

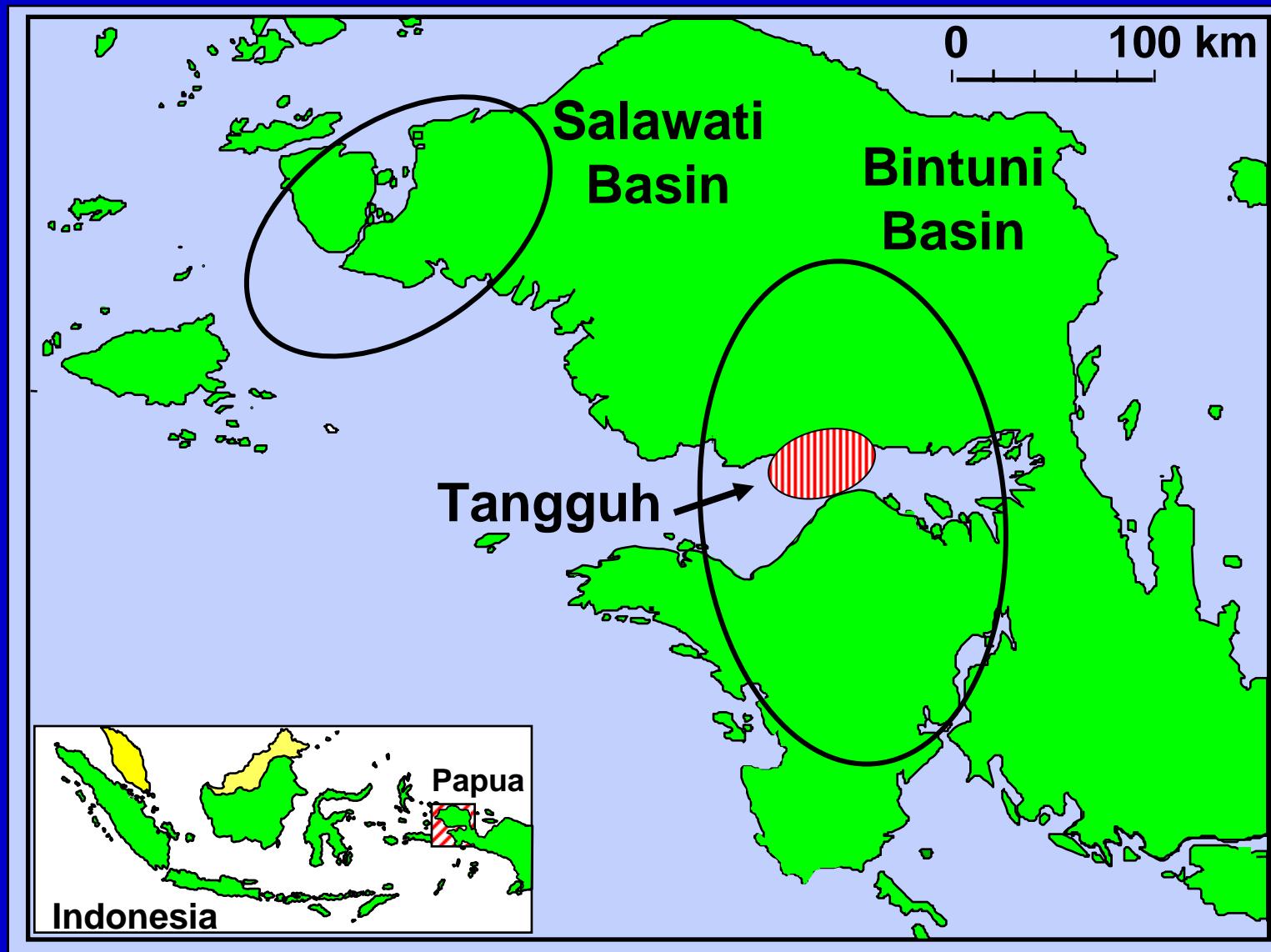
Tips for Success in High-Risk Exploration: The Tangguh Experience

James D. Robertson

Thesis

- **Basic Exploration Processes (Selecting Plays, Generating Prospects, Analyzing Risk, etc) Are Very Similar in High-Risk and Proven Areas**
- **High-Risk Strongly Correlates with Lack of Geologic Knowledge**
- **Guidelines Exist That Improve the Chance of Success in High-Risk Exploration Ventures**

