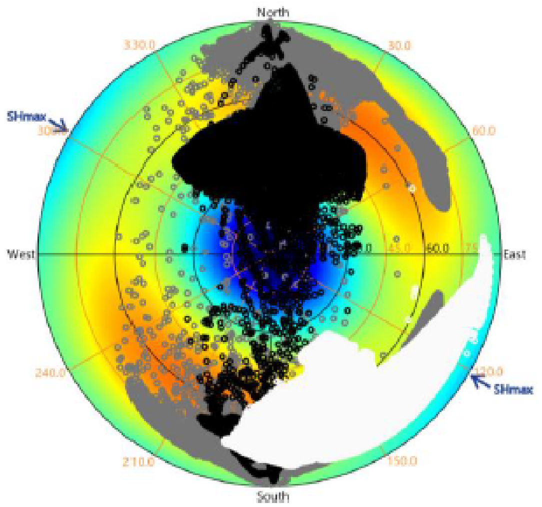


All figures are specific for stress and strength conditions at 7600 ft at Palo Alto RPN-S-No1

Risk is presented as the pressure change required to induce failure.

Cohesive strength is reduced to 0 to risk activation of existing faults and fractures

Stereonets plot poles to planes (northern hemisphere projection) Coloured by reactivation risk **calculated at Palo Alto RPN-S-No1**



Fault populations superimposed as poles to planes over reactivation risk

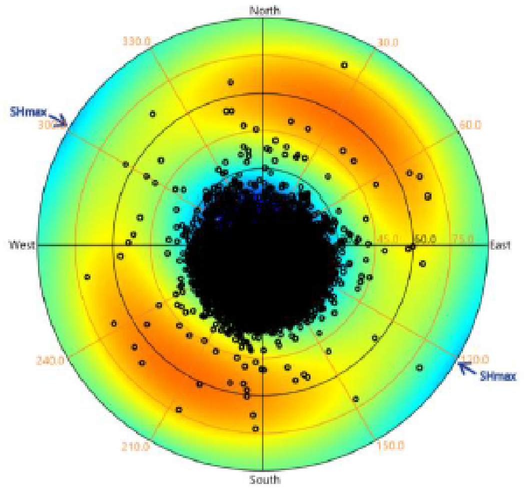
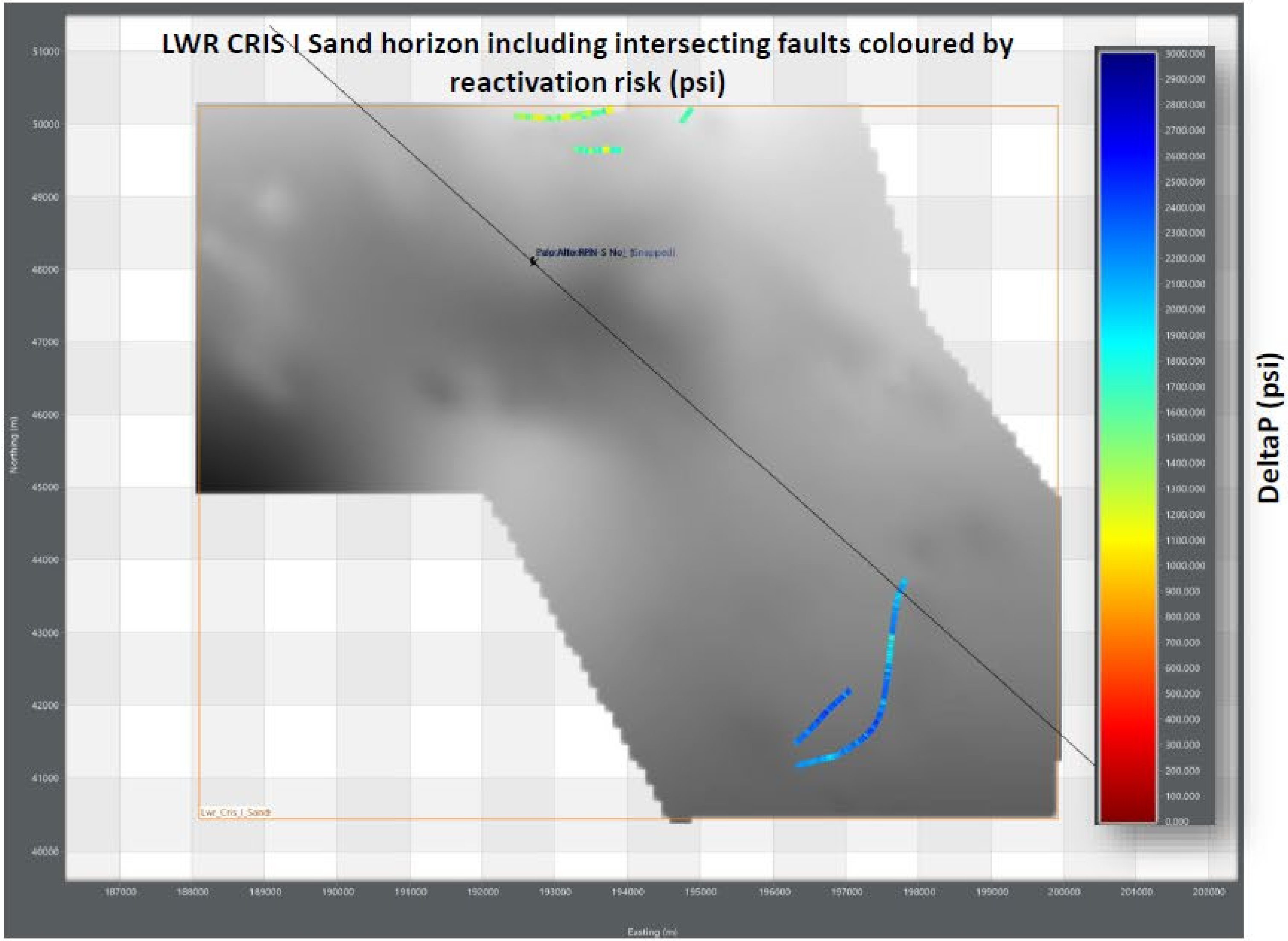