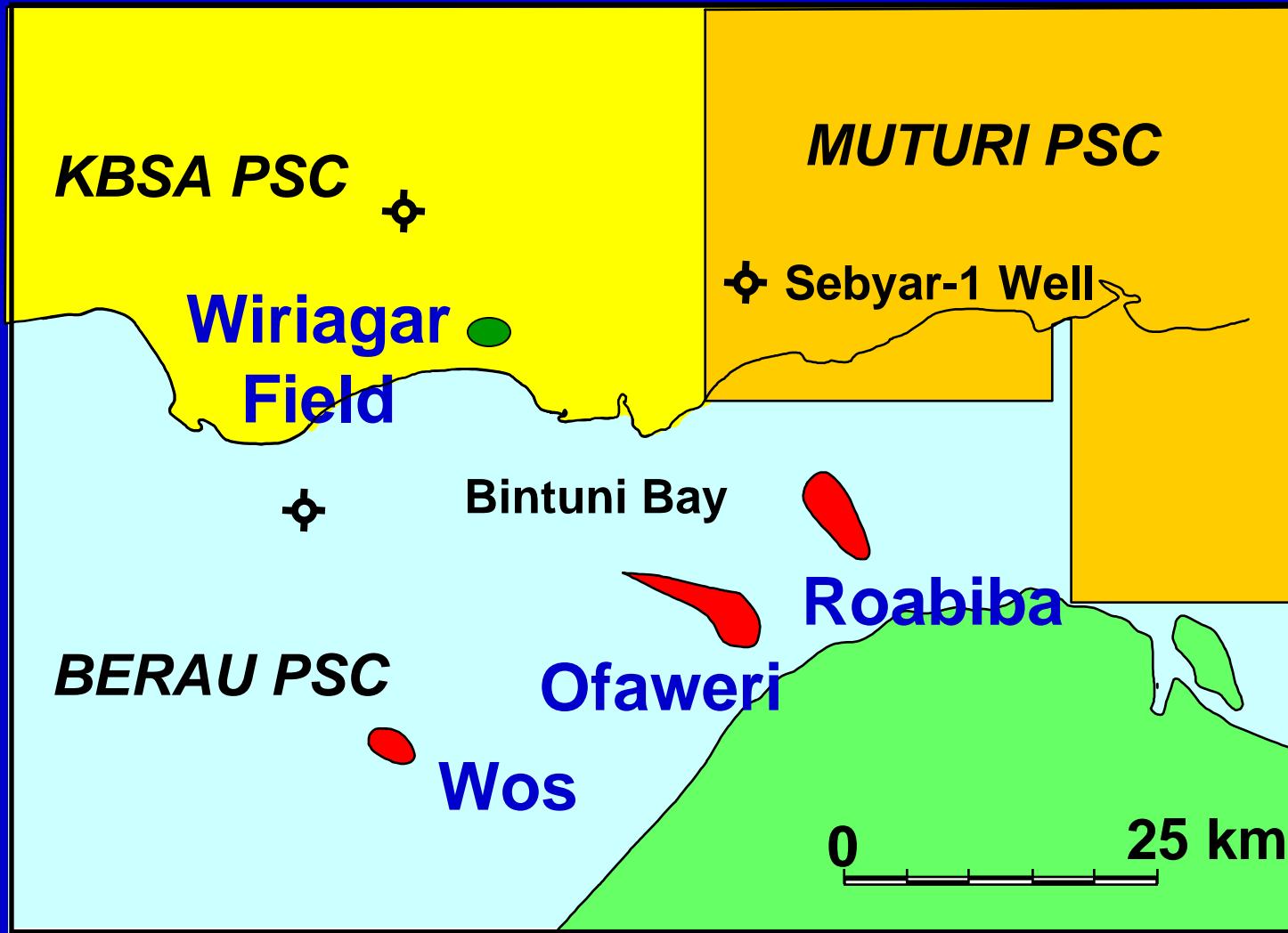
Tangguh Discovery



Tip #1 for High-Risk Exploration

- **Charge Matters More Than Trap or Reservoir In Initially Refining Search**
 - ◆ **Differentiate Between Weak vs Poorly Understood Charge Systems**
 - ◆ **Appreciate the Asymmetry with Proven Exploration Where Charge Is Often Secondary**