Image log derived surfaces (full population) are superimposed as poles to planes

Mid Case : LWR CRIS I Sand

Note: Maps consider 3-dimensionality of the problem, stereonets are for a single depth at Palo Alto RPN-S-No1

- Map illustrating faults intersecting the LWR CRIS I **Sand** horizon coloured by reactivation risk (pressure change required to initiate failure) at this intersection.
- Effective stresses are mapped to all faults and the pressure change required to activate the specific orientation of the fault across each triangulated surface is calculated.
- Fault cohesion conservatively assumed to be 0 psi and utilising friction angle equivalent to intact rock at this depth.
- Prediction suggests steep faults in the southeast will reactivate with a pressure change exceeding approx. 1600 psi.
- Faults are not critically oriented at this horizon under these conditions.



Tech Limit
Solutions with magnitude

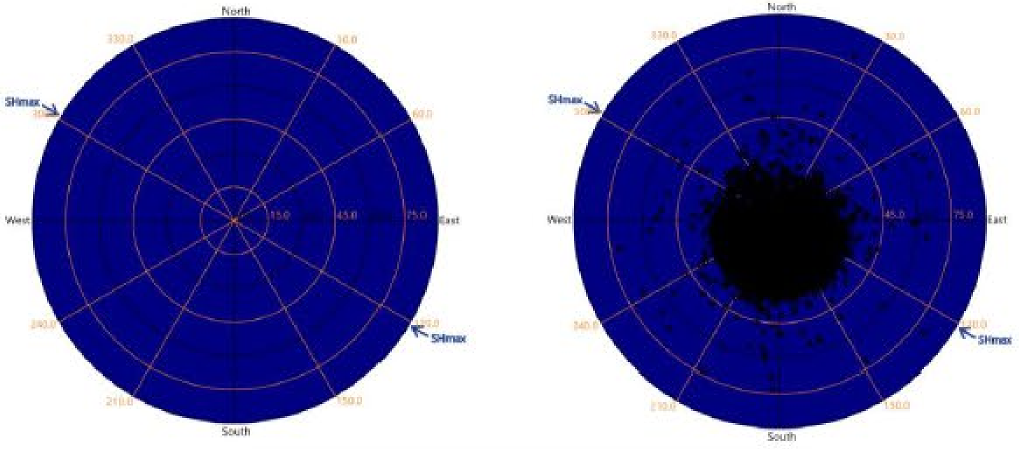
Deep Case Camerina

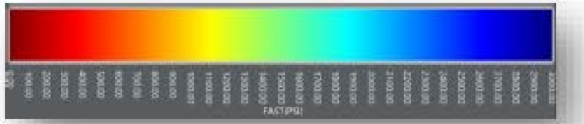
Shale: 10525 ft
Sand: 10800 ft

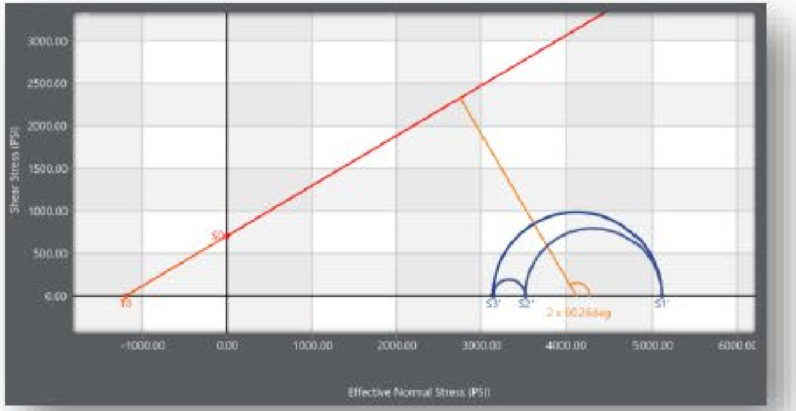
Deep Case Intact Rock

Risk is presented as the pressure change required to induce failure.
Intact rock strength used to risk creation of new faults and fractures at critical orientations

Camerina Shale (10525 ft)





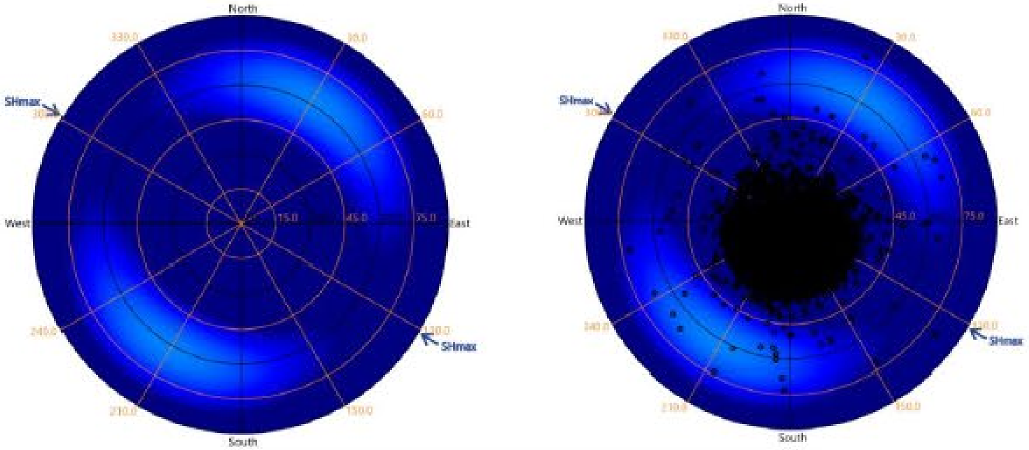


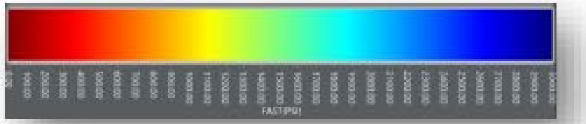
Stereonets plot poles to planes (northern hemisphere projection) Coloured by reactivation risk **calculated at Palo Alto RPN-S-No1**

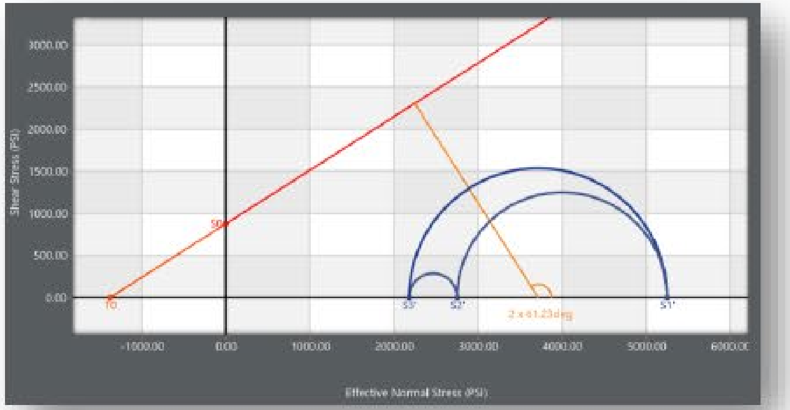
Image log derived surfaces (full population) are superimposed as poles to planes

Mohr diagrams plot the corresponding pore pressure & stress conditions

Camerina Sand (10800 ft)

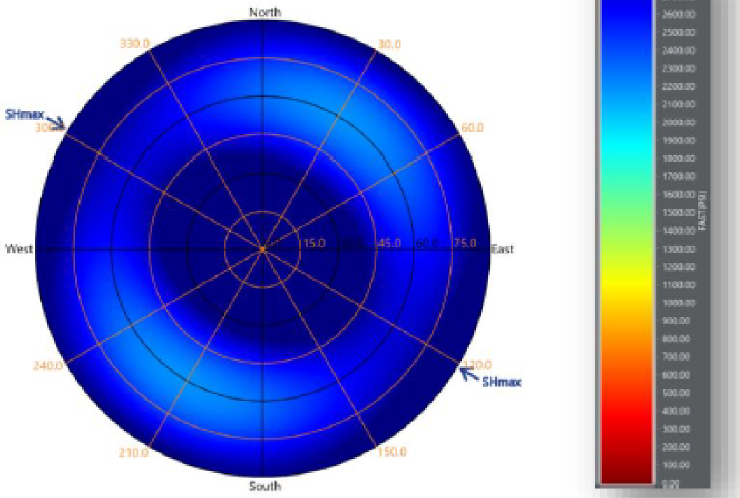




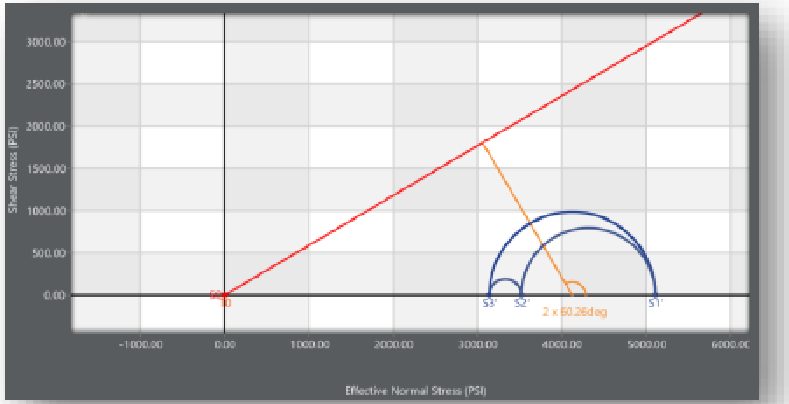


Deep Case React Camerina Shale

Relative risk of all possible pre-existing fault and fracture orientations



Mohr diagram illustrates the corresponding pore pressure, stress and strength conditions

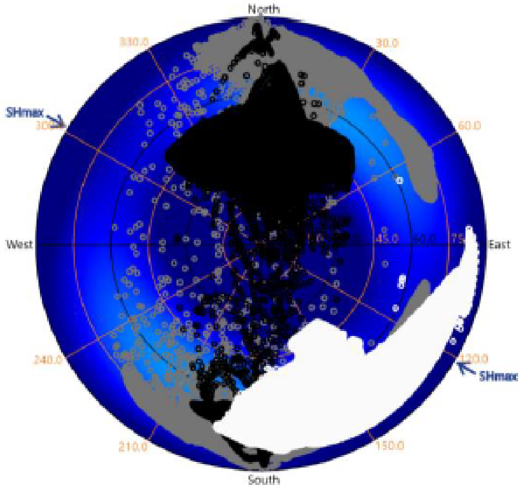


All figures are specific for stress and strength conditions at 10525 ft at Palo Alto RPN-S-No1

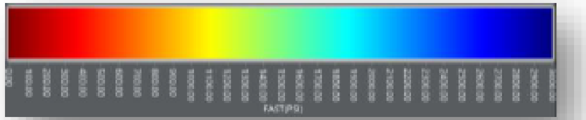
Risk is presented as the pressure change required to induce failure.