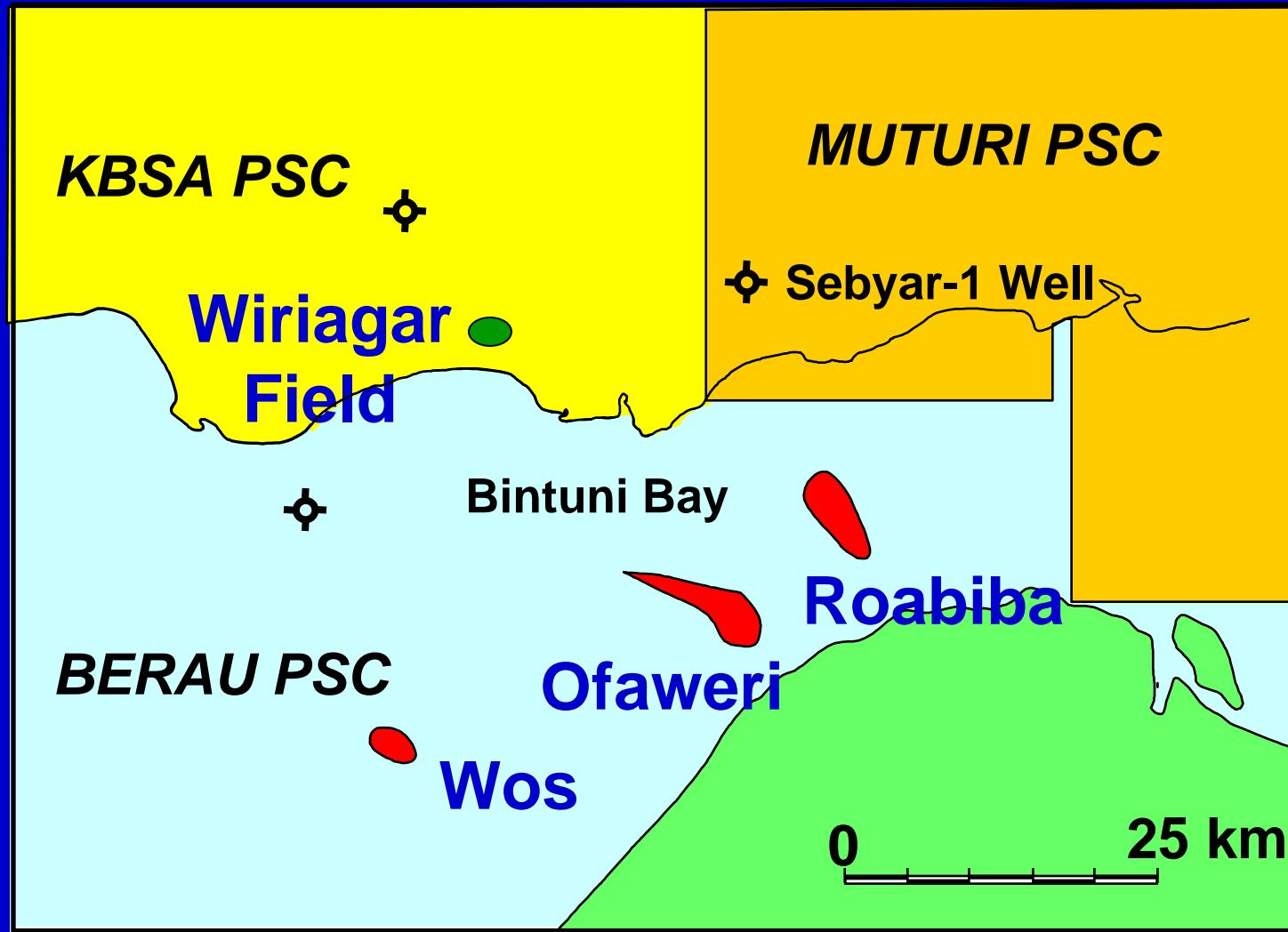
Tangguh in 1992



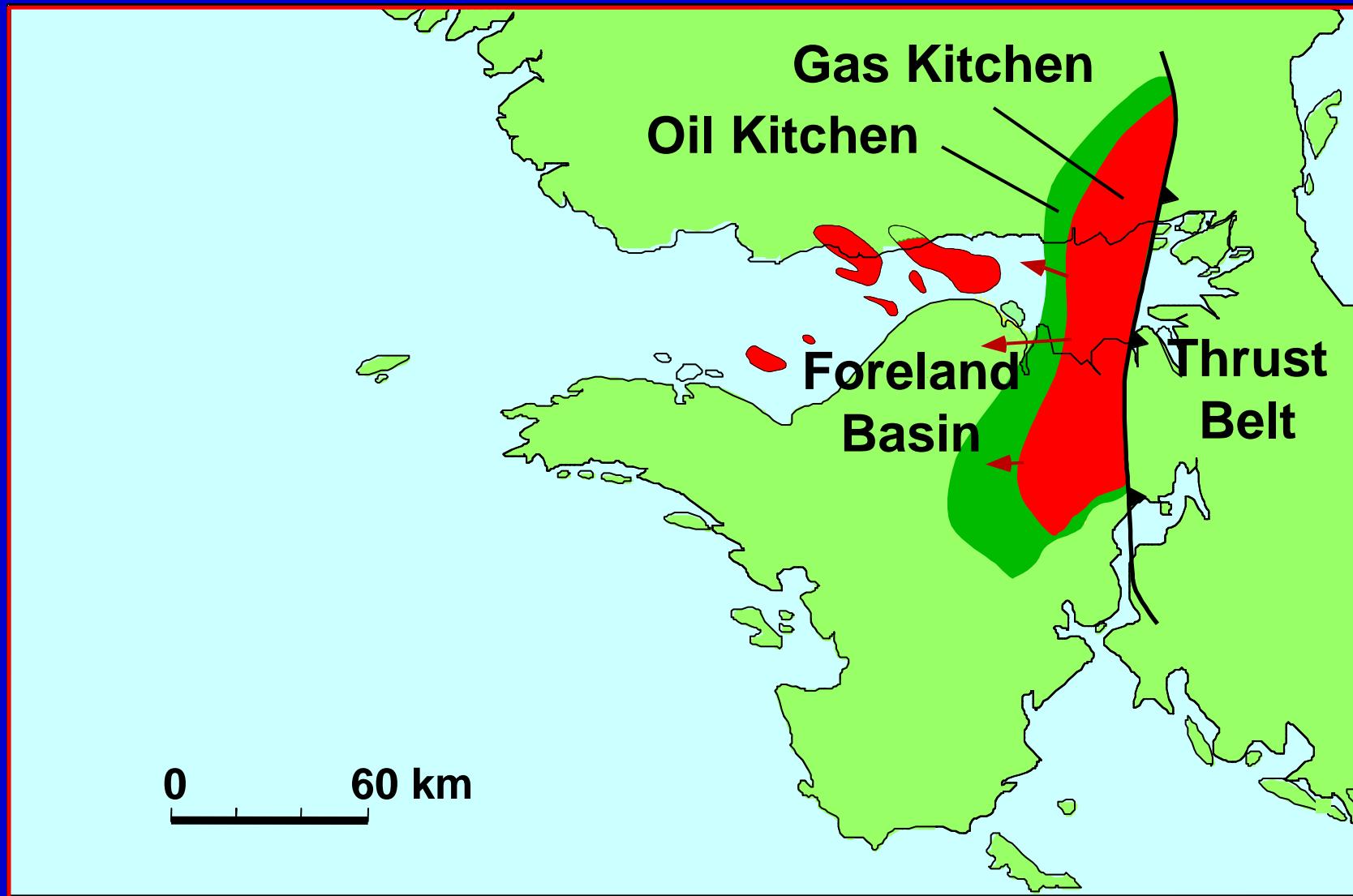
Tip #2 for High-Risk Exploration

- Use Petroleum Geochemistry as a Critical Exploration Technology**
 - ◆ Aggressively Acquire and Analyze Hydrocarbon and Source Rock Samples
 - ◆ Apply Modern Geochemical Methods
 - ◆ Assign a Dedicated Petroleum Geochemist to the Exploration Team