Cohesive strength is reduced to 0 to risk activation of existing faults and fractures

Stereonets plot poles to planes (northern hemisphere projection) Coloured by reactivation risk **calculated at Palo Alto RPN-S-No1**



Fault populations superimposed as poles to planes over reactivation risk



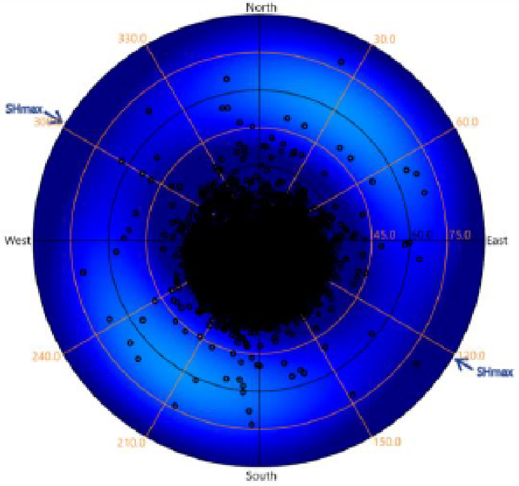
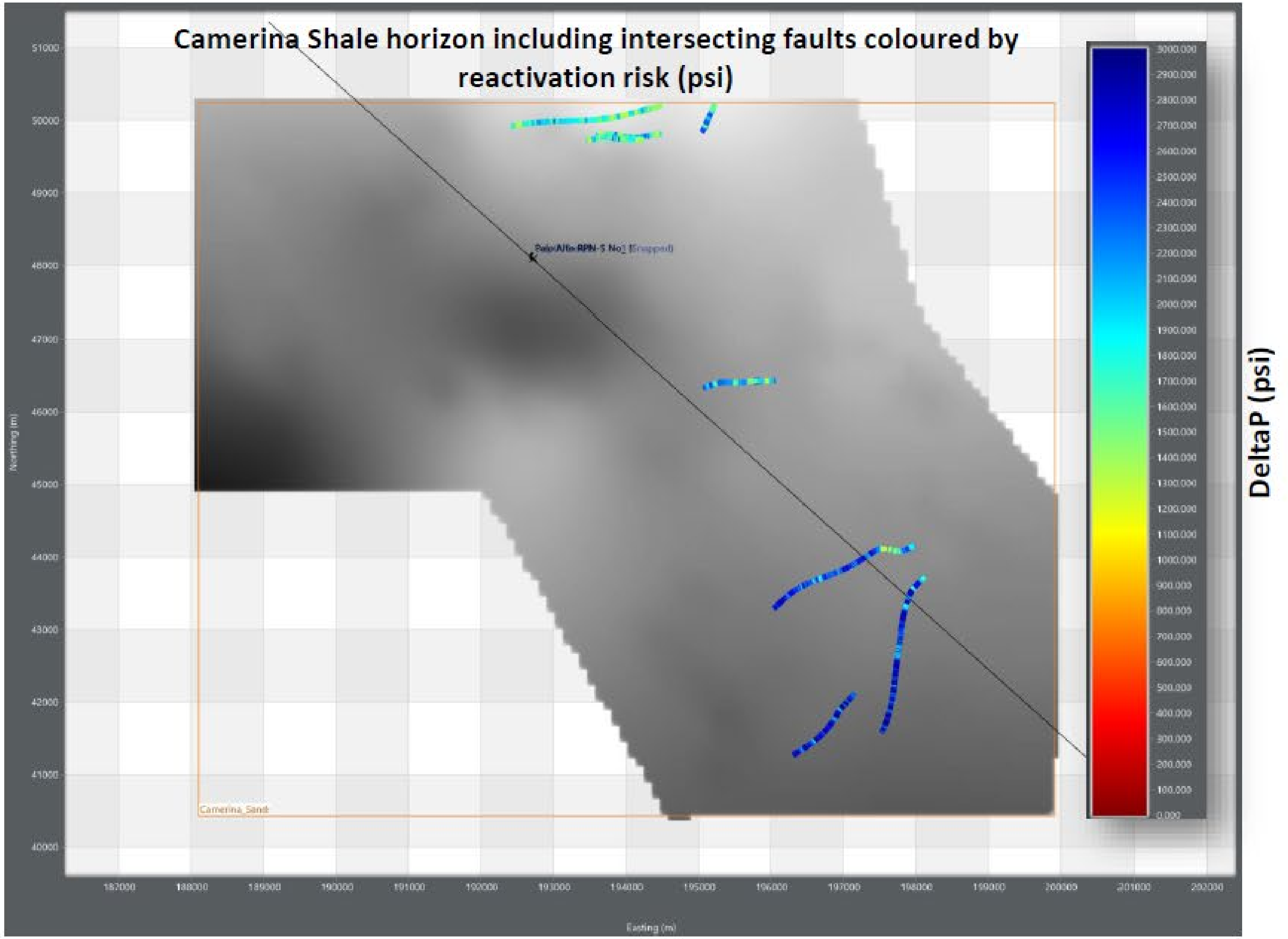


Image log derived surfaces (full population) are superimposed as poles to planes

Deep Case: Camerina Shale

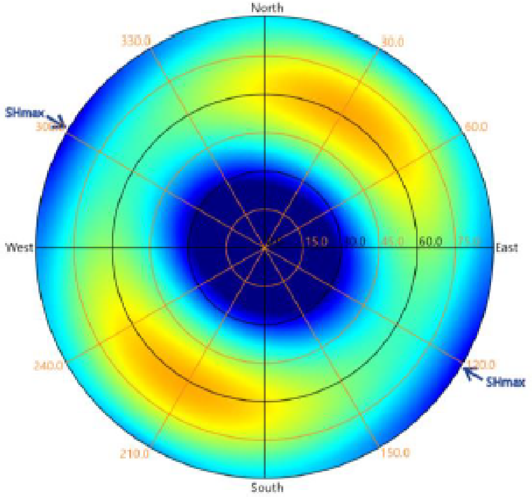
Note: Maps consider 3-dimensionality of the problem, stereonets are for a single depth at Palo Alto RPN-S-No1

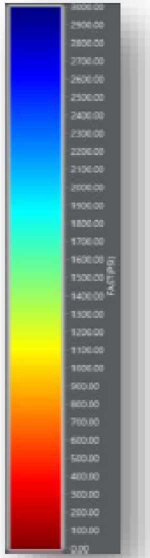
- Map illustrating faults intersecting the Camerina **Shale** horizon coloured by reactivation risk (pressure change required to initiate failure) at this intersection.
- Effective stresses are mapped to all faults and the pressure change required to activate the specific orientation of the fault across each triangulated surface is calculated.
- Fault cohesion conservatively assumed to be 0 psi and utilising friction angle equivalent to intact rock at this depth.
- Prediction suggests NW-SE oriented faults reactivate with a pressure change exceeding approx. 1900 psi.
- East-west oriented faults require in excess of 1100 psi to activate.



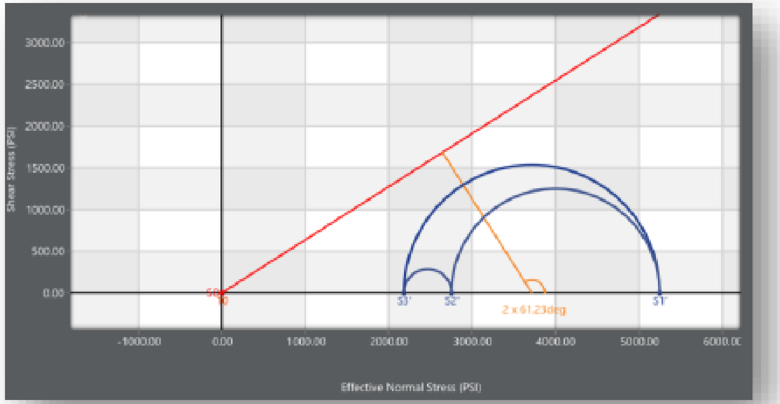
Deep Case React Camerina Sand

Relative risk of all possible pre-existing fault and fracture orientations





Mohr diagram illustrates the corresponding pore pressure, stress and strength conditions