Tangguh in 1992



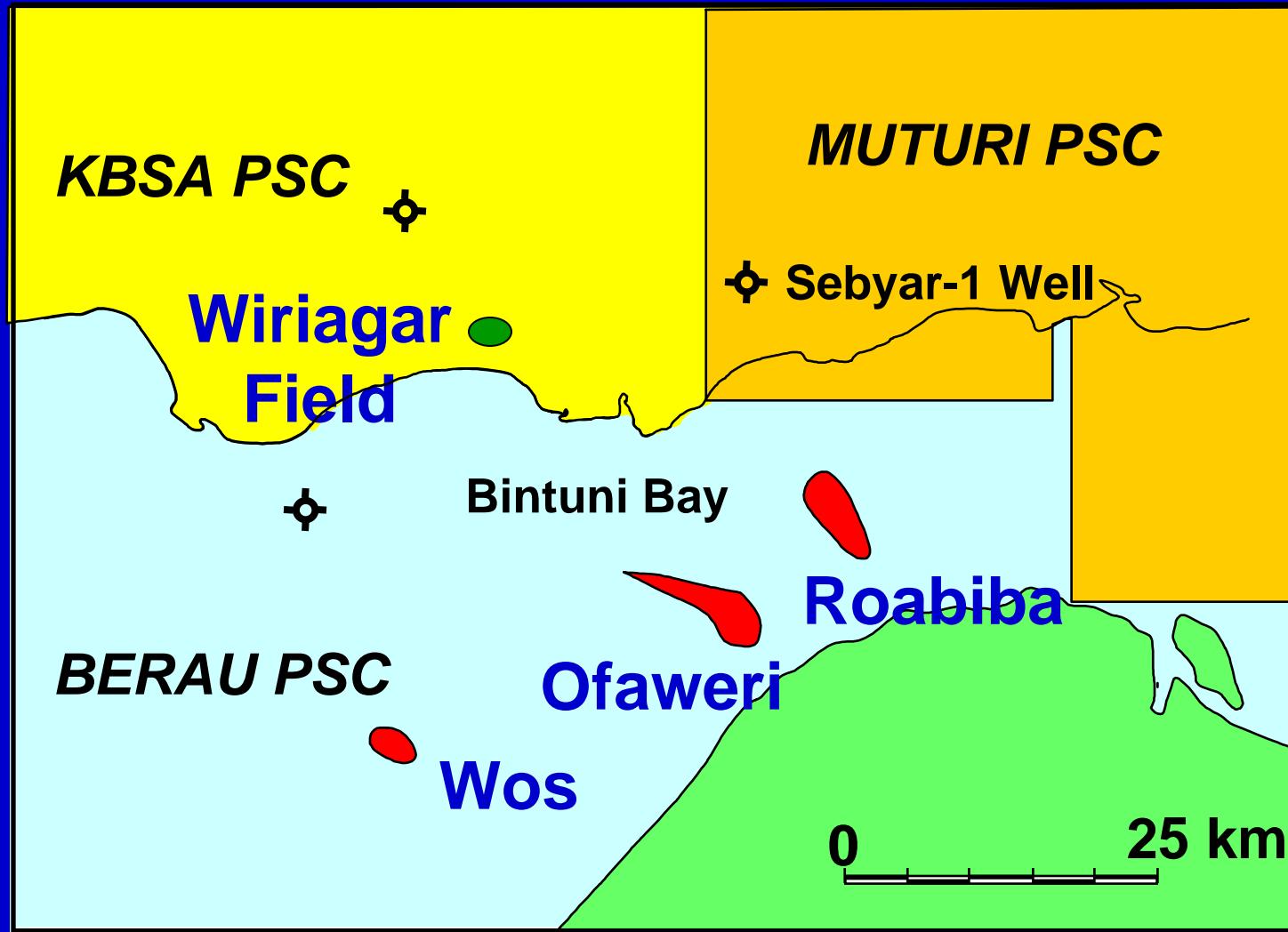
Tangguh Petroleum System



Tip #3 for High-Risk Exploration

- **Meld High-Risk Drilling with a Lower-Risk Alternate Outcome**
 - ♦ **Investigate Options to Monetize a Small Discovery and Recoup Costs**
 - ♦ **Preferentially Drill Where a Secondary Shallower Objective May Exist**