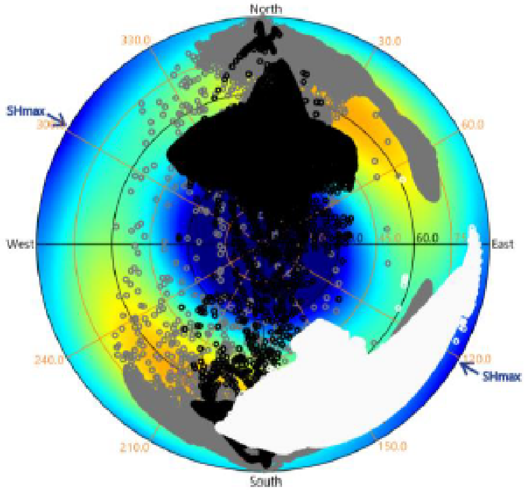


All figures are specific for stress and strength conditions at 10800 ft at Palo Alto RPN-S-No1

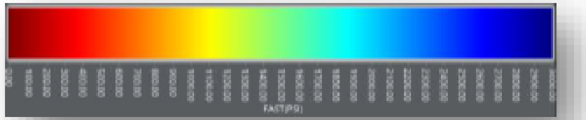
Risk is presented as the pressure change required to induce failure.

Cohesive strength is reduced to 0 to risk activation of existing faults and fractures

Stereonets plot poles to planes (northern hemisphere projection) Coloured by reactivation risk **calculated at Palo Alto RPN-S-No1**