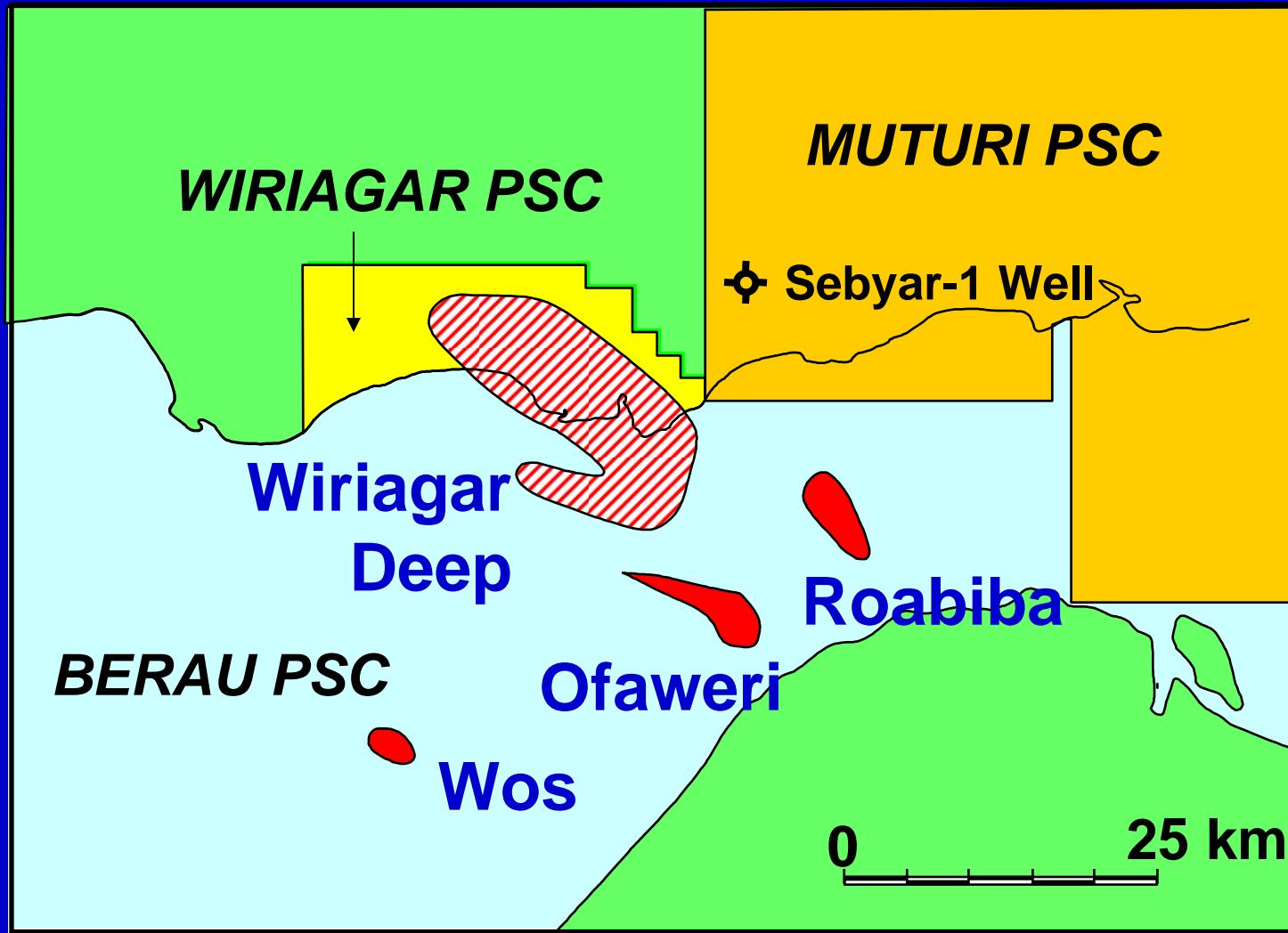
Tangguh in 1992



Tip #4 for High-Risk Exploration

- **Analyze Downhole Pressure Data Properly**
 - ◆ **Acquire Sufficient Pressure Data for Extensive Analyses**
 - ◆ **Assign a Pressure Expert to the Exploration Team**