Fault populations superimposed as poles to planes over reactivation risk



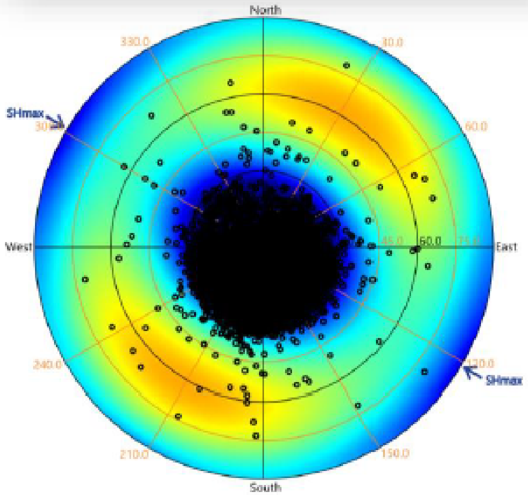
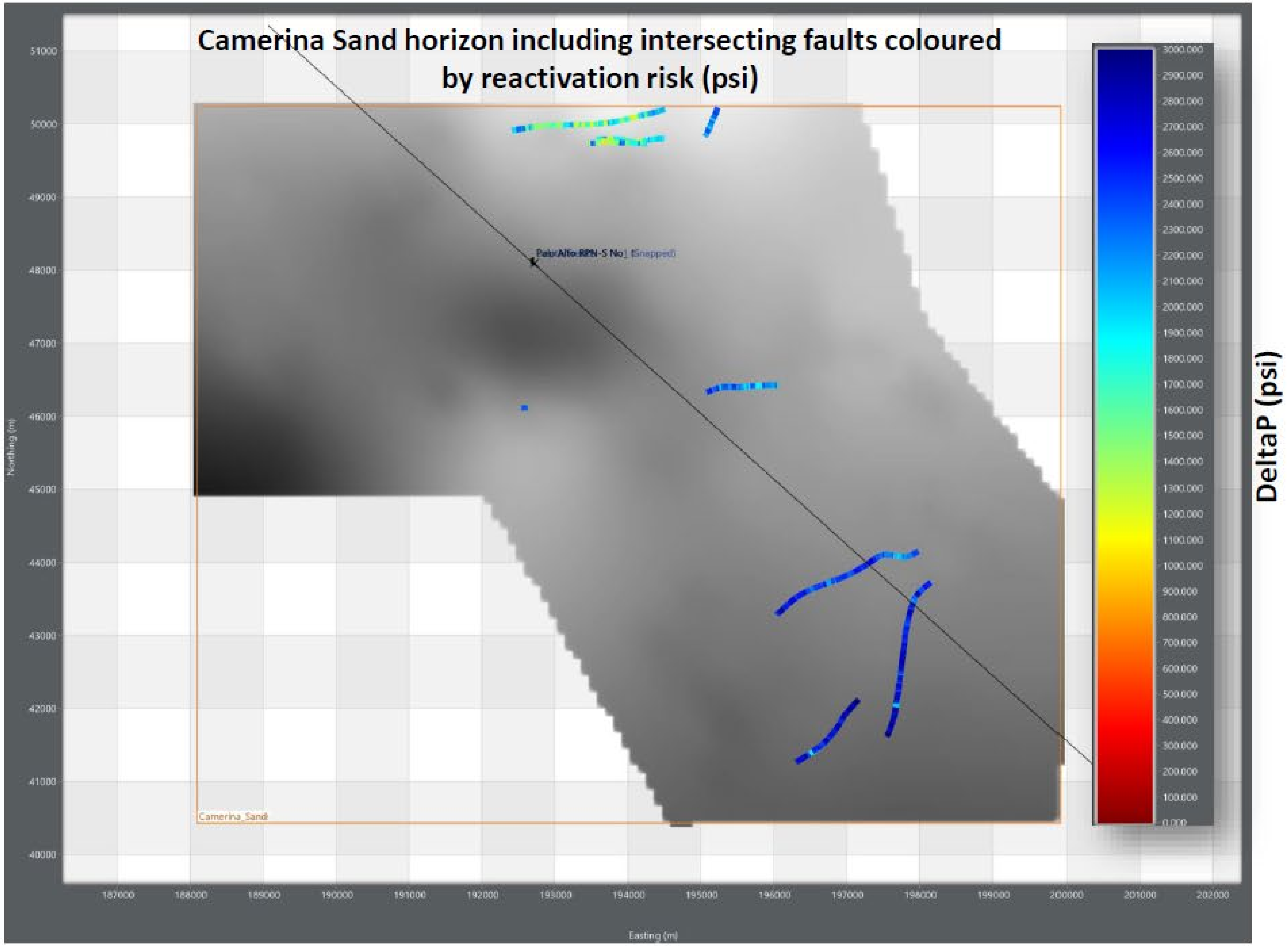


Image log derived surfaces (full population) are superimposed as poles to planes

Deep Case: Camerina Sand

Note: Maps consider 3-dimensionality of the problem, stereonets are for a single depth at Palo Alto RPN-S-No1

- Map illustrating faults intersecting the Camerina **Sand** horizon coloured by reactivation risk (pressure change required to initiate failure) at this intersection.
- Effective stresses are mapped to all faults and the pressure change required to activate the specific orientation of the fault across each triangulated surface is calculated.
- Fault cohesion conservatively assumed to be 0 psi and utilising friction angle equivalent to intact rock at this depth.
- Prediction suggests steep faults in the southeast will reactivate with a pressure change exceeding approx. 2400 psi.
- Segments of the east-west faults in the north are critically stressed with a pressure change exceeding 1100 psi.



Base Injection: Marg A Shale

Note: Maps consider 3-dimensionality of the problem, stereonets are for a single depth at Palo Alto RPN-S-No1

- Map illustrating faults intersecting the Marg A **Shale** horizon coloured by reactivation risk (pressure change required to initiate failure) at this intersection.
- Effective stresses are mapped to all faults and the pressure change required to activate the specific orientation of the fault across each triangulated surface is calculated.
- Fault cohesion conservatively assumed to be 0 psi and utilising friction angle equivalent to intact rock at this depth.
- Prediction suggests NW-SE oriented faults reactivate with a pressure change exceeding approx. 1900 psi.
- East-west oriented faults require in excess of 1100 psi to activate.