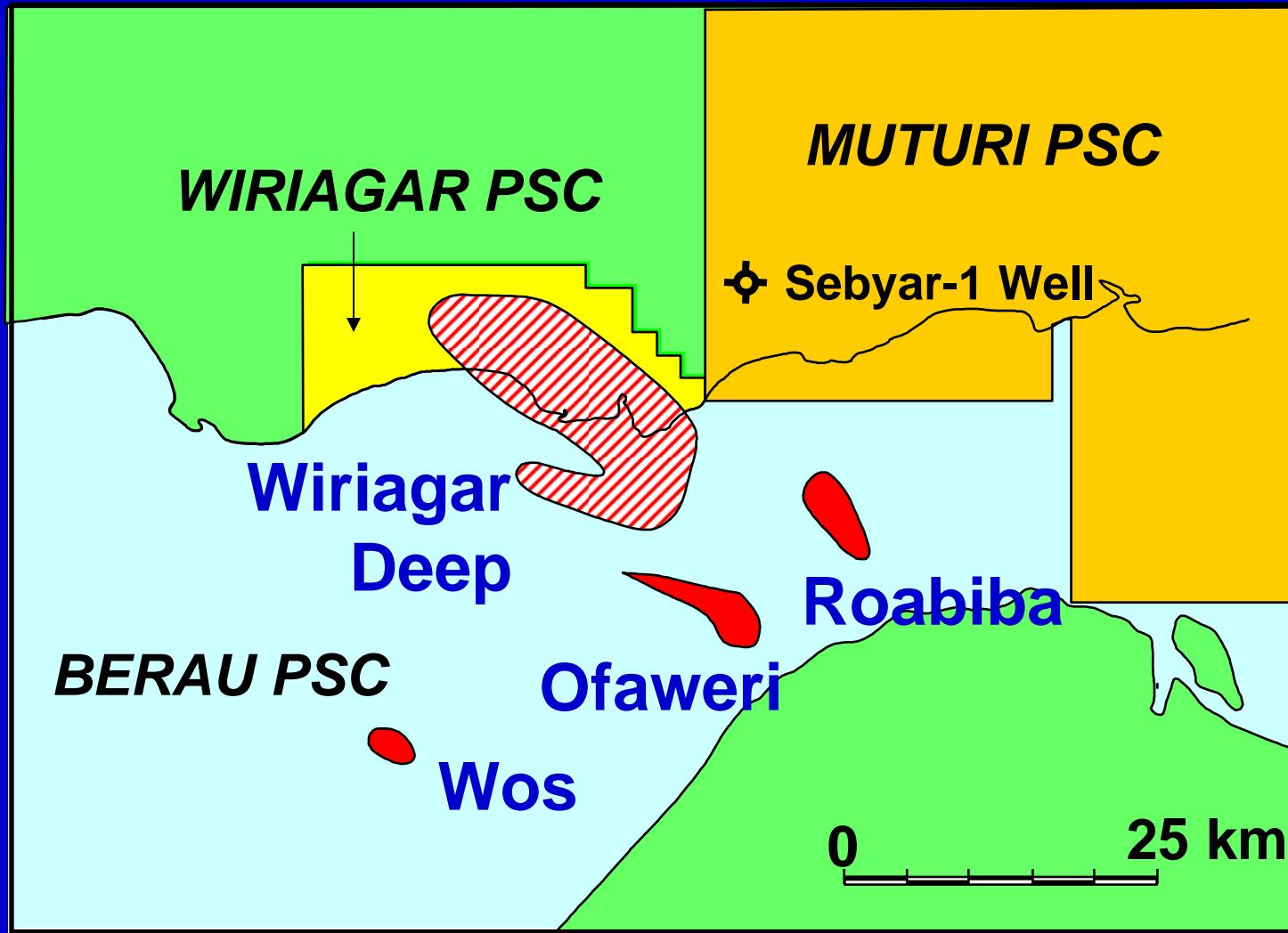
Tangguh in 1994



Tip #5 for High-Risk Exploration

- **Have Confidence that Exploration Knowledge Will Overcome an Adverse License Position**
 - ◆ Accept that Geologic Surprises May Trump Land Holdings
 - ◆ Realize that Land Deals Are Easier in High-Risk Areas than Proven Areas
 - ◆ Act Quickly While Knowledge Is Proprietary

Tangguh in 1994

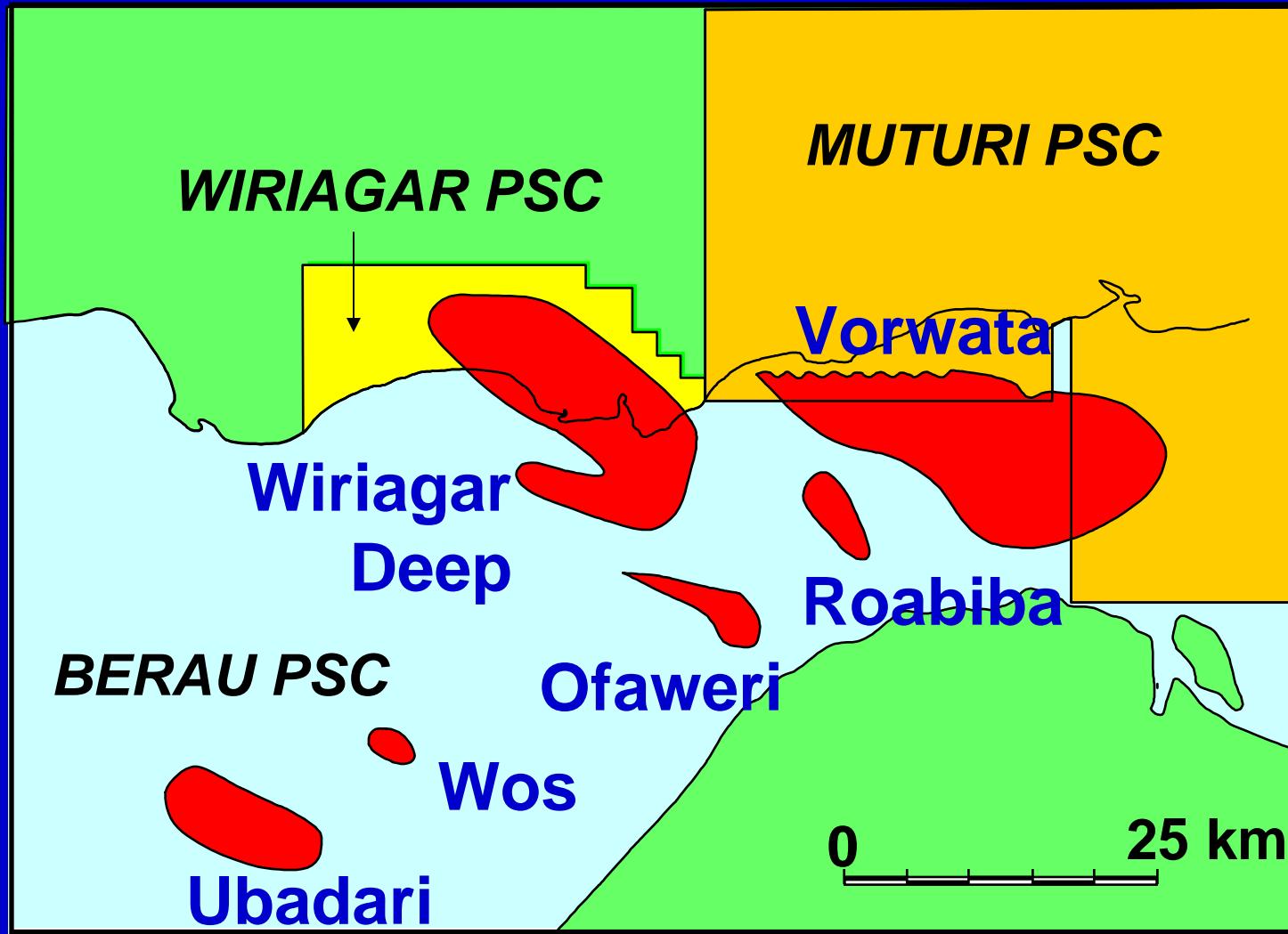


Tip #6 for High-Risk Exploration

■ Deploy an Expert Multidisciplinary Team

- ◆ Multiple and Progressive Insights Generally Are Needed to Understand Poorly Known Geology**
- ◆ Success Often Requires an Unbroken Chain of Correct Insights and Decisions**

Tangguh in 1998



Tip #7 for High-Risk Exploration

- **The Big Fields in a Basin Are Not Always Found First**
 - ◆ **Small Discoveries Are Valuable Data To Point the Way to the Giants**

Summary of the Tips

- Study Charge First to Refine Search**
- View Geochemistry as a Critical Exploration Tool Equal to Geology and Geophysics**
- Drill with Alternate Outcomes as Protection**
- Analyze Downhole Pressures Extensively**
- Rely on Exploration Knowledge to Overcome Land Problems**
- Deploy Expert Exploration Teams That Can Link Correct Insights Together**
- Appreciate That The Big Fields Are Not Always Found First**